

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

TECHNICAL SCHEDULES

Schedule -A

(See Clauses 2.1 and 8.1)

Site of the Project

1. The Site

- (i) Site of the Slope Protection Work and Re-construction of the Road on the Highway shall include the land, buildings, structures and road works as described in **Annex-I of this Schedule-A**.
- (ii) The dates of handing over the Right of Way to the Contractor are specified in **Annex-II of this Schedule-A**.
- (iii) An inventory of the site including the land, buildings, structures, road works, trees and any other immovable property on, or attached to, the site shall be prepared jointly by the Authority Representative and the Contractor, and such inventory shall form part of the memorandum referred to in **Clause 8.2 (i) of this Agreement**.
- (iv) The alignment plans showing the location of landslide / protection works of the Project Highway are specified in **Annex-III**. No modification in the existing alignment of the Project Highway is contemplated.
- (v) The status of the environment clearances obtained or awaited is given in **Annex-IV**.

Annex - I

(Schedule-A)

Site

[Note: All the Chainage/ location referred to in Annex-I to Schedule-A shall be existing Chainage.]

1. Site

The Site of 'Slope protection and landslide mitigation and Re-construction of Road section (from km 23+000 to km 23+200) on NH-110 near Tindhariya on EPC mode in the State of West Bengal'. The land, carriageway and slope protection locations comprising the Site are described below.

Sl no.	Chainage		Length (m)	Side (Hill /Valley)
	From	To		
1	23+000	23+200	200±	Hill and Valley

2. Land

The Site of the Project Highway comprises the land (Existing Right of Way) as described in the Annex-II.

3. Carriageway

The present carriageway of the Project Highway from Km 23+000 to Km 23+200 of NH-110 is constructed for Two Lane with paved shoulder. The type of the existing pavement is flexible. The carriageway was constructed Two Lane with paved shoulder in hilly terrain but got heavily affected due to erosion/slide/sinking zone. The proposed measures as mentioned in Schedule-B is to be constructed.

4. Major Bridges/Viaduct

The Site includes the following Major Bridges/Viaduct:

S. No.	Chainage (Km)	Type of Structure			No. of Spans with span length (m)	Width (m)
		Foundation	Sub-structure	Super-structure		
1		NIL				

5. Road over-bridges (ROB)/ Road under-bridges (RUB)

The Site includes the following ROB (road over bridge)/RUB (road under bridge):

S.No.	Chainage (Km)	Type of Structure		No. of Spans with span length (m)	Width (m)	ROB/ RUB
		Foundation	Superstructure			
NIL						

6. Grade separators

The Site includes the following grade separators:

S.No.	Chainage	Type of Structure		No. of Span with span length (m)	width
		Foundation	Superstructure		
NIL					

7. Minor bridges

The Site includes the following minor bridges:

S. No.	Chainage (Km)	Type of Structure	No. of Spans with span length (m)	Width (m)
		NIL		

8. Railway level crossings

The Site includes the following railway level crossings:

S. No.	Location (Km)	Remarks
NIL		

9. Underpasses (Vehicular, Non-Vehicular)

The Site includes the following underpasses:

S. No.	Chainage (Km)	Type of Structure	No. of Spans with span length (m)	Width (m)
NIL				

10. Culverts

The Site has the following culverts:

S. No.	Chainage (Km)/Culvert No	Type of Culvert	Span /Opening with span length/Dia (m)	Width (m)
1.	22+980 (approx.)	Culvert	2.4	
2.	23+080 (approx.)	Culvert	2.4	

11. Bus shelter

The details of bus Shelter on the Site are as follows:

S. No.	Chainage (Km)	Length (m)	Left Hand Side	Right Hand Side
1	Nil			

12. Truck Lay byes the details of truck lay byes are as follows:

S. No.	Chainage (Km)	Length (m)	Left Hand Side	Right Hand Side
Nil				

13. Roadside drains the details of the roadside drains are as follows:

S. No.	Location		Side	Type	
	From (Km)	To (Km)		Masonry/CC (Pucca)	Earthen (Kutcha)
1	22+900	23+380	Hill	CC	-

14. Major / Minor junctions

The details of major junctions are as follows:

S.No.	Location (Km)		At grade	Separated	Category of Cross Road			
	From	To			NH	SH	MDR	Others
NIL								

15. Bypasses

The details of the existing road sections proposed to be bypassed are as follows:

S. No.	Name of bypass (town)	Chainage (Km)		Length (in Km)
		From (Km)	To (Km)	
NIL				

16. Existing Retaining / Breast wall Protection Works

S. No.	Ch. From	Ch. To	Retaining Wall Length (m)	Breast Wall Length (m)	Remarks
1	22+900	23+200	-	300	Hill side

The Retaining / Breast wall were constructed in hilly terrain but got affected / damaged due to landslide/settlement. The proposed measures as mentioned in Schedule-B is to be constructed.

17. Existing Utilities

NIL

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Annex - II

(As per Clause 8.3 (i))

(Schedule-A)

Annex-II: Dates for providing Right of Way of Construction Zone

The dates on which the Authority shall provide Right of Way of Construction Zone to the Contractor on different stretches of the Site are stated below:

S. No.	From km to km		Length (m)	Date of providing Right of Way*
(1)	(2)		(3)	(4)
(i) Full Right of Way (full width)				
(a)	23+000	23+200	200±	On Appointed Date
(ii) Part Right of Way (part width): NA				
(iii) Balance Right of Way (width): NA				

*The dates specified herein shall in no case be beyond 150 (one hundred and fifty) days after the Appointed Date.

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Annex - III

(Schedule-A)

Alignment Plans

The existing alignment plan shall be followed. No modification in the existing alignment of the Project Highway is contemplated.

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Annex - IV

(Schedule-A)

Environment Clearances

Sr. No.	Clearances	Present Status
1	Environment Clearance	Not Applicable

Schedule - B

(See Clause 2.1)

CONSTRUCTION FOR MITIGATION MEASURES FOR SLOPE PROTECTION

1. Construction for Slope Protection Measures

Survey, identification of extent of instability, investigations, detailed designing and execution / construction of Slope Protection measures shall be done as described in Schedule B and in Schedule C as per approved design and standards, duly checked by the Proof & Safety Consultant and vetted by any one of the IITs/ THDC/ NIRM/ GSI during construction stage (it shall be EPC Contractor's responsibility to get the vetted drawings from IITs/ THDC/ NIRM/ GSI) and its maintenance for 5 years from the date of successful completion of the project / works with complete adherence of all relevant codal provisions, specifications and safety standards.

2. Development of the Project

Development of the project shall include Specialized Slope Protection measures as described in Annex-I of this Schedule B and Schedule-C.

3. Specifications and Standards

The Mitigation Measures for Slope Protection shall be constructed in conformity with the Specifications and Standards specified in Annex-I of Schedule-D.

Annex - I

(Schedule-B)

Description

CONSTRUCTION FOR SLOPE PROTECTION MEASURES

1. Execution/ Construction of Slope Protection Measures

- (i) The Project refers to Slope protection and landslide mitigation and Re-construction of Road section (from Km 23+000 to Km 23+200) on NH-110 in the State of West Bengal on Tindhariya section.
- (ii) The design and construction of the slope protection measures shall be carried out in accordance with the applicable codes, manuals, and specifications of the Indian Standards Institution (ISI), Indian Roads Congress (IRC) including its Special Publications, as well as relevant circulars and guidelines issued by the Ministry of Road Transport and Highways (MoRTH).
- (iii) The proposed landslide protection works, culvert, retaining structures, step wall, drains etc. of the project highway as indicated in Schedule B and Schedule C and their Annexures shall be treated as minimum requirements. Based on site condition and design requirements the Contractor shall finalise their Detailed Designs and submit to Authority & its Engineer and Safety Auditor for its review / approval, before start of the project execution in accordance with Article 10 of the EPC Agreement. The designs so approved shall not be in contradiction with the scope of the project. For avoidance of doubt, the provisions/measures mentioned in Schedule B & C shall not be changed, only the design of the components is to be submitted for review / approval by following details & minimum requirement given in Schedule-B, C and D.

(iv) General Scope and Features

The Contractor shall carryout Survey, Identify the extent of instability, investigations, detailed designing duly checked by the Proof & Safety Consultant as stipulated under Article-10 and duly vetted by any one of the IITs/ THDC/ NIRM/ GSI at their own cost. The investigations shall comprise of geological, geo-physical and geotechnical exploration works required for stability analysis and design of slope protection measures. All the civil works shall be carried out as per approved design and drawings of slope protection measures and as per technical specifications as given in Annexure-I of Schedule-D.

2. Widening of the existing highway

i. Width of Carriageway

- (a) The present carriageway of the Project highway is heavily damaged at majority of the section length. The proposed slope protection measures shall be executed

at damaged locations to reinstate the present carriageway to the original configuration (2-Lane with paved shoulder, i.e. Paved carriageway shall be 7m wide with 1.5 m paved shoulder both side and 1.0 m earthen shoulder valley side) or as per site.

- (b) The existing carriageway shall be protected by the Contractor and if any damages occurred to the existing carriageway during the execution shall be reinstated by the Contractor. The entire cross-sectional elements shall be accommodated in the available/proposed ROW.

3. Geometric Design and General Features

(i) General

Geometric design and general features of the Project Highway shall be in accordance with Section 2 of the Manual, referred to as the Manual and other relevant IRC Codes.

(ii) Design speed

The design speed for the project road shall be the minimum design speed of 40 Km per hr. except in cases where the same is not possible and for such cases design speed shall be in accordance with provisions for Mountainous & Steep terrain as per the Hill Road Manual.

(iii) Improvement of the existing road geometrics

The raising in road level shall match existing Finished Road Level (FRL) at either ends of the protection work stretches as per Geometric design. Alignment of the protection work shall follow the existing alignment (at present damaged due to landslide) plan of the Project as provided in Appendix-B-1.

(iv) Right of Way

Details of the Right of Way are given in Annex-II of Schedule-A. The existing shoulder including the roadside drain shall be re-constructed and its adequacy to be established in the length of proposed slope protection measures.

The Authority shall provide additional Right of Way (RoW) or designated legal access beyond the standard highway limits at the locations explicitly specified in Table below. This additional land width/access allocation is strictly for:

1. The construction of Catch Water Drains (CWDs) on hill slopes to properly intercept, collect, and safely discharge surface hill runoff before it flows into the main road formation, preventing uncontrolled velocity runoff from inducing pavement erosion and slope instability.
2. Accommodating subsurface slope stabilization anchor components (including soil nails, fully grouted rock bolts, or active ground anchors). For the purpose as detailed out in the Drawings and Schedule-B, C and D.

(v) Site Location of the Protection and Road Reconstruction

Sl. no.	Chainage		Length (m)	Remarks
	From	To		
1	23+000	23+200	200	The measures for slope protection and re-construction of the section shall be done as per provisions of Schedule-B, C and D.

(vi) Drawings (TCS) of the Project of Slope Protection

The Applicable drawings / typical cross section for slope protection measures shall be developed as given in table below with minimum scope as explained in Schedule-B, C & D:

S. No.	Chainages in km	Drawing Type	Stretch Length (m)	Details of minimum Scope
1	23+000 to 23+200 (Hill side)	Plan - 01	200	Construction of Slope protection measures as per Plan enclosed and Typical Cross Section of road as TCS-1 to 4 other protection measures as mentioned below.
2	23+000 to 23+200 (Hill Side)	Plan - 01	200 (Tentative)	Construction of CC stepped wall (or breast wall) of minimum height of 15 meter, in 7-10 m length; CC step wall shall be constructed after 1.0m hill side cutting in each step or appropriate as per site condition. Weep holes in CC stepped wall with 100mm diameter HDPE pipe @ 2.0m c/c longitudinally & vertically (staggered) in (1:20) slope. Step wall, Catchpit and Chutes having minimum 357.13 cum of M-15 grade.
3	23+000 to 23+200 (Valley Side)	TCS- 1 & TCS- 2	200	At velley side construction of Gabian stepped wall (or retaining wall) of minimum height of 3 meter; over 200mm thick M-20 grade PCC & bundled SDR consist each bundle @2m c/c in length in 2 rows minimum 101*2=202 bundles; in one bench of step, this benches shall be repeat after a certain height or may be 12m-15m height, shall be repeat in 3 times with minimum 606 nos having minimum 12m SDR length each 38/19MM (outer/inner) diameter. SDR anchored in slope shall be 38/19MM (outer/inner) diameter, SDA with minimum 1,377 nos having minimum 12m length each. Further, this shall be strengthened laterally with installation of 20 m long 100T capacity pre-stressed cable Anchors 34 nos in 3 rows within the bottom of slope. Further, high tensile wiremesh combined with 3D Net and Hydroseeding having minimum 6200sqm.

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S. No.	Chainages in km	Drawing Type	Stretch Length (m)	Details of minimum Scope
				The subsurface drainage pipe is minimum 287 nos in 3 m long.
4	23+000 Approx.	TCS- 1 & TCS- 2	200	1 nos Culvert in line with drawing provided TCS - 3 and TCS-4. The culvert is 3m x 3m with share key and RCC return wall. The RCC M-25 garde of concrete in culvert with share key and Return wall and 150mm PCC M-15 below the culvert.

Note -

- Filter media with granular materials/stone crushed aggregates satisfying the requirements laid down in clause 2504.2.2. of MoRT&H specifications shall be provided along the full length & height of walls for a minimum width of 0.6 m.

(vii) PROVISION OF DISASTER MANAGEMENT

The Contractor shall maintain a comprehensive Disaster Management system to mitigate and respond to all emergencies, including but not limited to slope failures, hydraulic surges, and hazardous incidents within the Project corridor. This mandate requires the integration of resilient engineering standards and the deployment of an Emergency Response Team to protect personnel, the Environment, and the Permanent Works. The Contractor's objective is to ensure the immediate containment of any catastrophic event and the preservation of the Right-of-Way as a functional transport artery, minimizing Project disruption through rigorous preparedness and rapid recovery protocols.

The scope of this Provision is strictly confined to the designated Right-of-Way for the duration of the Construction Period. Obligations include the performance of mandatory hazard assessments, procurement of emergency infrastructure, and the execution of site-specific evacuation and traffic management plans. Contractor liability is bounded by the project chainage (BEYOND $\pm 20\text{m}$) and terminates upon the issuance of the Taking-Over Certificate. All disaster response, civil protection, and regional recovery efforts beyond these defined limits remain the sole responsibility of the Competent Authorities.

Note-

(a) Extent of work -

- Start and end location of landslide protection work given in above table is tentative and shall be as per site requirements during execution of work.
- Stretch length specified above is minimum and height required for protection shall be as per site condition at the time of execution.
- The proposed type of Retaining Structures and sections mentioned are the minimum requirements and work shall be carried out based on detailed design carried out by the Contractor before execution following same TCS.

- Unfinished work before onset of monsoon must be protected by providing interim drainage measures, and retaining measures so that the executed protection measures are not affected during monsoon.
- All the boundaries / edges of the project site must be protected using relevant slope protection & erosion control measures as per site conditions giving proper closures and merging back to stable natural ground.
- The overall construction shall be top-down in terms of geometric corrections and immediate installation of erosion control measures & Anchors, berm by berm for landslide slope protection works. Drainage provision shall be such to maintain effective drainage at all point of time during construction including final drainage arrangement. No additional working zone beyond the available ROW shall be provided by the Authority and EPC Contractor shall prepare their work plan accordingly.

(b) Investigations - At the start of the work following Survey/Investigations/Studies shall be done.

- I. Topographic survey of above sites (by UAV/LIDAR)
- II. Hydraulic studies to be carried out with latest topographical details and available rainfall to assess the drainage requirement.
- III. Geological mapping and Geotechnical Investigations to establish strata and properties.
- IV. Any other investigations including Geophysical studies as required. The Contractor must incorporate these outcomes in detailed designs of landslide & slope protection measures.

(c) Design Basis

- I. The slope stability of landslide by geometric corrections, using toe/breast/retaining walls, surface protection, internal reinforcement, etc with consideration of sub-surface and surface water flow impact.
- II. Complete surface and sub-surface drainage plan through catch water drains, berm drains, and subsurface drains, including controlling water penetration in to subsoil through avoiding ponding and through cracks treatment behind the landslide top edges; with some of it seen as much behind as hundreds of meters from landslide edges. The treatments should be to fill the cracks up and seal it from top to stop further ingress of water into it, for any further propagation of cracks.
- III. Hill cutting shall be undertaken only after the finalization and approval of the cutting scheme and methodology proposed by the contractor with adequate protection and stabilization measures. Under no circumstances shall cut slopes be left unattended or unprotected in accordance with the provisions of IRC/SP:48-2023 and MoRTH guidelines.

4. Minimum scope description for each activity of Landslide/ sinking Protection Measures and Re-construction of culvert is mentioned hereunder:

S. No.	Minimum Scope - From km 23+000 to km 23+200
1	Scaling of rock chunk lying on the slope i/c all cost machineries, cost of crakamite powder if required, making the ramp including all cost of labour, material, breaking of rock piece using breaker and disposal of muck as per Technical Specifications. (Removal of loose debris, dismantling of failed structures, overhanging stones & cracked boulders) for a minimum quantity of 6,200 sqm. Muck disposal shall be done by EPC Contractor at suitable location identified by EPC Contractor at their own risk and cost inclusive of transportation charges.
2	Hill side from km 23+000 to km 23+200 - (Refer drawing Plan, TCS-1 & TCS- 2) Construction of CC stepped wall (or breast wall) of minimum height of 15 meter in 7-10 m length; the wall shall be constructed after 1.0m hill side cutting in each step or appropriate as per site condition. Weep holes in CC stepped wall with 100mm diameter HDPE pipe @ 2.0m c/c longitudinally & vertically (staggered) in (1:20) slope. Step wall, Catchpit and Chutes having minimum 357.13 cum of M-15 grade.
3	Valley side from km 23+000 to 23+200 - (Refer drawing Plan, TCS-1 & TCS- 2) At velley side construction of Gabian stepped wall (or retaining wall) of minimum height of 3 meter; over 200mm thick M-20 grade PCC & bundled SDRA consist each bundle @2m c/c in length in 2 rows minimum 101*2=202 bundles; in one step, this shall be repeat after a certain height or may be 12m-15m height from bottom, the same repeated in 3 times with minimum 606 nos having minimum 12m SDRA length each 38/19MM (outer/inner) diameter. SDR anchored in slope shall be 38/19MM (outer/inner) diameter, SDA with minimum 1,377 nos having minimum 12m length each. Further, this shall be strengthened laterally with installation of 20 m long 100T capacity pre-stressed cable Anchors 34 nos in 3 row at the bottom of slope. Further, high tensile wiremesh, 3D Net and Hydroseeding having minimum 6200sqm. The subsurface drainage pipe is minimum 287 nos in 3 m long.; Weep holes in CC stepped wall/ chute etc. with 100mm diameter HDPE pipe @ 2.0m c/c longitudinally & vertically (staggered) in (1:20) slope.
4	At km 23+200 approx.- (Refer drawing TCS-3 & 4) 1 nos Culvert in line with drawing provided TCS -3 and TCS-4. The culvert is 8m x 3m x 3m with share key and RCC return wall. The RCC M-25 garde concrete in culvert, share key, Return wall. PCC M-15 bottom of the culvert, chute guide wall and catchpit.

Note-

- (i) Works for Protection wall or step wall shall be of minimum grade M20. Steel of Fe 500 Grade
- (ii) To determine the design, pull out strength value, three (3) numbers of test anchor shall be installed along lower elevation at the site. The pull-out test shall be conducted on these installed anchors as per IS 11309 and average of three (3) Nos Pull Out strength value shall be considered as Design Pull Out value for all installed anchors at this location. 2% of installed anchors shall be tested on this average value. All the cost towards pull out tests (3 numbers and 2%) at each location shall be borne by EPC Contractor on its own. The tests shall be done in supervision of Authority Engineer.

- (iii) Installation of SDA as mentioned in above paras shall include the cement pressure grouting at a min. pressure ranging from 1 to 3 kg/cm² till all the cracks are suitably sealed / filled.
- (iv) The site is landslide/ sinking zone affected

5. Road Embankment and Cut /fill Section

Construction of road embankments/cuttings shall conform to the Specifications and Standards given in IRC: SP:48-2023 and IRC: SP:84-2019. Notwithstanding anything to the contrary contained in this agreement or Manual, the proposed profile of the project locations as indicated in Appendix B1 of Schedule-B shall be treated as minimum requirement. The project road was being constructed and got damaged due to landslide during construction. The required cut/fill section of the landslide protection works shall follow the detailed drawings/Specifications and Standards prepared for the slope protection measures of the site. The existing road / ground shall be required to be raised / filled to attain the minimum FRL as indicated in Appendix B1 of Schedule-B. The filling may vary from 1 meters to 5 meter. The EPC Contractor shall make the accurate assessment of filling and the cost shall be borne by EPC Contractor.

6. Pavement Design

- (i) Pavement design shall be carried out in accordance with section 5 of the IRC: SP: 73-2018. The raising in road level shall match existing Finished Road Level (FRL) at either ends of the protection work stretches as per Geometric design. Alignment of the proposed road work & protection work shall follow the existing alignment (at present damaged due to landslide) plan as provided in AppendixB-1. Accordingly, following stretches of the existing road shall be reconstructed after completion of slope protection measures: -

S. No.	Design Section (Km)		Remarks
	From	To	
1	23+000	23+200	Reconstruction of road shall be done in 'the length extending 20 m beyond the design chainages of site in each of the directions'.

(ii) Type of pavement

Flexible pavement shall be provided for the main carriageway, and it shall be designed in accordance with relevant manual with the minimum crust composition:

BC - 40 mm

DBM- 50 mm

WMM- 250 mm

GSB- 200 mm

Sub-grade- As per requirement to match the minimum FRL. EPC Contractor shall assess the cost by visiting the site and bid price shall be inclusive of required

thickness to achieve minimum FRL. Raising through subgrade thickness may vary upto 1m - 5m.

(iii) **Design requirements**

a) **Design Period and strategy**

Flexible pavement shall be designed for a minimum design period of 15 years.

b) **Design Traffic**

Notwithstanding anything to the contrary contained in this Agreement or the Manual, the Contractor shall design the pavement for design traffic of 25 million standard axles.

7. **Hill / Valley side Drainage:** Road side PCC (M-20) drain shall be provided at each (LHS) side of the road to ensure drainage continuity at either ends of the work stretches as per Geometric design. EPC Contractor shall prepare a drainage plan. Catch water drains to protect the PCC stepped wall & Gabion facia wall shall be constructed to catch the surface water.

Surface and subsurface drains for the project site are shown in the Typical drawings (Appendix B-1). The Contractor shall also provide road side drain along the length of the road. Surface water collected in catch water drain shall be connected to existing drainage system through chutes / cascades. Any modifications required to connect newly constructed drains with existing drainage system shall also be constructed by the contractor.

The Contractor shall also provide road side drain along the length of the road. Surface water collected in catch water drain shall be connected to existing drainage system through chutes / cascades. Any modifications required to connect newly constructed drains with existing drainage system shall also be constructed by the contractor. EPC Contractor shall construct catchpit and chutes for the existing culverts in accordance with Chapter 2 of IRC SP:48 - 2023.

The design shall be prepared by the Contractor as per the manual specified in Schedule D / IRC SP:48 - 2023. The detailed design of structures and drainage plan prepared by the Contractor shall be approved by Authority / Authority's Engineer. The Contractor shall provide continuity of drain to the nearest stable natural stream available to the area.

Drainage system including surface and subsurface drains for the Project Highway shall be provided as per the provision of relevant Manual.

Additional Provision in case of Hill Roads: -

The roadside and slope drainage network for hilly terrains shall be designed as a multi-tiered system engineered to prevent surface runoff from infiltrating treated slope configurations or causing destructive toe erosion. The drainage layout scope shall explicitly include:

- 1. Contour / Catch Water Drains (Expert Committee Code G12e): Reinforced lean*

concrete drains constructed around the upper periphery of treated slopes to cut off and safely bypass surface runoff water from entering active construction zones.

2. Channelization of Natural Hilly Streams and Nalas (Codes G12a to G12d): All cross-discharging natural watercourses intersecting the highway alignment must be structurally lined and channelized using Cement Concrete (CC) channels, anchored CC channels, or high-capacity Gabion Revetment Mattress channels, dimensioned precisely based on the catchment peak discharge values.

3. Sub-surface Internal Drainage Networks (Code G02a): Strategic installation of continuous horizontal rows of sub-surface semi-perforated PVC pipes wrapped with non-woven geotextile. These must be oriented specifically to intersect internal water-bearing rock joints, relieving internal hydrostatic pore water pressures within active slope bodies."

8. Design of Structures

(i) General

- a) All bridges, culverts and structures shall be designed and constructed in accordance with provision of the relevant Manual and shall conform to the cross-sectional features and other details specified therein.
- b) Width of the carriageway of new bridges and structures shall be as follows:

S. No.	Bridge/structure at (Km)	Width of carriageway and cross-sectional features*
NIL		

- c) The following structures shall be provided with footpaths:

S. No.	Location at Km	Remarks
NIL		

- d) All bridges shall be high-level bridges.
- e) The following structures shall be designed to carry utility services as per site requirement:

S. No	Bridge at (Km)	Utility service to be carried	Remarks
NIL			

- f) Cross-section of the new culverts and bridges at deck level for the Project Highway shall conform to the typical cross-sections given.

(ii) Culverts

- a) Overall width of all culverts shall be equal to the roadway width of the approaches.
- b) Reconstruction of existing culverts:

The existing culverts at the following locations shall be re-constructed as new culverts:

S. No.	Culvert location (Km)	Span/Opening (m)	Length (m)	Remarks, if any
1	23+000 (approx.)	3.0 x 3.0	8.0	Box Culvert

c) Widening of existing culverts:

All existing culverts which are not to be reconstructed shall be widened to the roadway width of the Project Highway as per the typical cross section given in the provision of relevant Manual. Repairs and strengthening of existing structures where required shall be carried out.

S. No.	Culvert location	Type, span, height and width of existing culvert (m)	Repairs to be carried out [specify]
Nil			

d) Additional new culverts (RCC Box type) shall be constructed as per particulars given in the table below:

S No.	Culvert location (Km)	Span/Opening (m)
NIL		

e) Repairs/replacements of railing/parapets, flooring and protection works of the existing culverts shall be undertaken as follows:

S. No.	Location at Km	Type of repair required
NIL		

f) Floor protection works shall be as specified in the relevant IRC Codes and Specifications.

(iii) Bridges

NIL

9. Traffic Control Devices and Road Safety Works;

- Traffic control devices and road safety works shall be provided in accordance with section 9 of the IRC: SP: 73:2018. National Highway traffic shall be operational in at least 7m width at all times at damaged locations. Roadway Indicators, Hazard markers and Object markers shall be placed along the section as per the Manual.
- Traffic signs shall be provided as per IRC 67 & MORTH circular no RT - 25035/07/2023- RS(Part) dated 24.12.2024 as mentioned in Schedule-C. Specifications of the reflective sheeting shall be Class C sheeting described in IRC:67 and type VIII, IX & XI as per ASTM D 4956-09 fixed over Aluminium or Aluminium Composite Material. Traffic signs shall be provided as per IRC 67-2022 & MORTH circular no RT - 25035/07/2023- RS(Part) (221534) dated 24.12.2024.

- c) **Road Marking:** The markings shall cover road marking for the pavement at all project sites as per para 6(i) of Annex-I of Schedule-B, as per relevant code and manual. Pavement marking shall be completed as per IRC 35 & MORTH circular no RT - 25035/07/2023- RS(Part) (221534) dated 24.12.2024.
- d) **Road studs:** The Reflective Pavement Markers (RRPM) i.e. road studs shall be provided along the entire section (from Km 23+000 to Km 23+200 ($\pm 20\text{m}$)) to improve the visibility in night time and wet weather conditions. These shall be prismatic retroreflective type conforming to ASTM D 4280. Table 9.1 of Manual presents the warrants for providing Road studs in two lane highway and the priorities to be followed along with placement details shall be as per IRC:35. The colour pattern of road studs for edge line and centre line with respect traffic movement is depicted in Fig. 9.3 of Manual.

10. Roadside Furniture

- (i) Roadside furniture shall be provided in accordance with the provision relevant manual, Schedule-B and Schedule-C.
- (ii) Overhead traffic signs: locations and size: NIL

11. **Muck Dumping Sites:** The EPC Contractor shall arrange the muck dumping sites at their own cost. The EPC Contractor shall have to present a Muck Disposal Plan according to the applicable rules and regulations of the Government of West Bengal and the Government of India. The excavated material available from excavation may be used by the EPC Contractor for the construction of project- related works provided it meets the standards and specifications as defined in Schedule D and after payments of all applicable royalties and levies, including taxes as per Government of West Bengal and Government of India rules and regulations. The EPC Contractor shall relocate and dump the excess material (at its own cost) at the suitable area identified by EPC Contractor, in a way to avoid any negative impact on the terrestrial and aquatic environment. For stabilization of dumped material, engineering measures and/or other measures, retaining structures shall be proposed by the EPC Contractor (at its own cost), with individual plans and cross sections for all muck disposal areas. The NGT Order dated 01.11.2018 shall be followed for disposal of muck.

12. **Damage to structures outside ROW:** The Contractor shall adopt such work methodology ensuring that there shall be no damages to structures located outside RoW (either private or Govt. structures such as permanent or temporary building structures, sheds, utilities, trees, or other immovable structures) on account of construction and maintenance of the project highway. To avoid the above issues, it is clarified that the cost of the repair/damaged structures, failing outside the ROW, should be borne by the Contractor, wherever damages are on account of the Contractor. Further, it shall be Contractor's responsibility to retain videographic and photographic records of structures at vulnerable areas. Authority's decision in

such cases 'whether the damages are on account of the Contractor or not' shall be binding on the EPC Contractor.

13. Hazardous Locations

The delineators shall also be provided at the entire project section referred in para 6(i) of Annex-I of Schedule-B.

14. Breast wall:

It is expected that the existing Breast wall may get damaged during construction of slope protection measures in the concerned stretches. If damaged then, reconstruction of the PCC type breast at such site shall be done by the EPC Contractor. PCC type breast wall shall be constructed with minimum height same as that of existing breast wall.

15. Work Zone Traffic Management Plan

The traffic diversion shall be prepared as per IRC SP 55 for smooth flow of traffic and safety. If required, a diversion plan shall be proposed and traffic management plan for reinstatement of project road at identified locations. The Contractor shall not block carriageway during construction at any time and necessary safety measures required during execution of work shall be provided as per IRC SP: 55, Guidelines on Traffic Management in Work Zones. No separate payment shall be made for providing Traffic Management Plan at site during execution of work.

16. Change of Scope

The Area, width (depth), length, and height of protection works, drainage system, concrete cladding/Retaining structures, breast wall and other items specified herein above shall be treated as approximate assessment. The actual quantities as required on the basis of detailed investigations shall be determined by the Contractor in accordance with the Specifications and Standards. Any variations in the lengths specified in this Schedule- B shall not constitute a Change of Scope, save and except any variations in the length arising out of a Change of Scope expressly undertaken in accordance with the provisions of Article 13.

The layout dimensions, structural cross-sections, linear horizontal spans, and vertical heights of all retaining walls, breast walls, concrete face cladding panels, shortcreting setups, cross-drainage channels, and rockfall barriers, etc. specified under this Schedule-B represent mandatory project minimum requirements firmed up by the Authority. Any localized quantitative change upto 10% for items measured in linear meters, or up to 10% for items measured in square meters or cum of a designated landslide stretch given above, shall not constitute a

Change of Scope (CoS), nor shall they qualify for additional financial variations, save and except for alterations executed strictly outside these thresholds under Article 13."

Sl no.	DESCRIPTION OF ITEMS	Measure-ment units
1	PCC step wall in pile foundation complete all including vibrating and compacting, finishing, curing, sampling, testing etc. (Concrete grade M20)	Length in meters
2	CC wall in open foundation complete all including vibrating and compacting, finishing, curing, sampling, testing etc. (Concrete grade M20)	Length in meters
3	Installation of Self driven rock anchor made of 40CR material with outer dia of 38 mm and inner dia of 19 mm, complete in all respect, including Cement pressure grouting in Rock / overburden with equipment required to complete the grouting work at required pressure and prestressed cable anchor.	Length in meters
5	Surface Drains in as per the direction of the Authority's Engineer.	Length in meters
6	Gabion wall with Perforated HDPE pipes (hill & valley side) Sub-Surface Drains	Area in sqm
7	Road work including all miscellaneous items & safety items	Length in meters

17.1. Staged Cutting and Stabilization Sequence

To allow excavated hillsides to achieve time-dependent mechanical stability, all highway construction works in mountainous stretches shall be executed in distinct temporal stages. The initial contract period of approximately one year shall be restricted strictly to initial formation cutting, slope profiling, and the simultaneous execution of the corresponding engineered slope stabilization measures. Subsequent sub-base layouts, pavement layer construction, and final structural works shall proceed only on those specific subsections where both the formation cut and the completed protection measures have remained proven stable through at least one full monsoon season.

17.2. Hill Side Excavation and Cutting Methodology

1. **Stepped Benching:** All major hill cutting activities shall be carried out in a stepped, terraced, or benched configuration rather than vertical or continuous steep un-benched cuts, maximizing structural resilience.

2. **Top-to-Bottom Execution:** Mechanical excavation works must proceed strictly

from the top of the designated cutting profile downward to mitigate localized rotational failure risks.

3. Simultaneous Protection: Surficial and structural protection works (including shotcreting, drapery netting, and active rock anchoring) must be implemented concurrently alongside the mechanical excavation sequence.

17.3. Pre-Execution Verification and Crack Remediation

Prior to commencing any mechanical excavation or hill cutting, the Contractor shall verify the actual site geometry by conducting a high-resolution topographic survey covering a 300-meter wide strip (150 meters on either side of the existing alignment center) using LIDAR or AI-camera fitted UAV drones.

Any ground tension cracks identified within this 300-meter influence zone must be mapped, traced, and immediately sealed using stable matching concrete filler materials to completely prevent the infiltration and percolation of surface rainwater into the underlying subsoil mass.

17.4. Permanent Geodetic Observation Points The Contractor shall construct permanent concrete geodetic observation pedestals on all treated and active slope faces. The exact spatial coordinates of these points must be regularly surveyed, logged, and monitored throughout the execution period to immediately detect any structural micro-movements or signs of creep within the slope mass.

18. Utility Shifting

Details are given in **Sheet-II (Annexure-I to Schedule-B)**

Utility Shifting: NIL.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Annexure-B-II

Schedule-B

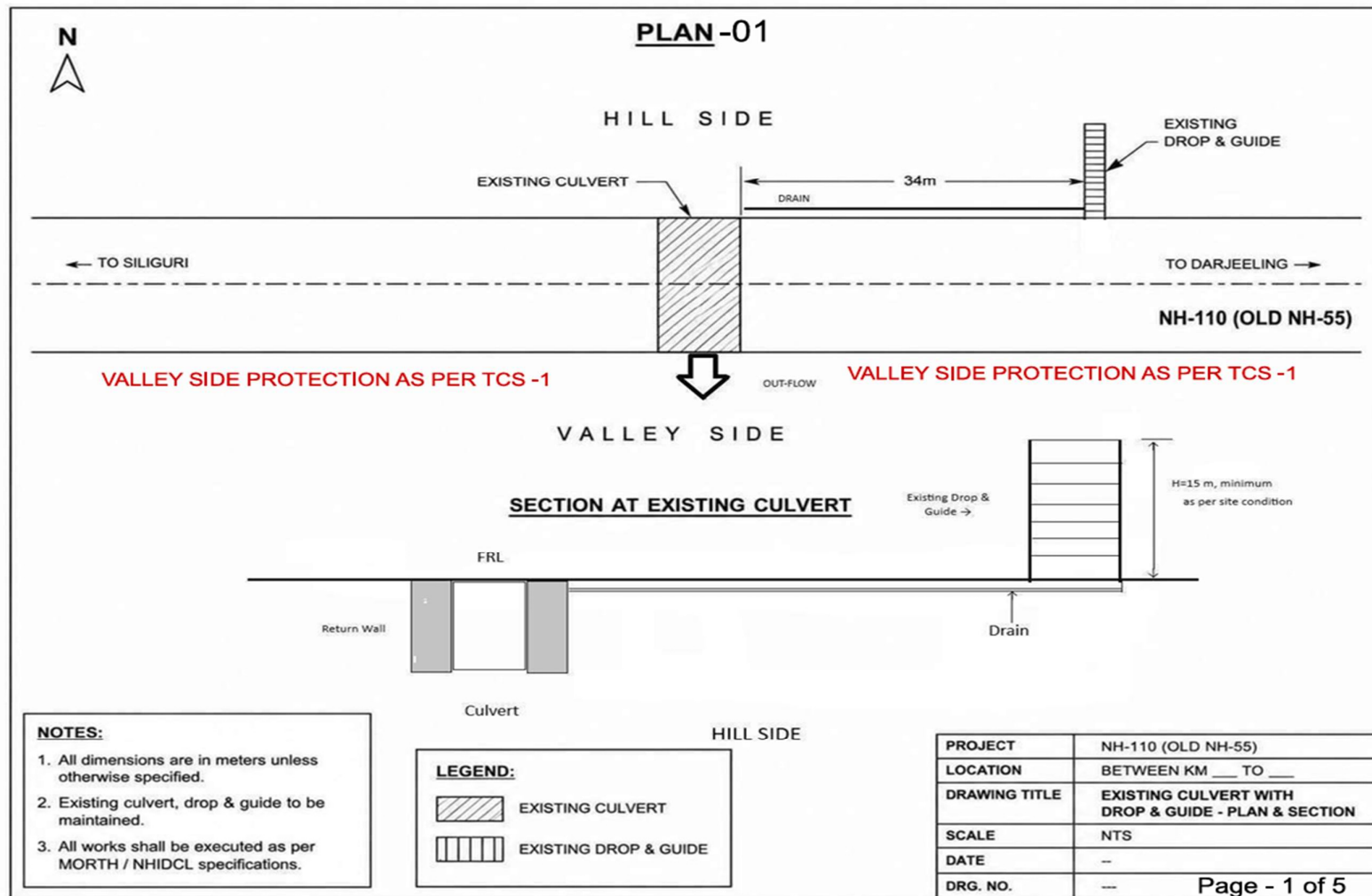
Widening Scheme:

The proposed slope protection measures shall be executed at damaged locations to reinstate the present carriageway to the original configuration (2-Lane with paved shoulder, i.e. Paved carriageway shall be 7m wide with 1.5 m paved shoulder both side and 1.0 m earthen shoulder valley side).

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

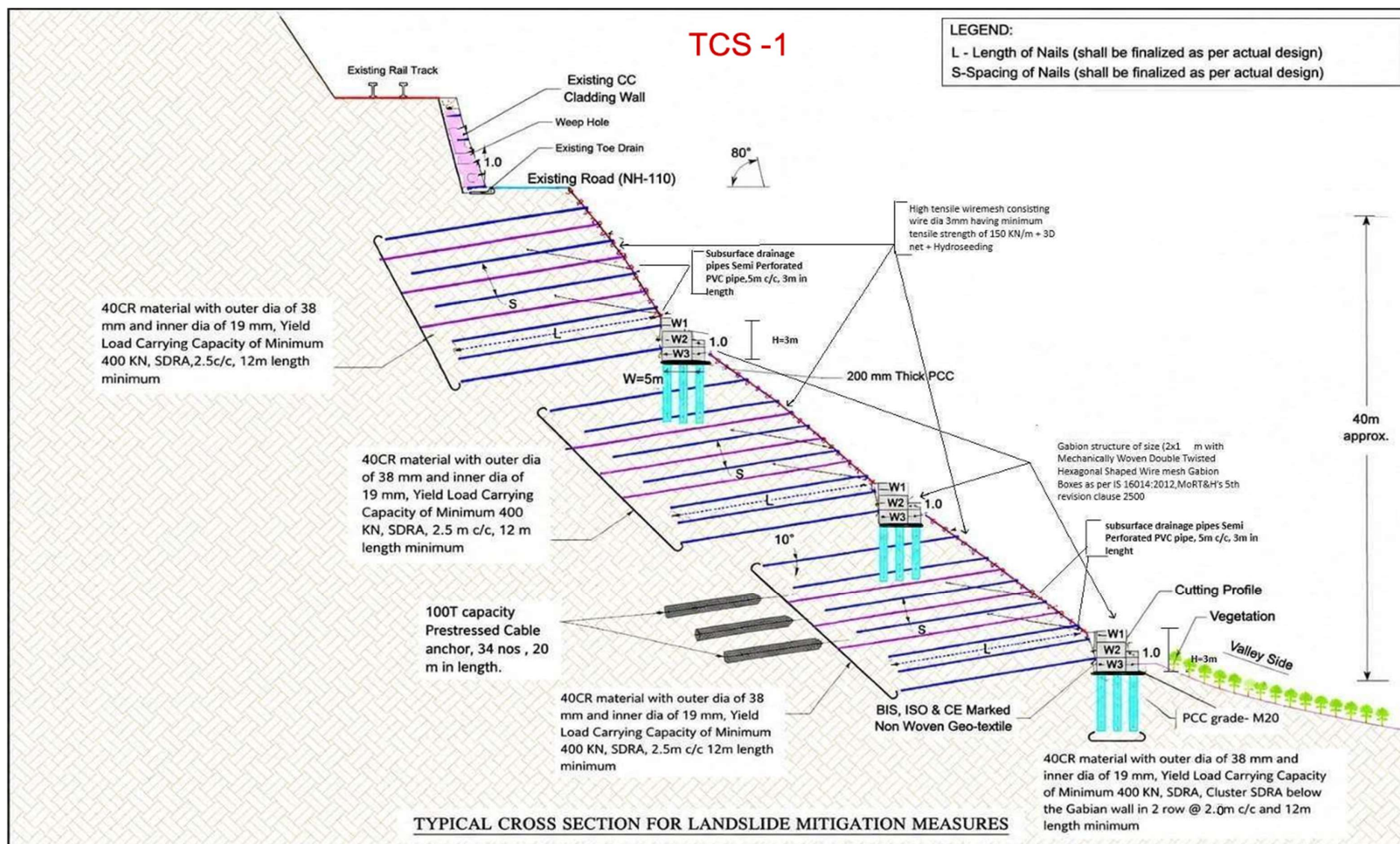
Appendix B-1

Applicable PLAN - 01



Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

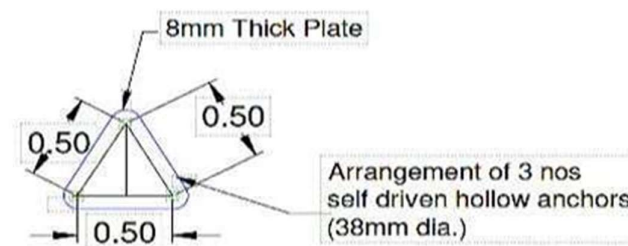
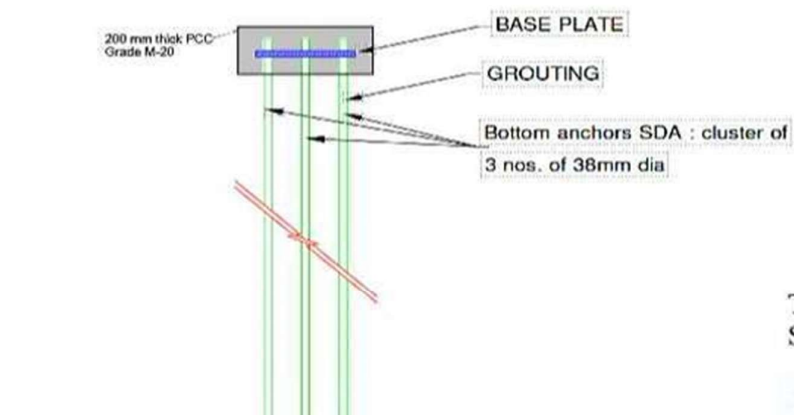
Drawing - TCS - 01



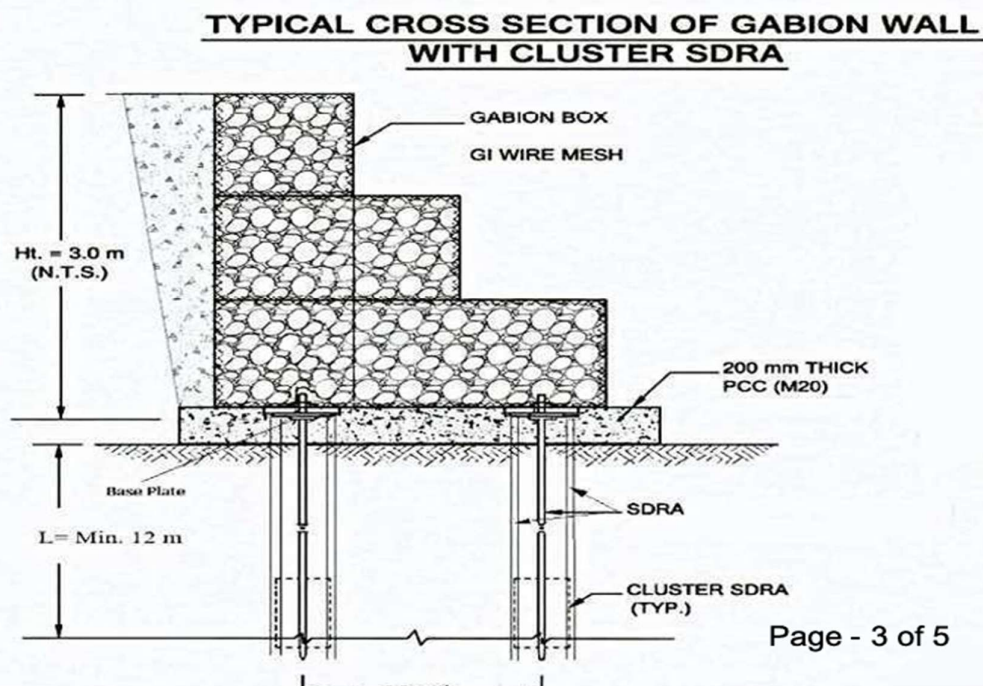
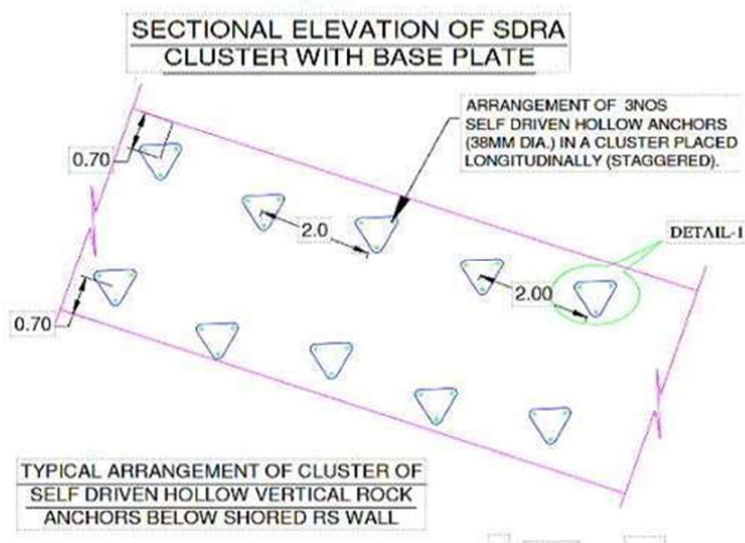
Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Drawing - TCS- 2

TCS -2



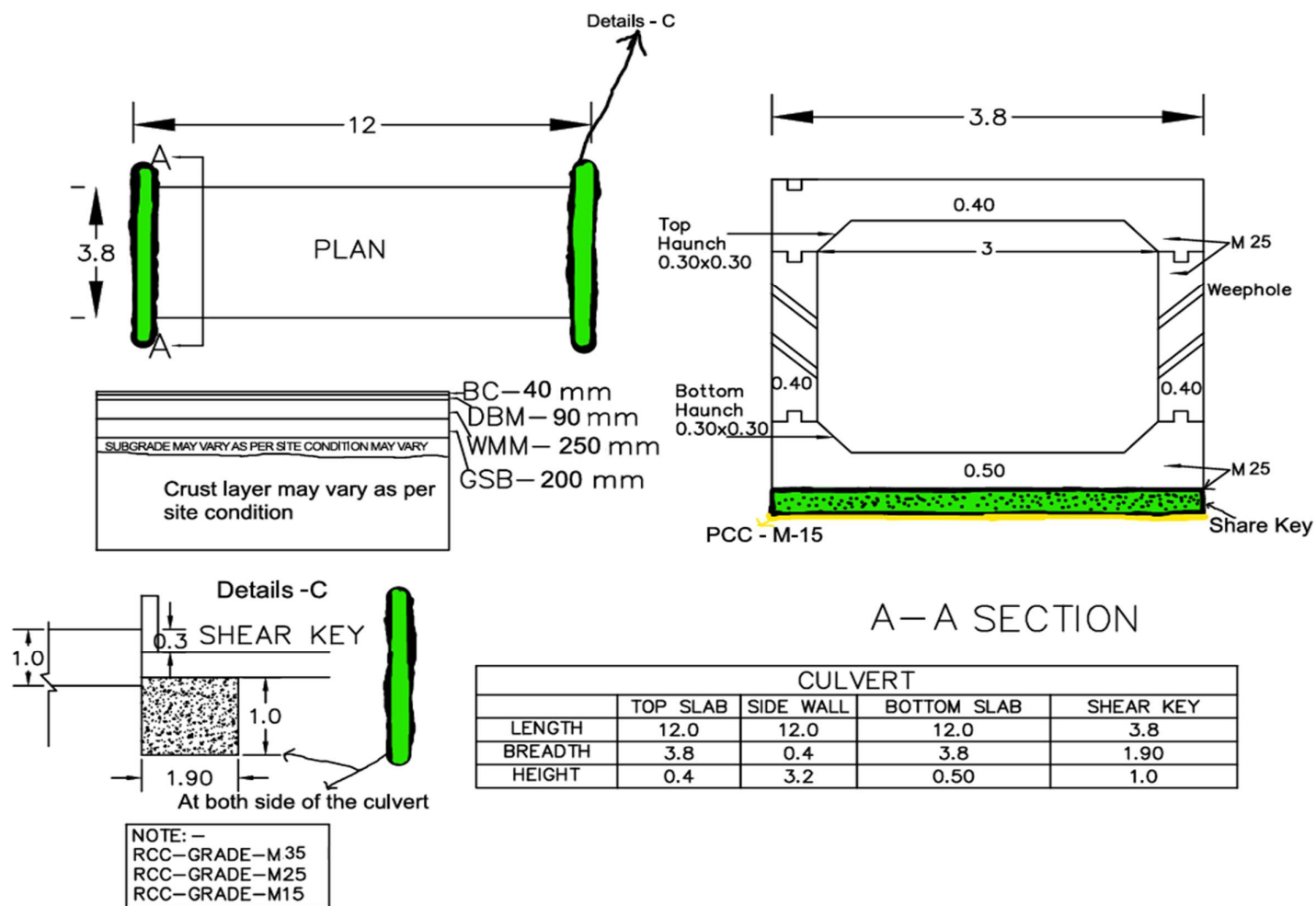
TYPICAL ARRANGEMENT OF SDR CLUSTER (DETAILS-1)



Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

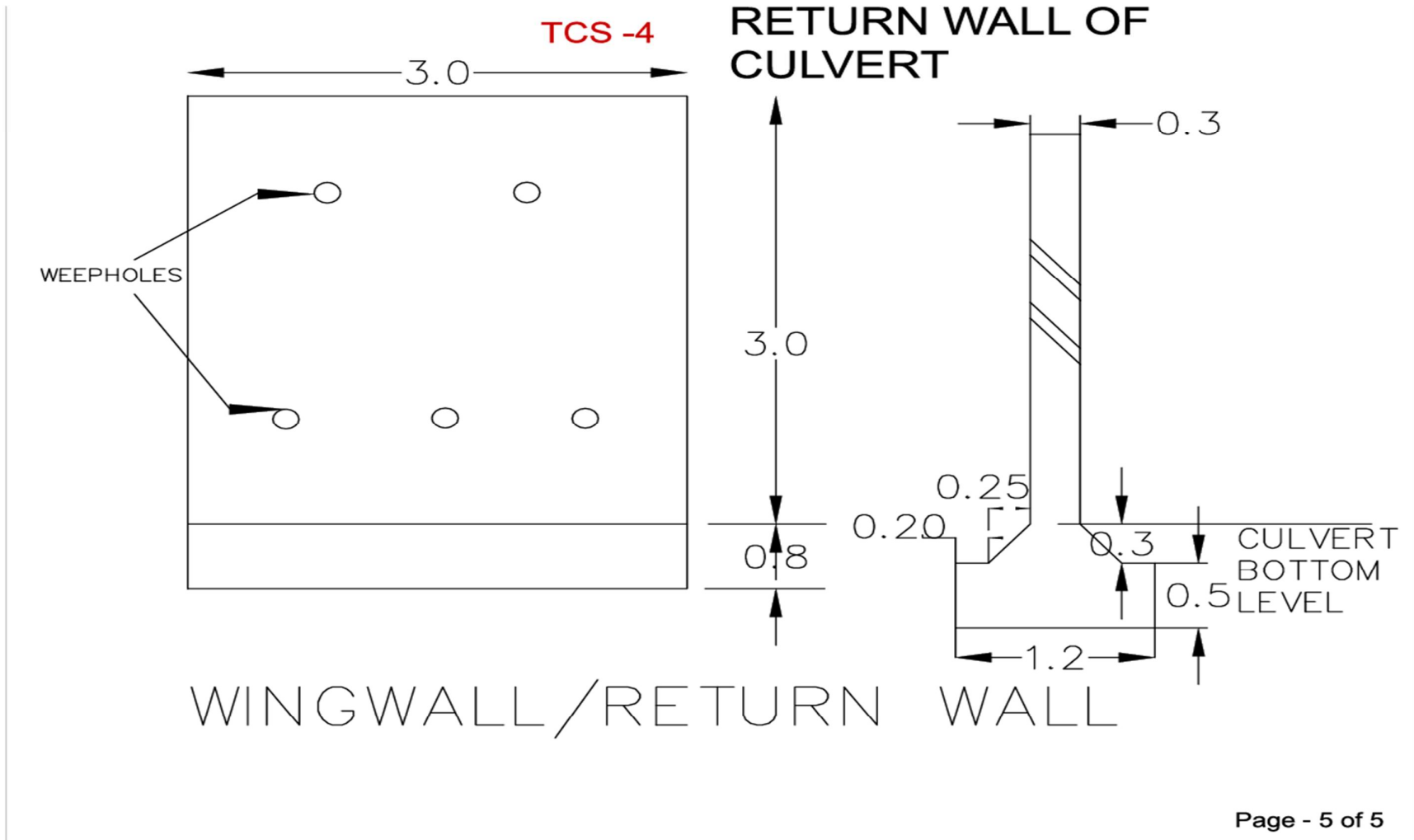
Box Culvert - TCS - 03

TCS -3



Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Return wall of Culvert - TCS - 4



Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule- C

(See Clause 2.1)

Project Facilities

1. Project Facilities

The Contractor shall construct the Project Facilities in accordance with the provisions of this Agreement. Such Project Facilities shall include:

- a) ~~toll plaza;~~
- b) roadside furniture;
- c) ~~pedestrian facilities;~~
- d) tree plantation;
- e) ~~truck lay-byes;~~
- f) ~~bus bays and bus shelters;~~
- g) ~~rest areas;~~
- h) Delineator;
- i) ~~Parapet wall and;~~

2. Description of Project Facilities

Each of the Project Facilities is described below:

(a) Roadside Furniture

Roadside furniture shall be provided in accordance with the manual of specification & standards.

(b) Traffic Signs & Marking

- i. **Traffic signs** viz roadside signs, overhead signs and kerb mounted signs. Traffic signs include road signs (Mandatory, Cautionary, and Informatory), overhead signs and gantry mounted signs along the entire Project as per design and site conditions. Also, Specifications of the reflective sheeting. Type-XI type of reflective sheeting to be provided as referred to the provision of Section 6.7.1 of IRC: 67-2022 of the Manual.
- ii. **Pavement Marking:** Pavement markings shall cover road marking (including Transverse Bar Markings) for the entire Project Highway as per relevant code and manual.
- iii. **Traffic Blinkers**
Traffic Blinkers shall cover the entire Project Highway in accordance with the manual of specification & standards.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule - D

(See Clause 2.1)

Specifications and Standards

1. Construction

The Contractor shall comply with the Specifications and Standards set forth in Annex-I of this Schedule-D for construction of the Project Highway.

2. Design Standards

The Project of Slope Protection Measures shall conform to design requirements set out in the following documents and Annex-I of this schedule:

- a). Manual of Specification and Standards for Two Laning of Highways with paved shoulder (IRC: SP: 73 - 2018), referred to herein as the Manual for 2-lane project road.
- b). IRC SP: 48 - 2023 (Hill Road Manual): referred to herein as the Hill Road Manual
- c). IRC: SP:106-2015 Engineering guidelines on Landslide Mitigation Measures for Indian Roads
- 3. Additional Provision for Hill Road Projects - All materials, structural designs, site investigation regimes, and construction operations concerning hill cutting and landslide mitigation shall strictly conform to:
 - i) IRC:75 (Guidelines for the Design of High Embankments and Cut Slopes in Hill Roads) and IRC: SP:48 (Hill Roads Manual).
 - ii) *Expert Committee Report on Cost Effective Long Term Remedial Measures for landslide Prone Areas in Hilly Regions issued by Ministry vide circular No RW/NH-33044/55/2021-S&R(P&B) pt/Hill Slope Monitoring dated 28.11.2024*

Ministry circular No RW/NH-33044/37/2025-S&R(P&B) dated 07.11.2025 on Additional Augmented and Systematic Remedial Measures to Address Concerns regarding Construction of National Highways in Hilly Regions

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Annex - I
(Schedule-D)

Specifications and Standards for Construction

1. Specifications and Standards

All Materials, works and construction operations shall conform to the Manual of Specifications and Standards for Four-Laning of Highways IRC: SP: 84-2019 and Hill Road Manual IRC SP: 48 - 2023 with all amendments till date published by IRC (referred to as “Manual” in this Schedule) and MORT&H Specifications for Road and Bridge Works (5th revision). In addition, provisions of relevant Codes, Standards, Specifications, Guidelines etc. of IRC, MoRTH, AASHTO, ASTM, Euro Codes and British Codes shall also be referred. Where the specification for a work is not given, Good Industry Practice shall be adopted to the satisfaction of the Authority’s Engineer.

1.1 Design Standards

- (i) IRC- HRB- Special Report-23 -State of the Art: Design and Construction of Rock fall Mitigation systems.
- (ii) IRC: SP: 42 - 2014, Guidelines of Road Drainage.
- (iii) IRC SP: 116-2018 - Guidelines for Design and Installation of Gabion Structures.
- (iv) BS 8006-1:2010+A1:2016-Code of Practice for Strengthened /Reinforced Soil& other fills.
- (v) BS 8006-2:2011 Code of Practice for Strengthened /Reinforced Soil, Soil nail design
- (vi) BS 8081:2015+A2:2018 - Code of Practice for Grouted Anchors.
- (vii) FHWA-NHI-14-007 - Soil Nail Walls Reference Manual (FHWA GEC 007), 2015.
- (viii) FHWA-IF-99-015 - Ground Anchors and Anchored System (GEC No. 4), 1999.
- (ix) IS 16014:2018, Mechanically Woven, Double-Twisted, Hexagonal Wire Mesh Gabions, Revet Mattresses, Rock Fall Netting and Other Products for Civil Engineering Purposes (Galvanized Steel Wire or Galvanized Steel Wire with Polymer Coating) – Specification.
- (x) IS 14268: 2017 - Uncoated Stress Relieved Low Relaxation Seven-Wire (Ply) Strand for Prestressed Concrete– Specification.
- (xi) IS: 1893-1 (2016), –Criteria for Earthquake Resistant Design of Structure, Bureau of Indian Standards, and New Delhi.
- (xii) Ministry of Road Transport and Highways (MORTH), –Specifications for Road and Bridges Works - Fifth Revision.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

- (xiii) Geological, geotechnical& Geophysical investigations as per IRC: 78, Specifications for drilling, coring testing etc. issued by ISI, BIS, MoRT&H and other relevant codes are applicable.
- (xiv) Other Indian / International Standards applicable as per Good Industry Practice.

1.2. Additional for Hilly Terrain Projects: - All materials, structural designs, site investigation regimes, and construction operations concerning hill cutting and landslide mitigation shall strictly conform to:

- i) IRC:75 (Guidelines for the Design of High Embankments and Cut Slopes in Hill Roads) and IRC: SP:48 (Hill Roads Manual).
- ii) *Expert Committee Report on Cost Effective Long Term Remedial Measures for landslide Prone Areas in Hilly Regions issued by Ministry vide circular No RW/NH-33044/55/2021-S&R(P&B) pt/Hill Slope Monitoring dated 28.11.2024*
- iii) *Ministry circular No RW/NH-33044/37/2025-S&R(P&B) dated 07.11.2025 on Additional Augmented and Systematic Remedial Measures to Address Concerns regarding Construction of National Highways in Hilly Regions*

In the event of any technical contradiction or ambiguity between the standard MoRT&H Specifications and the Expert Committee Guidelines of 28.11.2024 regarding slope stabilization items, the provisions, generic matrices, and material requirements of the **Expert Committee Guidelines** shall explicitly override the former."

2. Deviations from Specifications and Standards

- (i) The terms "Concessionaire", "Independent Engineer" and "Concession Agreement" used in the manual shall be deemed to be substituted by the terms "Contractor", "Authority's Engineer" and "EPC Agreement" respectively.
- (ii) Notwithstanding anything to the contrary contained in Paragraph 1 above, the following Specifications and Standards shall apply to the Project Highway, and for purposes of this Agreement, the aforesaid Specifications and Standards shall be deemed to be amended to the extent set forth below:

S. No.	Item and Clause Reference	Provision as per Manual	Modified
1	Clause 3.5.1 of IRC SP:48 -2023 Approach to Stability Analysis	Specification requirement described under Sn (i) to (iv).	Add following provision: Factor of Safety in case of Seismic Condition for landslide locations shall not be less than 1.00.

- (iii) Specifications for monitoring instruments shall be in accordance with section 6 of IRC SP 106- 2015.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

(iv) The EPC Contractor shall ensure signing of agreement between the contractor and technology provider before use of material/technology/design. The agreement shall have the provision of involvement of technology provider during execution. Technology provider shall deploy the requisite design expert/material technologist/skilled and trained construction supervision personnel to certify material testing and material characterization for design, proof check of design, approved construction methodology, quality control and supervision and certification of the day-to-day construction/execution. The technology provider shall submit the warranty for the products to be used along with all other documents as required by IRC: SP:112-2017 “Manual for Quality Control in road & bridge works”. Copy of such agreement shall be furnished to AE, PMU and to RO NHIDCL for reference and record.

(iv) Additional Specifications and Material Standards for Hill terrain projects: -
All works of Slope stabilization and drainage shall comply with the following material properties, operational tolerances, and testing codes:

Table D-1: Material Specifications & Testing Codes for Slope Works

Sl. No.	Slope Treatment Component	Mandatory Minimum Technical Specification & Enforceable Code Compliance	Mandatory Field Testing & Sampling Frequency
1	Geotechnical Sub-Surface Core Investigations	- All core drilling must log Rock Quality Designation (RQD), Geological Strength Index (GSI), and Rock Mass Rating (RMR) basic metrics. - Bulk sampling of gravelly, boulder-strewn, or river-borne debris mass must be tested using a Large-Scale Shear Box apparatus (minimum box dimension of 300mm x 300mm) to establish realistic cohesion and internal friction angle values.	- Minimum 1 core borehole per 500 meters or closer at critical landslide clusters, deep cut sections (≥6.0m), or soft ground zones. - Minimum 3 Large Shear Box tests per representative strata change.
2	Subsurface Anchors, Rock Bolts, and Soil Nails (<i>Expert Committee Codes G07a / G07b</i>)	- Solid steel reinforcement bars must be Thermo-Mechanically Treated (TMT) conforming to IS:1786 with a minimum yield strength of 500 MPa. - Self-Drilling Anchors (SDA) must conform to ASTM A615 or equivalent European (EN) standards. - For highly aggressive, weathered rock environments (Grades W3 to	Pull-out Proof Testing: Minimum 2% of the total number of installed production anchors/bolts must be proof-tested up to 1.5 times the design load in accordance with ASTM D4435 or IS:11309 under the supervision of the Authority’s Engineer. - Grout cube testing (IS:4031) for every 5m³ of

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

		W5), Double-Corrosion Protection (DCP) sheathing (pre-encapsulated smooth corrugated HDPE tube) is compulsory.	grout mix or per day's work (minimum compressive strength 30 MPa at 28 days).
3	Surficial Cladding and Face Shotcreting (<i>Expert Committee Code G04l</i>)	- Shotcreting must be Fiber Reinforced Shotcrete (FRC) utilizing alkali-resistant macro-synthetic or steel fibers (minimum dosage of 40 kg/m³ for steel or 5 kg/m³ for macro-synthetic) to control shrinkage and handle structural shear strains. - Minimum characteristic compressive strength must be M25 grade in compliance with IS:9013 / IS:9103.	- Minimum 3 compressive strength test cores shall be extracted from field-sprayed test panels (minimum panel size 500mm x 500mm x 100mm) for every 50 m³ of shotcrete sprayed or per shift's output. - Thickness checks via physical probing pin penetrations at a frequency of 1 test per 10 m² of sprayed slope face.
4	High-Capacity Flexible Drapery & Rockfall Barriers (<i>Expert Committee Codes G06a / G09b</i>)	- All high-tensile steel wire mesh drapery and dynamic flexible rockfall barriers must be system-certified under international dynamic drop impact testing protocols (ETAG-027 / EN 15746). - Dynamic barriers must possess an energy absorption capacity rating not less than the firmed-up baseline hazard requirement (e.g., 2000 kJ to 5000 kJ) with an uncompromised net retention grid.	Manufacturer's Test Certificate (MTC): Compulsory for every structural component batch (wire ropes, energy dissipators, anchors, and shackles). - Visual verification and grid alignment checks across 100% of the barrier post positions prior to tensioning works.

ANNEXURE-II: TECHNICAL SPECIFICATIONS

(SPECIFICATIONS AND STANDARDS FOR DESIGN AND CONSTRUCTION)

The following Specifications and Standards shall be applied in addition to IRC: SP: 84-2019 and IRC SP: 48 - 2023, MoRTH specifications with all amendments till bid due date. Out of given alternatives in the agreement, such specifications and standards shall be adopted, for design of slope protection measures specified in Schedule-B, which are proven to be better. Authority Engineer's decision shall be final in this regard.

1. SUPPLY AND INSTALLATION OF SELF DRILLING ANCHORS (SDA) OF 38/19mm DIAMETER

The SDA shall be designed and arranged to stabilize in-situ strata. The grout shall be made of OPC min. grade 43 & above with suitable admixtures. SDA bars shall have corrosion protection coating including hexagonal nut, washer plate, coupler for connecting bars all with hot dipped Zinc coated of 86micron. Additionally post installation all the exposed portion shall be coated with epoxy coating of minimum 150 micron. The SDA rod shall be continuously threaded. For convenience of installation, appropriate arrangement (coupler) shall be made to connect two smaller lengths of SDA to achieve the required length. As mentioned in Hill Road Manual, BS 8081-2015 shall be referred for design, testing, monitoring, and maintenance.

Installation of Self driven rock anchor made of 40CR material with outer diameter of 38 mm and inner diameter of 19 mm, Yield Load Carrying Capacity of Minimum 400 KN in soil / overburden / rock suitable for drilling placing and cement grouting. Installation with all accessories such as 76 mm diameter sacrificial drill bit, couplers, 200*200mm base plate with 10mm thick and nut and bolt complete in all respect. The cement grouting shall be done at a min. pressure ranging from 1 to 3 kg/cm² till all the cracks are suitably sealed / filled.

Any equivalent or greater proven alternative technologies that meet the minimum technical criteria of anchors may be used subject to prior written approval of competent authority in NHIDCL. These criteria include Bond Strength, Anchor Length, Yield load, Tensile strength, Pull-out resistance, and Corrosion protection measures etc. for the design life.

2. SUPPLYING & FIXING THREE-DIMENSIONAL TURF REINFORCEMENT MAT (TRM) MADE OF CONTINUOUS MONOFILAMENTS (3D REINFORCED EROSION CONTROL MAT).

Supplying and fixing reinforced erosion Control mat (for surficial erosion control) made from a polymeric three-dimensional matrix of minimum mass per unit area 400 grams/sqm conforming to EN ISO 9864 extruded onto a primary mesh rhomboidal or mechanically woven double twisted steel wire mesh having longitudinal tensile strength of 55+-5 kN/m, having proven life of >50 years complying with class C3 Site Environmental level

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

mentioned in Tables 4 and 8 of IS:14191-6 including fixing of U pins of 8mm diameter of depth 500mm at 1m c/c spacing complete with all materials, etc.

(i) **Geo-mat specifications:**

Polymer	Polypropylene
Mass per unit area (EN ISO 9864) $\pm 10\%$	400 g/m ²
Melting point	150 degree C
Density	900 Kg/m ³
UV Resistance	UV stabilized

(ii). **Reinforcement**

Type	Rhomboidal or Double twisted woven steel wire mesh. Wires protected with galvanization
Wire dia (Int./Ext.), mm	2.7/3.7
Mesh wire-primary corrosion	Zn-5% Al +Polymer coating as per IS:4826 - 1979

(iii). **Characteristics of Steel reinforced Synthetic Geomat**

Mechanical Properties of Steel Reinforced Synthetic Geomat		
Mechanical Strength (Length)	kN/m	55 (+) or (-) 5 (Minimum)
Nominal Physical properties of High Strength Reinforced Synthetic Geomat		
Mass per unit area (EN ISO 9864)	g/m ²	1900
Voids index	%	>90
Nominal Thickness (EN ISO 9863-1)	mm	12
Geomat colour (*)	Black/Brown/Green	

3. CONCRETE:

The minimum concrete grades for various structures shall follow specifications

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

- Surface CC drains: M20
- PCC/ CC works and Retaining walls / Breast wall: M25
- RCC works and Concrete step wall: M25,

IS 456 shall be used for all concrete related designs, and quality control.

Testing and Acceptance criteria:

The manufacturer of the synthetic mat shall provide Manufacturers Test Certificate / Certificate of Conformity for the material with every lot/shipment. The Manufacturers Test Certificate / Certificate of Conformity for synthetic mat shall be provided for certifying that system confirms to all the technical requirements.

4. Gabion structure with Mechanically Woven Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes as per IS 16014:2012, MoRT&H's 5th revision clause 2500;

Providing & making Gabion structure of size (2x1x1)m with Mechanically Woven Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes as per IS 16014:2012, MoRT&H's 5th revision clause 2500 of required size, Mesh Type 10x12(D=100 mm with tolerance of $\pm 2\%$), Zinc+10% Al alloy+Polymer coated, Mesh wire diameter 2.7/3.7mm (ID/OD), mechanically edged/selvedged with partitions at every 1m interval and shall have minimum 10 numbers of openings per meter of mesh perpendicular to twist, tying with lacing wire of diameter 2.2/3.2mm(ID/OD), supplied @3% by weight of Gabion boxes, filled with boulders with least dimension of 200 mm, as per drawing, all complete as per directions of Engineer-in-charge.

5. Geo-jute mat;

Supply and fixing layer of Geo-jute mat with spraying of seeds of Lemon grass/Dedonia/Vetiver etc., including all cost of material, with following properties:

- a. Material 100% natural,
- b. Weight 500 GSM,
- c. Minimum Breaking Load along Machine Direction (warp way)-10.0(kN/m), Cross Direction (Weft way)- 10.0(kN/m), d. Max. Elongation at break (in %): Machine Direction (warp way) 10, Cross Direction (Weft way)-12.

6. HT Rolled Cable Net;

High tensile rolled cable net having aperture size not more than 300mm in one direction and minimum longitudinal tensile strength 120 KN/M and punching resistance 220 kN, comprising of minimum 8mm diameter wire rope cable with a minimum breaking load of 40.7kN. The tensile strength of wire of the cable should be 1770 N/sqmm having corrosion protection of having 95% Zn + 5% Al Class-B (Galfan) Coating as per IS/ISO-17746-2016 for treatment of slopes (net, boundary rope(12mm diameter) & rope anchor etc.

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comprising of the complete system), labour, special labour and T&P required to complete the work in all respect in accordance with drawings, Technical Specifications.

7. SUPPLYING AND FIXING OF EROSION CONTROL COIR MAT AND U-PINS

Geo-jute mat with spraying of seeds of Lemon grass/Dedonia/Vetiver, complying with MoRTH specifications 707 and with following properties:

- a. Material 100% natural, biodegradable non-woven
- b. Weight 500 GSM,
- c. Minimum Breaking Load along Machine Direction (warp way)-10.0(kN/m), Cross Direction (Weft way)- 10.0(kN/m),
- d. Max. Elongation at break (in %): Machine Direction (warp way) 10, Cross Direction (Weft way)-12.

8. SUBSURFACE DRAINS

Pressure relief drains shall be of Slotted/perforated pipes, installed in drilled holes drilled as shown in drawings to tap the sub-surface flow. Sub surface drains shall be Corrugated and Slotted High-Density Polyethylene (HDPE) pipes (wrapped with Type-2 non-woven geotextile) of 100 mm internal diameter, installed in pre-bored hole drilled with upward gradient. The space around the pipe at the face of the cut slope / wall shall be packed with rich sand cement mortar mixed in proportion not leaner than 1(cement):4 (sand).

8. (i) **Gabion Facia box** - BIS certified Gabion fascia box with 2m integrated tail of Size 3m(Length of Tail)x3m(Length of Box)x1m(Height of unit) with Mechanically Woven Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes as per IS 16014:2012, MoRT&H's 5th revision clause 2500, of required size, Mesh Type 10x12 (D=100 mm with tolerance of $\pm 2\%$) Zn +Polymer coated, Mesh wire diameter 2.70/3.70 mm (ID/OD), mechanically edged/selvedged with partitions at every 1m interval and shall have minimum 10 numbers of openings per meter of mesh perpendicular to twist, tying with lacing wire of diameter 2.2 /3.2 mm (ID/OD), supplied @3% by weight of Gabion boxes, filled with boulders with least dimension of 200 mm, as per drawing.

(ii) **High strength flexible geogrids (HSFG)** as soil reinforcement / basal reinforcement as per MORTH 3100 and IRC 113, made of high tenacity polyester core with polyethylene coating with Minimum Long Term Design Strength (LTDS) of more than 50% of ultimate tensile strength at 30 degree Celcius corresponding to 12 % strain. (Ultimate tensile strength- 200 kN/m).

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(iii) **Drainage composite** for use behind walls, between two different fills, alongside drains of road, below concrete lining of canals etc. having three dimensional composite with thermobonding a draining core having “W” configuration in extruded monofilaments of minimum thickness 7.2mm, with two filtering UV stabilized polypropylene nonwoven geotextile of minimum thickness of 0.75mm and tensile strength of 8.0 kN/m that will be working as separation or protecting layer, geocomposite having in plane flow capacity of 2.3 L / (m.s) at hydraulic gradient of 1.0 & 20 kPa pressure and tensile strength of 18 kN/m , with mass per unit area of 740 gsm, at easily accessible location including top and bottom, with all leads and lifts, manpower and machinery, materials, labour etc. complete and as directed by Engineer.

(v) **Needle Punched and mechanically bonded non-woven Geotextile** indigenously manufactured from high quality fibers on the prepared subgrade for Separation. (Ref to MoRT&H’s 5 th Specification 702) 150 GSM

9. Hydroseeding of soil slopes:

Hydroseeding of soil slopes including mixing of seeds, mulch (meeting performance parameters as mentioned in technical specification), fertilizer and soil amendment products if required in hydroseeder machine with water and spraying the mixture with 100 psi pressure pump on hilly slopes on exposed soils, (end product must form a blanket within 2 hours of application, and soil erosion must be controlled after 2 hours of application) including maintenance- for three months (watering 2-3 times a day after 24 hours of hydroseeding) or till propagation of grasses and shrubs.

10. QUALITY ASSURANCE PLAN:

S No	Material or Process / Characteristics	Frequency	Reference Standard	Level of Check
1	Earth work in filling			
a	Index properties	1 set of tests per 3000 cum	IS: 2720 Part - 2,3,4,5,6,8,9	Four
b	MDD & OMC		IS 2720 Part 7	Four
c	Thickness	For every layer	Technical Specifications/ drawings	Three
d	Field dry density and moisture content	1 test per 1000 sqm of completed area	IS 2720 Part 28	Three
e	Level and slope	For topmost layer and for outer slope	As per drawing	Three
2	Anchor			
1	Diameter	Per lot	MTC	One
2	Length	Per lot	MTC	One

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S No	Material or Process / Characteristics	Frequency	Reference Standard	Level of Check
3	Mechanical Properties	Per lot	MTC	One
4	All Relevant Tests of Grouted anchor as per Annex-G BS: 8081-2015			
3	Cement Concrete			
a	Mix Design	For each grade of concrete and material source	IS 10262	Three
b	Grade of concrete	For each pour	IS: 456 and drawings	Three
b	Cube Strength		IS 516	Three
c	Slump test		IS 1199	Three
4	Steel Reinforcement			
a	Grade of steel		As per approved construction drawings	One
5	Mechanically Woven DT mesh			
1	Mesh dimension	1 per 8000 Sqm.	ASTM-A 975	Two
2	Mesh opening (D-dimension)	1 per 8000 Sqm.	EN 10223-3	Two
3	Mesh wire diameter	1 per 8000 Sqm.	EN 10223-3	Two
4	Mesh wire zinc coating thickness	1 per 8000 Sqm.	EN 10244-2	Two
5	Polymer coating thickness	1 per 8000 Sqm.	ASTM-A 975	Two
6	Grout			
a	Grouting compound	Per lot	Data Sheet	One
7	Non -woven geotextile			
1	Tensile strength & Elongation	Per lot	Cl. 702 MoRTH	One
2	Puncture strength	Per lot	Cl. 702 MoRTH	One
3	Apparent opening size	Per lot	Cl. 702 MoRTH	One
4	Permeability	Per lot	Cl. 702 MoRTH	One
5	Mass per unit area	Per lot	Cl. 702 MoRTH	One
8	Erosion control mat			
1	Tensile strength	Per lot	Cl. 706 MoRTH	One
2	Thickness	Per lot	Cl. 706 MoRTH	One
3	Mass per unit area	Per lot	Cl. 706 MoRTH	One
4	UV stability at 500h, Retained strength percentage with respect to original strength	Per lot	Cl. 706 MoRTH	One
9	Mesh Rope			
1	Diameter	1 per 8000 Sqm.	As per drawing	One
2	Zinc coating	1 per 8000 Sqm.	IS 1835 (Class A)	One
3	Rope grade	1 per 8000 Sqm.	1770N/mm ²	One
4	Rope type	1 per 8000 Sqm.	IS 2266/ISO 2048	One

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S No	Material or Process / Characteristics	Frequency	Reference Standard	Level of Check
5	Tensile strength	1 per 8000 Sqm.	IS 1835	Two
10	Rhomboidal Wire Rope Panel			
1	Physical dimension	1 per 1000 Sqm	TDS	One
2	Tear resistance at junction of cable intersections	1 per 8000 Sqm.	15kN	Two
3	Pull apart resistance at junction of cable intersection	1 per 8000 Sqm.	9kN	Two
11	HDPE Pipe			
a	Nominal Dimensions		As per approved construction drawings	One
b	Pressure rating		IS 4984	
12	Jute Geotextile			
a	Thickness	One test for every 5000 sqm	IS 7702: 1975	One
b	Aperture size		IS 2405 (Part - I & II)- 1980	
c	Minimum Breaking load		IS 1969: 1985	
13	Drainage Composite			
a	Hydraulic Properties	One test for every 5000 sqm		
1	In plane water flow		Cl. 704 MoRTH	Four
2	AOS of filter Geotextile		Cl. 704 MoRTH	Four
b	Physical and Mechanical Properties			
S No	Material or Process / Characteristics	Frequency	Reference Standard	Level of Check
1	Mass Per Unit Area		Cl. 704 MoRTH	Four
2	Thickness		Cl. 704 MoRTH	Four
3	CBR Puncture Resistance		Cl. 704 MoRTH	Four
4	Tensile Strength		Cl. 704 MoRTH	Four
5	UV Resistance		Cl. 704 MoRTH	Four

Level of Check

One - Manufacturer's Test Certificate

Two - Checks or Confirmatory tests by Contractor

Three - Checks or Confirmatory tests by Contractor and witnessed by consultant

Four - Third Party Testing

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Schedule - E

(See Clauses 2.1 and 14.2)

Maintenance Requirements

1. Maintenance Requirements

- (i) The Contractor shall, at all times maintain the Project Highway in accordance with the provisions of this Agreement, Applicable Laws and Applicable Permits.
- (ii) The Contractor shall repair or rectify any Defect or deficiency set forth in Paragraph 2 of this Schedule-E within the time limit specified therein and any failure in this behalf shall constitute non-fulfilment of the Maintenance obligations by the Contractor. Upon occurrence of any breach hereunder, the Authority shall be entitled to effect reduction in monthly lump sum payment as set forth in Clause 14.6 of this Agreement, without prejudice to the rights of the Authority under this Agreement, including Termination thereof.
- (iii) All Materials, works and construction operations shall conform to the MORTH Specifications for Road and Bridge Works, and the relevant IRC publications. Where the specifications for a work are not given, Good Industry Practice shall be adopted.

2. Repair/rectification of Defects and deficiencies

The obligations of the Contractor in respect of Maintenance Requirements shall include repair and rectification of the Defects and deficiencies specified in Annex - I of this Schedule-E within the time limit set forth therein.

3. Other Defects and deficiencies

In respect of any Defect or deficiency not specified in Annex - I of this Schedule-E, the Authority's Engineer may, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards, and any deviation or deterioration beyond the permissible limit shall be repaired or rectified by the Contractor within the time limit specified by the Authority's Engineer.

4. Extension of time limit

Notwithstanding anything to the contrary specified in this Schedule-E, if the nature and extent of any Defect or deficiency justifies more time for its repair or rectification than the time specified herein, the Contractor shall be entitled to additional time in conformity with Good Industry Practice. Such additional time shall be determined by the Authority's Engineer and conveyed to the Contractor and the Authority with reasons thereof.

5. **Emergency repairs/restoration**

Notwithstanding anything to the contrary contained in this Schedule-E, if any Defect, deficiency or deterioration in the Project Highway poses a hazard to safety or risk of damage to property, the Contractor shall promptly take all reasonable measures for eliminating or minimizing such danger.

6. **Daily inspection by the Contractor**

The Contractor shall, through its engineer, undertake a daily visual inspection of the Project Highway and maintain a record thereof in a register to be kept in such form and manner as the Authority's Engineer may specify. Such record shall be kept in safe custody of the Contractor and shall be open to inspection by the Authority and the Authority's Engineer at any time during office hours.

7. **Pre-monsoon inspection / Post-monsoon inspection**

The Contractor shall carry out a detailed pre-monsoon inspection of all vulnerable locations where slope protection measures taken and drainage system before 1st May every year in accordance with the guidelines contained in IRC: SP35 and other relevant guidelines for slope protection measures. Report of this inspection together with details of proposed maintenance works as required on the basis of this inspection shall be sent to the Authority's Engineer before the 10th May every year. The Contractor shall complete the required repairs before the onset of the monsoon and send to the Authority's Engineer a compliance report. Post monsoon inspection shall be done by the 30th October and the inspection report together with details of any damages observed and proposed action to remedy the same shall be sent to the Authority's Engineer.

8. **Repairs on account of natural calamities**

All damages occurring to the Project Highway on account of a Force Majeure Event or wilful default or neglect of the Authority shall be undertaken by the Authority at its own cost. The Authority may instruct the Contractor to undertake the repairs at the rates agreed between the Parties.

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Annex - I

(Schedule-E)

Repair/rectification of Defects and deficiencies

The Contractor shall repair and rectify the Defects and deficiencies specified in this Annex-I of Schedule-E within the time limit set forth in the table below.

Table -1: Maintenance Criteria for Pavements:

Asset Type	Performance Parameter	Level of Service (LOS)		Frequency of Inspection	Tools/Equipment	Standards and References for Inspection and Data Analysis	Time limit for Rectification/Repair	Maintenance Specifications
		Desirable	Acceptable					
Flexible Pavement (Pavement of MCW, Service Road, approaches of Grade structure, approaches of connecting roads, slip roads, lay	Potholes	Nil	< 0.1 % of area and subject to limit of 10 mm in depth	Daily	Length Measurement Unit like Scale, Tape, odometer etc.	IRC 82: 2015 and Distress Identification Manual for Long Term Pavement Performance Program, FHWA 2003 (http://www.tfhrcc.com/pavement/ltp/reports/03031/)	24-48 hours	MORT&H Specification 3004.2
	Cracking	Nil	< 5 % subject to limit of 0.5 sqm for any 50 m length	Daily			7-15 days	MORT&H Specification 3004.3
	Rutting	Nil	< 5 mm	Daily	Straight Edge		15 -30 days	MORT&H Specification 3004.2
	Corrugations and Shoving	Nil	< 0.1 % of area	Daily	Length Measurement Unit like Scale,		2-7 days	IRC:82-2015

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Asset Type	Performance Parameter	Level of Service (LOS)		Frequency of Inspection	Tools/Equipment	Standards and References for Inspection and Data Analysis	Time limit for Rectification/Repair	Maintenance Specifications
		Desirable	Acceptable					
byes etc. as applicable)	Bleeding	Nil	< 1 % of area	Daily	Tape, odometer etc.		3-7 days	MORT&H Specification 3004.4
	Ravelling/ Stripping	Nil	< 1 % of area	Daily			7-15 days	IRC:82-2015 read with IRC SP 81
	Edge Deformation/ Breaking	Nil	< 1 m for any 100 m section and width < 0.1 m at any location, restricted to 30 cm from the edge	Daily			7- 15 days	IRC:82-2015
	Roughness BI	2000 mm/km	2400 mm/km	Bi-Annually	Class I Profilometer SCRM (Sideway-force Coefficient Routine Investigation Machine or equivalent)	Class I Profilometer : ASTM E950 (98) :2004 -Standard Test Method for measuring Longitudinal Profile of Travelled Surfaces with Accelerometer Established Inertial Profiling Reference ASTM E1656 -94: 2000- Standard Guide for Classification of Automatic Pavement Condition Survey Equipment	180 days	IRC:82-2015
	Skid Number	60SN	50SN	Bi-Annually			180 days	BS: 7941-1: 2006
	Pavement Condition Index	3	2.1	Bi-Annually			180 days	IRC:82-2015
	Other Pavement Distresses			Bi-Annually			2-7 days	IRC:82-2015

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Asset Type	Performance Parameter	Level of Service (LOS)		Frequency of Inspection	Tools/Equipment	Standards and References for Inspection and Data Analysis	Time limit for Rectification/Repair	Maintenance Specifications
		Desirable	Acceptable					
	Deflection/Remaining Life			Annually	Falling Weight Deflectometer	IRC 115: 2014	180 days	IRC:115-2014
Rigid Pavement (Pavement of MCW, Service Road, Grade structure, approaches of connecting roads, slip roads, lay byes etc. as applicable)	Roughness BI	2200mm/km	2400mm/km	Bi-Annually	Class I Profilometer	ASTM E950 (98) :2004 and ASTM E1656 -94: 2000	180 days	IRC:SP:83-2008
	Skid	Skid Resistance no. at different speed of vehicles		Bi-Annually	SCRIM (Sideway-force Coefficient Routine Investigation Machine or equivalent)	IRC:SP:83-2008	180 days	IRC:SP:83-2008
		Minimum SN	Traffic Speed (Km/h)					
		36	50					
		33	65					
		32	80					
		31	95					
		31	110					
Embankment/ Slope	Edge drop at shoulders	Nil	40mm	Daily	Length Measurement	IRC SP:73-2018, IRC 36-2010 & IRC 56-2011	7-15 days	MORT&H Specification 408.4
	Slope of camber/cross fall	Nil	<2% variation in prescribed slope of camber /cross fall	Daily	Unit like Scale, Tape, odometer etc.		7-15 days	MORT&H Specification 408.4

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Asset Type	Performance Parameter	Level of Service (LOS)		Frequency of Inspection	Tools/Equipment	Standards and References for Inspection and Data Analysis	Time limit for Rectification/Repair	Maintenance Specifications
		Desirable	Acceptable					
	Embankment Slopes	Nil	<15 % variation in prescribe side slope	Daily			7-15 days	MORT&H Specification 408.4
	Embankment Protection	Nil	Nil	Daily	NA		7-15 days	MORT&H Specification
	Rain Cuts/ Gullies in slope	Nil	Nil	Daily Specially During Rainy Season	NA		7-15 days	MORT&H Specification

In addition to the above performance criterion, the contractor shall strictly maintain the rigid pavements as per requirements in the following table

Table -2: Maintenance Criteria for Rigid Pavements:

S.No.	Type of Distress	Measured Parameter	Degree of Severity	Assessment Rating	Repair Action	
					For the case $d < D/2$	For the case $d > D/2$
CRACKING						
1	Single Discrete Cracks Not intersecting with any joint	w = width of crack L = length of crack d = depth of crack D = depth of slab	0	Nil, not discernible	No Action	Not applicable
			1	w < 0.2 mm. hair cracks		
			2	w = 0.2 - 0.5 mm, discernible from slow-moving car	Seal without delay	Seal, and stitch if L > 1m. Within 7days
			3	w = 0.5 - 1.5 mm, discernible from fast-moving car		

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S.No.	Type of Distress	Measured Parameter	Degree of Severity	Assessment Rating	Repair Action	
					For the case $d < D/2$	For the case $d > D/2$
2	Single Transverse (or Diagonal) Crack intersecting with one or more joints	w = width of crack L = length of crack d = depth of crack D = depth of slab	4	w = 1.5 - 3.0 mm	Seal, and stitch if $L > l$ m. Within 7 days	Staple or Dowel Bar Retrofit, FDR for affected portion. Within 15days
			5	w > 3 mm.		
			0	Nil, not discernible	No Action	
			1	w < 0.2 mm, hair cracks	Route and seal with epoxy. Within 7 days	Staple or Dowel Bar Retrofit. Within 15days
			2	w = 0.2 - 0.5 mm, discernible from slow vehicle		
			3	w = 0.5 - 3.0 mm, discernible from fast vehicle	Route, seal and stitch, if $L > 1$ m. Within 7 days	
3	Single Longitudinal Crack intersecting with one or more joints	w = width of crack L = length of crack d = depth of crack D = depth of slab	4	w = 3.0 - 6.0 mm	Dowel Bar Retrofit. Within 15 days	Full Depth Repair Dismantle and reconstruct affected. Portion with norms and specifications - See Para 5.5 & 9.2 Within 15days
			5	w > 6 mm, usually associated with spalling, and/or slab rocking under traffic	Not Applicable, as it may be full depth	
			0	Nil, not discernible	No Action	
			1	w < 0.5 mm, discernible from slow moving vehicle	Seal with epoxy, if $L > 1$ m. Within 7 days	Staple or dowel bar retrofit. Within 15days
			2	w = 0.5 - 3.0 mm, discernible from fast vehicle	Route seal and stitch, if $L > l$ m. Within 15 days	-
			3	w = 3.0 - 6.0 mm	Staple, if $L > 1$ m. Within 15 days	Partial Depth Repair with stapling.

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S.No.	Type of Distress	Measured Parameter	Degree of Severity	Assessment Rating	Repair Action	
					For the case $d < D/2$	For the case $d > D/2$
					4	w = 6.0 - 12.0 mm, usually associated with spalling
		5	w > 12 mm, usually associated with spalling, and/or slab rocking under traffic	Full Depth Repair Dismantle and reconstruct affected portion as per norms and specifications - See Para 5.6.4 Within 15 days		
4	Multiple Cracks intersecting with one or more joints	w = width of crack	0	Nil, not discernible	No Action	-
			1	w < 0.2 mm, hair cracks	Seal, and stitch if L > 1 m. Within 15 days	
			2	w = 0.2 - 0.5 mm. discernible from slow vehicle		
			3	w = 0.5 - 3.0 mm, discernible from fast vehicle	Full depth repair within 15 days	Dismantle, Reinstall subbase, Reconstruct whole slab as per specifications within 30 days
			4	w = 3.0 - 6.0 mm panel broken into 2 or 3 pieces		
			5	w > 6 mm and/or panel broken into more than 4 pieces		
5	Corner Break	w = width of crack L = length of crack	0	Nil, not discernible	No Action	-
			1	w < 0.5 mm; only 1 corner broken	Seal with low viscosity epoxy to secure broken parts Within 7 days	Seal with epoxy seal with epoxy Within 7days
			2	w < 1.5 mm; L < 0.6 m, only one corner broken		
			3	w < 1.5 mm; L < 0.6 m, two corners broken	Partial Depth (Refer Figure 8.3 of IRC:SP: 83-2008) Within 15 days	Full depth repair
			4	w > 1.5 mm; L > 0.6 m or three corners broken		

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S.No.	Type of Distress	Measured Parameter	Degree of Severity	Assessment Rating	Repair Action	
					For the case $d < D/2$	For the case $d > D/2$
			5	three or four corners broken		Reinstate sub-base, and reconstruct the slab as per norms and specifications within 30days
6	Punch-out (Applicable to Continuous Reinforced Concrete Pavement (CRCP) only)	w = width of crack L = length (m/m2)	0	Nil, not discernible		No Action
			1	$w < 0.5 \text{ mm}$; $L < 3 \text{ m/m}^2$	Not Applicable, as it may be full depth	Seal with low viscosity epoxy to secure broken parts. Within 15days Full depth repair - Cut out and replace damaged area taking care not to damage reinforcement. Within 30days
			2	either $w > 0.5 \text{ mm}$ or $L < 3 \text{ m/m}^2$		
			3	$w > 1.5 \text{ mm}$ and $L < 3 \text{ m/m}^2$		
			4	$w > 3 \text{ mm}$, $L < 3 \text{ m/m}^2$ and deformation		
			5	$w > 3 \text{ mm}$, $L > 3 \text{ m/m}^2$ and deformation		
Surface Defects						
7	Ravelling or Honeycomb type surface	r = area damaged surface/total surface of slab (%) h = maximum depth of damage	0	Nil, not discernible	Short Term	Long Term
					No action.	Not Applicable
			1	$r < 2 \%$	Local repair of areas damaged and liable to be damaged. Within 15 days	
			2	$r = 2 - 10 \%$		
			3	$r = 10\text{-}25\%$	Bonded Inlay, 2 or 3 slabs if Affecting. Within 30 days	
			4	$r = 25 - 50 \%$		

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S.No.	Type of Distress	Measured Parameter	Degree of Severity	Assessment Rating	Repair Action	
					For the case $d < D/2$	For the case $d > D/2$
			5	$r > 50\%$ and $h > 25\text{ mm}$	Reconstruct slabs, 4 or more slabs if affecting. Within 30 days	
8	Scaling	r = damaged surface/total surface of slab (%) h = maximum depth of damage	0	Nil, not discernible	Short Term No action.	Long Term
			1	$r < 2\%$	Local repair of areas damaged and liable to be damaged. Within 7days	Not Applicable
			2	$r = 2 - 10\%$		
			3	$r = 10 - 20\%$		
			4	$r = 20 - 30\%$	Bonded Inlay within 15 days	
			5	$r > 30\%$ and $h > 25\text{ mm}$	Reconstruct slab within 30 days	
			9	Polished Surface/Glazing	t = texture depth, sand patch test	
1	$t > 1\text{ mm}$					
2	$t = 1 - 0.6\text{ mm}$	Monitor rate of deterioration				
3	$t = 0.6 - 0.3\text{ mm}$					
4	$t = 0.3 - 0.1\text{ mm}$					
5	$t < 0.1\text{ mm}$	Diamond Grinding if affecting 50% or more slabs in a continuous stretch of minimum 5 km. Within 30 days				
10	Pop out (Small Hole), Pothole Refer Para 8.4	n = number/ m^2 d = diameter	0	$d < 50\text{ mm}$; $h < 25\text{ mm}$; $n < 1$ per 5 m^2	No action.	Not Applicable

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

S.No.	Type of Distress	Measured Parameter	Degree of Severity	Assessment Rating	Repair Action	
					For the case $d < D/2$	For the case $d > D/2$
		h = maximum depth	1	$d = 50 - 100 \text{ mm}; h < 50 \text{ mm}; n < 1$ per 5 m^2	Partial depth repair 65 mm deep. Within 15 days	
			2	$d = 50 - 100 \text{ mm}; h > 50 \text{ mm}; n < 1$ per 5 m^2		
			3	$d = 100 - 300 \text{ mm}; h < 100 \text{ mm}; n < 1$ per 5 m^2	Partial depth repair 110mm i.e.10 mm more than the depth of the hole. Within 30 days	
			4	$d = 100 - 300 \text{ mm}; h > 100 \text{ mm}; n < 1$ per 5 m^2		
			5	$d > 300 \text{ mm}; h > 100 \text{ mm}; n > 1$ per 5 m^2	Full depth repair. Within 30 days	

Joint Defects						
11	Joint Seal Defects	loss or damage L = Length as % total joint length	0	Difficult to discern.	Short Term	Long Term
			1	Discernible, $L < 25\%$ but of little immediate consequence with regard to ingress of water or	No action. Clean joint, inspect later.	Not Applicable

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Joint Defects						
				trapping incompressible material.		
			3	Notable. L > 25% insufficient protection against ingress of water and trapping incompressible material.	Clean and reapply sealant in Selected locations. Within 7 days	
			5	Severe; w > 3 mm negligible protection against ingress of water and trapping incompressible material.	Clean, widen and reseal the joint. Within 7 days	
12	Spalling of Joints	w = width on either side of the joint L = length of spalled portion (as % joint length)	0	Nil, not discernible	No action.	Not Applicable
			1	w < 10 mm	Apply low viscosity epoxy resin/ mortar in cracked portion.	
			2	w = 10 - 20 mm, L < 25%	Within 7 days	
			3	w = 20 - 40 mm, L > 25%	Partial Depth Repair. Within 15 days	
			4	w = 40 - 80 mm, L > 25%	30 - 50 mm deep, h = w + 20% of w, within 30 days	
			5	w > 80 mm, and L > 25%	50 - 100 mm deep repair.	

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Joint Defects						
					H = w + 20% of w. Within 30 days	
13	Faulting (or Stepping) in Cracks or Joints	f = difference of level	0	not discernible, < 1 mm	No action.	No action.
			1	f < 3 mm		
			2	f = 3 - 6 mm	Determine cause and observe, take action for diamond grinding	Replace the slab as appropriate.
			3	f = 6 - 12 mm	Diamond Grinding	Within 30days
			4	f = 12 - 18 mm	Raise sunken slab.	Replace the slab as appropriate. Within 30days
			5	f > 18 mm	Strengthen subgrade and sub-base by grouting and raising sunken slab	
14	Blow-up or Buckling	h = vertical displacement from normal profile	0	Nil, not discernible	Short Term	Long Term
			1	h < 6 mm	No Action	
			2	h = 6 - 12 mm		
			3	h = 12 - 25 mm	Install Signs to Warn Traffic within 7 days	
			4	h > 25 mm	Full Depth Repair.	

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Joint Defects						
					Within 30 days	
			5	shattered slabs, ie 4 or more pieces	Replace broken slabs. Within 30 days	
15	Depression	h = negative vertical displacement from normal profile L=length	0	Not discernible, h < 5 mm	No action.	Not Applicable
			1	h = 5 - 15 mm		
			2	h = 15-30 mm, Nos <20% joints	Install Signs to Warn Traffic within 7 days	
			3	h = 30 - 50 mm		
			4	h > 50 mm or > 20% joints	Strengthen subgrade. Reinstate pavement at normal level if L < 20 m. Within 30 days	
			5	h > 100 mm		
16	Heave	h = positive vertical displacement from normal profile. L = length	0	Not discernible. h < 5 mm	Short Term	Long Term
					No action.	Scrabble
			1	h = 5 - 15 mm	Follow up.	
			2	h = 15 - 30 mm, Nos <20% joints	Install Signs to Warn Traffic within 7 days	
			3	h = 30 - 50 mm		

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Joint Defects						
			4	h > 50 mm or > 20% joints	Stabilise subgrade. Reinstate pavement at normal level if length < 20 m. Within 30 days	
			5	h > 100 mm		
17	Bump	h = vertical displacement from normal profile	0	h < 4 mm	No action	
			1	h = 4 - 7 mm	Grind, in case of new construction within 7 days	Construction Limit for New Construction.
			3	h = 7 - 15 mm	Grind, in case of ongoing Maintenance within 15 days	Replace in case of new construction. Within 30days
			5	h > 15 mm	Full Depth Repair. Within 30 days	Full Depth Repair. Within 30days
18	Lane to Shoulder Drop-off	f = difference of level	0	Nil, not discernible < 3mm	Short Term	Long Term
					No action.	
			1	f = 3 - 10 mm	Spot repair of shoulder within 7 days	
			2	f = 10 - 25 mm		
			3	f = 25 - 50 mm	Fill up shoulder within 7 dayss	
			4	f = 50 - 75 mm		

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Joint Defects						
			5	f > 75 mm		For any 100 m stretch Reconstruct shoulder, if affecting 25% or more of stretch. Within 30days
Drainage						
19	Pumping	quantity of fines and water expelled through open joints and cracks Nos	0	not discernible	No Action	Inspect and repair sub-drainage at distressed sections and upstream.
			1 to 2	slight/ occasional Nos < 10%	Repair cracks and joints Without delay.	
			3 to 4	appreciable/ Frequent 10 - 25%	Lift or jack slab within 30 days.	
		Nos/100 m stretch	5	abundant, crack development > 25%	Repair distressed pavement sections. Strengthen subgrade and subbase. Replace slab. Within 30 days	
20	Ponding	Ponding on slabs due to blockage of drains	0-2	No discernible problem	No action.	Action required to stop water damaging
			3 to 4	Blockages observed in drains, but water flowing	Clean drains etc within 7 days, Follow up	

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Joint Defects						
			5	Ponding, accumulation of water observed	-do-	foundation within 30 days.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Table -3: Maintenance Criteria for Safety Related Items and Other Furniture Items:

Asset Type	Performance Parameter	Level of Service (LOS)			Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Highway	Availability of Safe Sight Distance	As per IRC: 52-2019, a minimum of safe stopping sight distance shall be available throughout.			Monthly	Manual Measurements with Odometer along with video/ image backup	Removal of obstruction within 24 hours, in case of sight line affected by temporary objects such as trees, temporary encroachments. In case of permanent structure or design deficiency: Removal of obstruction/improvement of deficiency at the earliest Speed Restriction boards and suitable traffic calming measures such as transverse bar marking, blinkers, etc. shall be applied during the period of rectification.		IRC : 52-2019
		Design Speed, kmph	Desirable Minimum Sight Distance (m)	Safe Stopping Sight Distance (m)					
		50	120	60					
		40	90	45					
Pavement Marking	Wear	<70% of marking remaining			Bi-Annually	Visual Assessment as per Annexure-F of IRC:35-2015	Re - painting	Cat-1 Defect - within 24 hours Cat-2 Defect - within 2 months	IRC:35-2015

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Asset Type	Performance Parameter	Level of Service (LOS)		Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
	Day time Visibility	During expected life Service Time Cement Road - 130mcd/m ² /lux Bituminous Road - 100mcd/m ² /lux		Monthly	As per Annexure-D of IRC:35-2015	Re - painting	Cat-1 Defect - within 24 hours Cat-2 Defect - within 2 months	IRC:35-2015
	Night Time Visibility	<u>Initial and Minimum Performance for Dry Retro reflectivity during night time:</u>		Bi-Annually	As per Annexure-E of IRC:35-2015	Re - painting	Cat-1 Defect - within 24 hours Cat-2 Defect - within 2 months	IRC:35-2015
		Design Speed	(RL) Retro Reflectivity (mcd/m ² /lux)					
			Initial (7 days) Minimum Threshold level (TL) & warranty period required up to 2 years					
		Up to 65	20080					
		65 - 100	250120					
		Above 100	350150					
		<u>Initial and Minimum Performance for Night Visibility under wet condition (Retro reflectivity):</u> Initial 7 days Retro reflectivity: 100 mcd/m ² /lux						

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
		Minimum Threshold Level: 50 mcd/m ² /lux					
	Skid Resistance	Initial and Minimum performance for Skid Resistance: Initial (7days): 55BPN Min. Threshold: 44BPN *Note: shall be considered under urban/city traffic condition encompassing the locations like pedestrian crossings, bus bay, bus stop, cycle track intersection delineation, transverse bar markings etc	Bi-Annually	As per Annexure-G of IRC:35-2015		Within 24 hours	IRC:35-2015
Road Signs	Shape and Position	Shape and Position as per IRC:67-2022. Signboard should be clearly visible for the design speed of the section.	Daily	Visual with video/image backup	Improvement of shape, in case if shape is damaged. Relocation as per requirement	48 hours in case of Mandatory Signs, Cautionary and Informatory Signs (Single and Dual post signs) 15 Days in case of Gantry/Cantilever Sign boards	IRC:67-2022
	Retro reflectivity	As per specifications in IRC:67-2022	Bi-Annually	Testing of each signboard using Retro Reflectivity Measuring Device. In accordance	Change of signboard	48 hours in case of Mandatory Signs, Cautionary and Informatory Signs (Single and Dual post signs)	IRC:67-2022

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
				with ASTM D 4956-09.		1 Month in case of Gantry/ Cantilever Sign boards	
Kerb	Kerb Height	As per IRC 86:1983 depending upon type of Kerb	Bi-Annually	Use of distance measuring tape	Raising Kerb Height	Within 1 Month	RC 86:1983
	Kerb Painting	<u>Functionality:</u> Functioning of Kerb painting as intended	Daily	Visual with video/image backup	Kerb Repainting	Within 7-days	RC 35:2015
Other Road Furniture	Reflective Pavement Markers (Road Studs)	Numbers and Functionality as per specifications in IRC:SP 73-2018 and IRC:35-2015, unless specified in Schedule-B.	Daily	Counting	New Installation	Within 2 months	IRC:SP:73-2018, IRC:35-2022
	Pedestrian Guardrail	<u>Functionality:</u> Functioning of guardrail as intended	Daily	Visual with video/image backup	Rectification	Within 15 days	IRC:SP:73-2018,
	Traffic Safety Barriers	<u>Functionality:</u> Functioning of Safety Barriers as intended	Daily	Visual with video/image backup	Rectification	Within 7 days	IRC:SP:73-2018, IRC:119-2015
	End Treatment of Traffic Safety Barriers	<u>Functionality:</u> Functioning of End Treatment as intended	Daily	Visual with video/image backup	Rectification	Within 7 days	IRC:SP:73-2018, IRC:119-2015
	Attenuators	<u>Functionality:</u> Functioning of Attenuators as intended	Daily	Visual with video/image backup	Rectification	Within 7 days	IRC:SP-2014, IRC:119-2015
	Guard Posts and Delineators	<u>Functionality:</u> Functioning of Guard Posts and Delineators as intended	Daily	Visual with video/image backup	Rectification	Within 15 days	IRC: 79 - 2019

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
	Overhead Sign Structure	Overhead sign structure shall be structurally adequate	Daily	Visual with video/image backup	Rectification	Within 15 days	IRC:67-2022
	Traffic Blinkers	Functionality: Functioning of Traffic Blinkers as intended	Daily	Visual with video/image backup	Rectification	Within 7 days	IRC:SP:73-2018,
Highway Lighting System	Highway Lights	Illumination: Minimum 40 Lux illumination on the road surface	Daily	The illumination level shall be measured with luxmeter	Improvement in Lighting System	24 hours	IRC:SP:73-2018
		No major failure in the lighting system	Daily	-	Rectification of failure	24 hours	IRC:SP:73-2018,
		No minor failure in the lighting system	Monthly	-	Rectification of failure	8 hours	IRC:SP:73-2018,
	Toll Plaza Canopy Lights	Minimum 40 Lux illumination on the road surface	Daily	The illumination level shall be measured with luxmeter	Improvement in Lighting System	24 hours	IRC:SP:73-2018,
		No major/minor failure in the lighting system	Daily	-	Rectification of failure	8 hours	IRC:SP:73-2018,

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Trees and Plantation including median plantation	Obstruction in a minimum head-room of 5.5 m above carriageway or obstruction in visibility of road signs	No obstruction due to trees	Monthly	Visual with video/image backup	Removal of trees	Immediate	IRC:SP:73-2018,
	Deterioration in health of trees and bushes	Health of plantation shall be as per requirement of specifications & instructions issued by Authority from time to time	Daily	Visual with video/image backup	Timely watering and treatment. Or Replacement of Trees and Bushes.	Within 90 days	IRC:SP:73-2018,
	Vegetation affecting sight line and road structures	Sight line shall be free from obstruction by vegetation	Daily	Visual with video/image backup	Removal of Trees	Immediate	IRC:SP:73-2018,
Rest Areas	Cleaning of toilets	-	Daily	-	-	Every 4 hours	
	Defects in electrical, water and sanitary installations	-	Daily	-	Rectification	24 hours	

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Other Project Facilities and Approach roads	Damage or deterioration in Approach Roads, pedestrian facilities, truck lay-bys, bus-bays, bus-shelters, cattle crossings, Traffic Aid Posts, Medical Aid Posts and other works		Daily	-	Rectification	15 days	IRC:SP:73-2018,

Table 4: Maintenance Criteria for Structures and Culverts:

Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Pipe/box/slab culverts	Free waterway/unobstructed flow section	85% of culvert normal flow area to available.	2 times in a year (before and after rainy season)	Inspection by Bridge Engineer as per IRC SP: 35-1990 and recording of depth of silting and area of vegetation.	Cleaning silt up soils and debris in culvert barrel after rainy season, removal of bushes and vegetation, U/s of barrel, under barrel and D/s of barrel before rainy season.	15 days before onset of monsoon and within 30 days after end of rainy season.	IRC 5-2015, IRC SP:40-2019 and IRC SP:13-2004
	Leak-proof expansion joints if any	No leakage through expansion joints	Bi-Annually	Physical inspection of expansion joints as per IRC SP: 35-1990 if any, for leakage strains on walls at joints.	Fixing with sealant suitably	30 days or before onset of rains whichever comes earlier	IRC SP:40-2019 and IRC SP:69-2011
	Structurally sound	Spalling of concrete not	Bi-Annually	Detailed inspection of all components of	Repairs to spalling, cracking, delamination,	15 days	IRC SP 40-2019 and

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
		more than 0.25 sqm		culvert as per IRC SP:35-1990 and recording the defects	rusting shall be followed as per IRC: SP:40-2019.		MORTH Specification s clause 2800
		Delamination of concrete not more than 0.25 Sqm.					
		Cracks wider than 0.3 mm not more than 1m aggregate length					
	Protection works in good condition	Damaged of rough stone apron or bank revetment not more than 3 sqm, damage to solid apron (concrete apron) not more than 1 sqm	2 times in a year (before and after rainy season)	Condition survey as per IRC SP:35-1990	Repairs to damaged aprons and pitching	30 days after defect observation or 2 weeks before onset of rainy season whichever is earlier.	IRC: SP 40-2019 and IRC: SP:13-2004.
Bridges including ROB's Flyover etc. as applicable	Riding quality or user comfort	No pothole in wearing coat on bridge deck	Daily	Visual inspection as per IRC SP:35-1990	Repairs to BC or wearing coat	15 days	MORT&H Specification 2811

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Bridge - Super Structure	Bumps	No bump at expansion joint	Daily	Visual inspection as per IRC SP:35-1990	Repairs to BC on either side of expansion joints, profile correction course on approach slab in case of settlement to approach embankment	15 days	MORT&H Specification 3004.2 & 2811.
	User safety (condition of crash barrier and guard rail)	No damaged or missing stretch of crash barrier or pedestrian hand railing	Daily	Visual inspection and detailed condition survey as per IRC SP: 35-1990.	Repairs and replacement of safety barriers as the case may be	3days	IRC: 5-2015, IRC SP: 73-2018 and IRC SP: 40-2019.
	Rusted reinforcement	Not more than 0.25 sq.m	Bi-Annually	Detailed condition survey as per IRC SP: 35-1990 using Mobile Bridge Inspection Unit	All the corroded reinforcement shall need to be thoroughly cleaned from rusting and applied with anti-corrosive coating before carrying out the repairs to affected concrete portion with epoxy mortar / concrete.	15 days	IRC SP: 40-2019 and MORTH Specification 1600.
	Spalling of concrete	Not more than 0.50 sq.m					
	Delamination	Not more than 0.50 sq.m					
	Cracks wider than 0.30 mm	Not more than 1m total length	Bi-Annually	Detailed condition survey as per IRC SP: 35-1990 using Mobile Bridge Inspection Unit	Grouting with epoxy mortar, investigating causes for cracks development and carry out necessary rehabilitation.	48 Hours	IRC SP: 40-2019 and MORTH Specification 2800.

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
	Rainwater seepage through deck slab	Leakage - nil	Quarterly	Detailed condition survey as per IRC SP: 35-1990 using Mobile Bridge Inspection Unit	Grouting of deck slab at leakage areas, waterproofing, repairs to drainage spouts	1 months	MORTH specification s 2600 & 2700.
	Deflection due to permanent loads and live loads	Within design limits.	Once in every 10 years for spans more than 40 m	Load test method	Carry out major rehabilitation works on bridge to retain original design loads capacity	6 months	IRC SP: 51-2015.
	Vibrations in bridge deck due to moving trucks	Frequency of vibrations shall not be more than 5 Hz	Once in every 5 years for spans more than 30m and every 10 years for spans between 15 to 30 m	Laser displacement sensors or laser vibro-meters	Strengthening of super structure	4 months	AASHTO LRFD specifications
	Leakage in Expansion joints	No damage to elastomeric sealant compound in strip seal expansion joint, no leakage of rain water through expansion joint in	Bi-Annually	Detailed condition survey as per IRC SP:35-1990 using Mobile Bridge Inspection Unit	Replace of seal in expansion joint	15 days	MORTH specifications 2600 and IRC SP: 40-2019.

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
		case of buried and asphalt plug and copper strip joint.					
	Debris and dust in strip seal expansion joint	No dust or debris in expansion joint gap.	Monthly	Detailed condition survey as per IRC SP:35-1990 using Mobile Bridge Inspection Unit	Cleaning of expansion joint gaps thoroughly	3 days	MORTH specifications 2600 and IRC SP: 40-2019.
	Drainage spouts	No down take pipe missing/broken below soffit of the deck slab. No silt, debris, clogging of drainage spout collection chamber.	Monthly	Detailed condition survey as per IRC SP: 35-1990 using Mobile Bridge Inspection Unit	Cleaning of drainage spouts thoroughly. Replacement of missing/broken down take pipes with a minimum pipe extension of 500mm below soffit of slab. Providing sealant around the drainage spout if any leakages observed.	3 days	MORTH specification 2700.

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Bridge-substructure	Cracks/spalling of concrete/ rusted steel	No cracks, spalling of concrete and rusted steel	Bi-Annually	Detailed condition survey as per IRC SP: 35-1990 using Mobile Bridge Inspection Unit	All the corroded reinforcement shall need to be thoroughly cleaned from rusting and applied with anti-corrosive coating before carrying out repairs to substructure by grouting/guniting and micro concreting depending on type of defect noticed	30 days	IRC SP: 40-2019 and MORTH specification 2800.
	Bearings	Delamination of bearing reinforcement not more than 5%, cracking or tearing of rubber not more than 2 locations per side, no rupture of reinforcement or rubber	Bi-Annually	Detailed condition survey as per IRC SP: 35-1990 using Mobile Bridge Inspection Unit	In case of failure of even one bearing on any pier/abutment, all the bearings on that pier/abutment shall be replaced, in order to get uniform load transfer on to bearings.	3 months	MORTH specification 2810, IRC 83 and IRC SP: 40-2019.

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
Bridge Foundation	Scouring around foundations	Scouring shall not be lower than maximum scour level for the bridge	Bi-Annually	Condition survey and visual inspection as per IRC SP:35-1990 using Mobile Bridge Inspection Unit. In case of doubt, use Underwater camera for inspection of deep wells in major Rivers.	Suitable protection works around pier/abutment	1 month	IRC SP: 40-2019, MORTH specification 2500
	Protection works in good condition	Damaged of rough stone apron or bank revetment not more than 3 sq.m, damage to solid apron (concrete apron) not more than 1 sq.m	2 times in a year (before and after rainy season)	Condition survey as per IRC SP:35-1990	Repairs to damaged aprons and pitching.	30 days after defect observation or 2 weeks before onset of rainy season whichever is earlier.	IRC: SP 40-2019 and IRC: SP:13-2022.
Slope Protection (Landslide & Sinking)	Movement & deformation in landslide & sinking zones	Movement & deformation beyond permissible limit should be made	14 Days	Once in month/ as when noticed	Standard method as approved by the Authority QA/QC plan of the contractor	30 days after defect observation or 2 weeks before onset of rainy season whichever is earlier	Refer the Schedule B and Schedule D

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Asset Type	Performance Parameter	Level of Service (LOS)	Frequency of Measurement	Testing Method	Recommended Remedial measures	Time limit for Rectification	Specifications and Standards
		good to the design standard					
	Any material or defect development in workmanship used in protection work	The material and workmanship specification should be in accordance with Schedule B and Schedule D	14 Days	Once in month/ as when noticed	Standard method as approved by the Authority QA/QC plan of the contractor	30 days after defect observation or 2 weeks before onset of rainy season whichever is earlier.	Refer the Schedule B and Schedule D
Note: Any Structure during the entire contract period which is found that does not complies with all requirements of this Table will be prepared, rehabilitated or even reconstructed under the scope of the contractor.							

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Table 5: Maintenance Criteria for Hill Roads

In addition to above, for hill roads the following provisions for maintenance is also to done.

Hill Roads			
	Nature of Defect / Deficiency	Temporary Measures for Minor rectification	Permanent Measures for Major rectification / re-construction
(i)	Damage to PCC Breast wall / RCC Cladding / RCC step wall	within 48 (forty-eight) hours	15 to 30 (Fifteen to thirty) days as specified by AE
(ii)	HT Rolled cable Net, DT Mesh, Coir Mat, 3D Net, SDA, others such as Gabion Facia with geogrids	within 48 (forty-eight) hours	15 to 30 (Fifteen to thirty) days as specified by AE
(iii)	Any damage to other assets of project,	within 48 (forty-eight) hours	within 15 to 30(fifteen to thirty) days as specified by the Authority's Engineer
(iv)	Landslides requiring clearance	12 (Twelve) hours	

Note: For all tables 1 to 5 above, latest BIS & IRC standards (even those not indicated herewith) along with MoRTH specifications shall be binding for all maintenance activities. Where necessary, the Authority may modify the time limit for repair/rectification, or add to the nature of Defect or deficiency before issuing the bidding document, with the approval of the ED(P).

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule - F

(See Clause 3.1.5(a))

APPLICABLE PERMITS

1. Applicable Permits

The Contractor shall obtain, as required under the Applicable Laws, the following Applicable Permits:

- (a) Permission of the State Government for extraction of boulders from quarry;
- (b) Permission of Village Panchayat and Pollution Control Board for installation of crushers;
- (c) License for use of explosives;
- (d) Permission of the State Government for drawing water from river/reservoir;
- (e) License from inspector of factories or other competent Authority for setting up batching plant;
- (f) Clearance of Pollution Control Board for setting up batching plant;
- (g) Clearance of Village Panchayats and Pollution Control Board for setting up asphalt plant;
- (h) Permission of Village Panchayats and State Government for borrow earth;
- (i) Applicable clearances from RTO, PESO (Petroleum Explosive Safety Organization) and PCB (Pollution Control Board) for movement and operation of HIPR train and
- (j) Any other permits, clearances or approvals required under Applicable Laws.

1.2 Applicable permits, as required, relating to environmental protection and conservation shall have been produced by the Authority in accordance with the provisions of this Agreement.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule - G

(See Clauses 7.1 and 19.2)

Annex-I

(See Clause 7.1)

Form of Bank Guarantee

[Performance Security/Additional Performance Security]

To,

The Executive Director,

Regional Office - Siliguri (West Bengal),

National Highways and Infrastructure Development Corporation of India Limited,

Unit 402, Quantum Building, Parivahan Nagar, P.O & P.S. Matigara, Pin Code 734010.

WHEREAS:

- (A) [name and address of contractor] (hereinafter called the “**Contractor**”) and [name and address of the authority], (hereinafter called the “**Authority**”) have entered into an agreement (hereinafter called the “**Agreement**”) for the construction of the ***** section of [National Highway No.

] on Engineering, Procurement and Construction (the “EPC**”) basis, subject to and in accordance with the provisions of the Agreement

- (B) The Agreement requires the Contractor to furnish a Performance Security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the {Construction Period/ Defects Liability Period and Maintenance Period} (as defined in the Agreement) in a sum of Rs..... cr. (Rupees crore) (the “**Guarantee Amount**”).
- (C) We, through our branch at (the “**Bank**”) have agreed to furnish this bank guarantee (*hereinafter called the “Guarantee”*) by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Contractor’s obligations during the {Construction Period/ Defects Liability Period and Maintenance Period} under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of [General Manager in the National Highways Authority of India], that the Contractor has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.
3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.
4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.
5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfilment and/ or performance of all or any of the obligations of the Contractor contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.
6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfillment, compliance and/or performance of all or any of the obligations of the Contractor under the Agreement.
7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Guarantee shall cease to be in force and effect on ****\$. Unless a demand or claim under this Guarantee is made in writing before expiry of the Guarantee, the Bank shall be discharged from its liabilities hereunder. **Additionally, the claim period shall be 01 (one) year more beyond the validity of e-BG.**
9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.
10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.
11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

Signed and sealed this day of, 20..... at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature) (Name) (Designation)

(Code Number) (Address)

NOTES:

- (i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

- (ii) The address, telephone number and other details of the head office of the Bank as well as of issuing branch should be mentioned on the covering letter of issuing branch.

\$ Insert date being 2 (two) years from the date of issuance of this Guarantee (in accordance with Clause 7.2 of the Agreement).

Annex - II

(Schedule - G)

(See Clause 19.2)

Annexure-II: Form for Insurance Surety Bond for Advance Payment

To,
The Executive Director,
Regional Office - Siliguri (West Bengal),
National Highways and Infrastructure Development Corporation of India Limited,
Unit 402, Quantum Building, Parivahan Nagar, P.O & P.S. Matigara, Pin Code 734010.

WHEREAS:

(A) [Name and address of contractor] (hereinafter called the "Contractor") has executed an agreement (hereinafter called the "Agreement") with the [name and address of the authority], (hereinafter called the "Authority") for the construction of the ***** section of [National Highway No. **] on Engineering, Procurement and Construction (the "EPC") basis, subject to and in accordance with the provisions of the Agreement.

(B) In accordance with Clause 19.2 of the Agreement, the Authority shall make to the Contractor an interest bearing @Bank Rate + 3% advance payment (hereinafter called "Advance Payment") equal to 10% (ten per cent) of the Contract Price; and that the Advance Payment shall be made in two installments subject to the Contractor furnishing an irrevocable and unconditional Insurance Surety Bond by Insurance Company for an amount equivalent to 110% (one hundred and ten percent) of such installment to remain effective till the complete and full repayment of the installment of the Advance Payment as security for compliance with its obligations in accordance with the Agreement. The amount of (first/second) installment of the Advance Payment is Rs. cr. (Rupees crore) and the amount of this

(C) Insurance Surety Bond is Rs. cr. (Rupees - crore) (the "Guarantee Amount") \$.

(D) We, through our branch at (the "Insurance Company" have agreed to furnish this Insurance Surety Bond (hereinafter called the "Guarantee") for the Guarantee Amount.

NOW, THEREFORE, the Insurance Company hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Insurance Company hereby unconditionally and irrevocably guarantees the due and faithful repayment on time of the aforesaid instalment of the Advance Payment under and in accordance with the Agreement, and agrees and undertakes to pay to the authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein. A letter from the Authority, under the hand of an officer not below the rank of General Manager in the National Highways and Infrastructure Development Corporation of India Limited that the Contractor has committed default in the due and faithful performance of all or any of its obligations for the repayment of the instalment of the Advance Payment under and in accordance with the Agreement shall be conclusive, final and binding on the Insurance Company.

⁵ The guarantee amount should be equivalent to 110% of the value of the applicable instalment.

The Insurance Company further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final and binding on the Insurance Company, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

2. In order to give effect to this Insurance Surety Bond, the Authority shall be entitled to act as if the Insurance Company were the principal debtor and any change in the constitution of the Contractor and/or the Insurance Company, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Insurance Company under this Guarantee.
3. It shall not be necessary, and the Insurance Company hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Insurance Company its demand under this Guarantee.
4. The Authority shall have the liberty, without affecting in any manner the liability of the Insurance Company under this Guarantee, to vary at any time, the terms and conditions of the Advance Payment or to extend the time or period of its repayment or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Insurance Company shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Insurance Surety Bond from its liability and obligation under this Guarantee and the Insurance Company hereby waives all of its right under any such law.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

5. This Insurance Surety Bond is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Advance Payment.
6. Notwithstanding anything contained herein before, the liability of Insurance Company under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Insurance Company under this Guarantee all rights of the Authority under this Insurance Surety Bond shall be forfeited and the Insurance Company shall be relieved from its liabilities hereunder.
7. The Insurance Surety Bond shall cease to be in force and effect on \$****. Unless a demand or claim under this Guarantee is made in writing on or before the aforesaid date, the Insurance Company shall be discharged from its liabilities hereunder. **Additionally, the claim period shall be 01 (one) year beyond the validity of ISB.**
8. The Insurance Company undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Insurance Company.
9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Insurance Company at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.
10. This Insurance Surety Bond shall come into force with immediate effect and shall remain in force and effect up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

Signed and sealed this day of 20 at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Insurance Company by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

- NOTES:
- (i) The Insurance Surety Bond should contain the name, designation and code number of the officer(s) signing the Insurance Surety Bond.
 - (ii) The address, telephone number and other detail of the head of the Insurance Company as well as issuing branch should be

⁵ Insert a date being 90 (ninety) days after the end of one year from the date of payment of the Advance payment to the Contractor (in accordance with Clause 19.2 of the Agreement)

Annex - III
(Schedule - G)
(See Clause 19.2)

Form for Guarantee for Advance Payment

To,

The Executive Director,

Regional Office - Siliguri (West Bengal),

National Highways and Infrastructure Development Corporation of India Limited,

Unit 402, Quantum Building, Parivahan Nagar, P.O & P.S. Matigara, Pin Code 734010.

WHEREAS:

(A) [name and address of contractor] (hereinafter called the “Contractor”) has executed an agreement (hereinafter called the “Agreement”) with the [name and address of the authority], (hereinafter called the “Authority”) for the construction of the ***** section of [National Highway No. **] on Engineering, Procurement and Construction (the “EPC”) basis, subject to and in accordance with the provisions of the Agreement.

(B) In accordance with Clause 19.2 of the Agreement, the Authority shall make to the Contractor an interest bearing @*Bank Rate* + 3% advance payment (herein after called “Advance Payment”) equal to 10% (ten per cent) of the Contract Price; and that the Advance Payment shall be made in two installments subject to the Contractor furnishing an irrevocable and unconditional guarantee by a scheduled bank for an amount equivalent to 110% (one hundred and ten percent) of such installment to remain effective till the complete and full repayment of the installment of the Advance Payment as security for compliance with its obligations in accordance with the Agreement. The amount of {first/second} installment of the Advance Payment is Rs. ----- cr. (Rupees ----- crore) and the amount of this Guarantee is Rs. ----- cr. (Rupees ----- crore) (the “Guarantee Amount”) \$.

(C) We, through our branch at (the “Bank”) have agreed to furnish this bank guarantee (*hereinafter called the “Guarantee”*) for the Guarantee Amount. NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful repayment on time of the aforesaid instalment of the Advance Payment under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

sum specified therein. A letter from the Authority, under the hand of an officer not below the rank of [General Manager in the National Highways Authority of India], that the Contractor has committed default in the due and faithful performance of all or any of its obligations for the repayment of the instalment of the Advance Payment under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

§ The Guarantee Amount should be equivalent to 110% of the value of the applicable instalment.

2. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

3. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.

4. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Advance Payment or to extend the time or period of its repayment or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

5. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Advance Payment.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

6. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

7. The Guarantee shall cease to be in force and effect on ****. \$ Unless a demand or claim under this Guarantee is made in writing on or before the aforesaid date, the Bank shall be discharged from its liabilities hereunder.

8. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

10. This Guarantee shall come into force with immediate effect and shall remain in force and effect up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

Signed and sealed this day of, 20..... at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

NOTES:

(i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.

(ii) The address, telephone number and other details of the head office of the Bank as well as of issuing branch should be mentioned on the covering letter of issuing branch.

\$ Insert a date being 90 (ninety) days after the end of one year from the date of payment of the Advance payment to the Contractor (in accordance with Clause 19.2 of the Agreement).

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule - H

(See Clauses 10.1 (iv) and 19.3)

Contract Price Weightages

1.1 The Contract Price for this Agreement is Rs.....

1.2 Proportions of the Contract Price for different stages of Construction of the Project Highway shall be as specified below:

Item	Weightage in Percentage to the Contract Price	Stage of for Payment	Percentage Weight in particular Item
1	2	3	4
Road works including culverts (completed in all respect etc.)	0.60%	A- 2 Lane Curve Improvement / Realignment / New / Reconstruction	
		(1) Earth work upto top of Subgrade	-
		(2) Granular Sub-Base Course (GSB) and other layers	-
		(3) Bituminous Base Course/DBM	-
		(4) Wearing Coat/ BC	-
		(5) Earthen / Granular Shoulders	-
		B - Reconstruction and New Construction Culverts.	-
		(1) Culverts	100%
Slope Protection Works (completed in all respect etc.)	99.34%	A- Dismantling of existing structures and Excavation of Hill slope, removal & disposal of material necessary for construction (hill & valley side)	0.55%
		B- PCC-M15, for CC stepped wall, Catchpit, Chute, Drop & Guide. (hill & valley side)	1.25%

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

		C.- Gabian wall at valley side	
		1. Earthwork in excavation and PCC M-20 for Gabian wall	1.09%
		2. Providing & making Gabion structure complete in all respect etc.	7.79%
		3. Providing & Backfilling behind wall complete in all respect etc.	2.90%
		4. Supply and installation of non woven geotextile complete in all respect etc.	0.32%
		D- Anchor Works	
		(1) Scaling complete in all respect etc.	3.79%
		(1) Self Drilling Anchors including end plates, cement pressure grouting complete in all respect etc.	62.15%
		(2) 100T capacity Prestressed Cable anchor including end plates, cement pressure grouting complete in all respect etc.	5.81%
		E- Erosion Control	
		(1) Supply and installation of high tensile wiremesh complete in all respect etc.	8.53%
		(1) Supply and fixing 3D net complete in all respect etc.	1.78%
		(3) Hydroseeding complete in all respect etc.	2.80%
		(4) Providing and installing subsurface drainage pipes Semi Perforated PVC pipe complete in all respect etc.	1.12%
		(5) Road side CC Drainage works, berm drains, toe drains, catch drains, chute drains etc., Surface drains on hill & valley slope	0.12%
Other works (completed in all respect etc.)	0.06%	(1) Road Signs, Road Safety Devices including delineators, Road Furniture's, Road Markings & Road Studs etc. and other miscellaneous safety items	100%

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

1.3 Procedure of estimating the value of work done.

1.3.1 Road works

Procedure for estimating the value of road work done shall be as follows:

Table 1.3.1

Stage of for Payment	Percentage Weight in particular Item	Payment Procedure
Road works including culverts		
A- 2 Lane Curve Improvement / Realignment / New / Reconstruction	-	
(1) Earth work upto top of Subgrade	-	
(2) Granular Sub-Base Course (GSB) and other layers	-	-
(3) Bituminous Base Course/DBM	-	
(4) Wearing Coat/ BC	-	
(5) Earthen / Granular Shoulders	-	
B - Re-construction and New Construction Culvert.	0.60%	
(1) Culverts	100%	Cost of each culvert shall be determined on pro rata basis with respect to the total number of culverts. Payment of each stage shall be made completed in all respect.

Cost per km = P x weightage for road work x weightage for bituminous work x (1/L)

Where

P = Contract Price

L = Total equivalent intermediate-Lane length in km as defined above

Similarly, the rates per km for other stages shall be worked out accordingly.

Note: The length affected due to law and order problems or litigation during execution including the length not handed over to the Contractor under clause 8.3 of this Contract Agreement due to which the Contractor is unable to execute the work, may be deducted from the total project length for payment purposes. The total length calculated here is only for payment purposes and will not affect and referred in other clauses of the Contract Agreement

1.3.2 Slope Protection Works

Procedure for estimating the value of Slope Protection Work shall be as stated in table 1.3.2

Table 1.3.2

Stage of for Payment	Percentage Weight in particular Item	Payment Procedure
A- Dismantling of existing structures and excavation of Hill slope, removal & disposal of material necessary for construction (hill & valley side)	0.55%	Unit of measurement is area in sqm. Payment shall be made on pro rata basis on completion of each stage in an area of not less than 20% of the total volume of excavation/ dismantle, removal of muck & safe disposal.
B- PCC-M15, for CC stepped wall, Catchpit, Chute, Drop & Guide. (hill & valley side)	1.25%	Unit of measurement is linear length. Payment shall be made on pro rata basis on completion of each stage in a length of not less than 20% of the total length.
C.- Gabian wall at valley side		
1. Earthwork in excavation and PCC M-20 for Gabian wall	1.09%	Unit of measurement is linear length of Gabian wall. Payment shall be made on pro rata basis on completion of each stage in a length of not less than 10% of the total length.
2. Providing & making Gabion structure complete in all respect etc.	7.79%	
3. Providing & Backfilling behind wall complete in all respect etc.	2.90%	
4. Supply and installation of non-woven geotextile complete in all respect etc.	0.32%	
D- Anchor Works		

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

(1) Scaling complete in all respect etc.	3.79%	Unit of measurement is area in sqm. Payment shall be made on pro rata basis on completion of each stage in an area of not less than 20% of the total area.
(1) Self Drilling Anchors including end plates, cement pressure grouting complete in all respect etc.	62.15%	Unit of measurement is linear length of the item. Payment shall be made on pro rata basis on completion of each stage in a length of not less than 10% of the total length of the item.
(2) 100T capacity Prestressed Cable anchor including end plates, cement pressure grouting complete in all respect etc.	5.81%	
E- Erosion Control		
(1) Supply and installation of high tensile wiremesh complete in all respect etc.	8.53%	Unit of measurement is area in sqm. Payment shall be made on pro rata basis on completion of each stage in an area of not less than 25% of the total area.
(2) Supply and fixing 3D net complete in all respect etc.	1.78%	
(3) Hydroseeding complete in all respect etc.	2.80%	
(4) Providing and installing subsurface drainage pipes Semi Perforated PVC pipe complete in all respect etc.	1.12%	Unit of measurement is linear length of the item. Payment shall be made on pro rata basis on completion of each stage in a length of not less than 50% of the total length of the item.
(5) Road side CC Drainage works, berm drains, toe drains, catch drains, chute drains etc., Surface drains on hill & valley slope	0.12%	

1.3.3 Other works

Procedure for estimating the value of other work shall be as stated in table 1.3.3

Table 1.3.3

Stage of for Payment	Percentage Weight in particular Item	Payment Procedure
1) Road Signs, Road Safety Devices including delineators, Road Furniture's, Road Markings & Road Studs etc. and other miscellaneous safety items	100%	Unit of measurement is linear length. Payment shall be made on pro rata basis on completion of each stage in a length of not less than 50% of the total length of the item.

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Notes: -

Notwithstanding anything contained in Tables under clause 1.3.1, 1.3.2, 1.3.3 or any other progress payment guidelines in this Agreement, interim payment for subsequent non-bituminous base courses, bituminous base courses, or wearing coats under Category A or Category B shall be withheld for any sub-stretch in mountainous or landslide-prone terrain until both of the following mandatory safety requirement are fulfilled:

(i) The firmed-up cut profiles and matching slope protection/stabilization systems (detailed in Schedule-B) have been completely executed by the Contractor.

(ii) The completed slope stabilization measures have remained stable on-site through at least one full monsoon season, verified through continuous coordinate spatial logs from the permanent geodetic observation pedestals and certified in writing by the Authority's Engineer.

2. Procedure for payment for Maintenance

- (a) The cost for maintenance shall be as stated in Clause 14.1 (i)
- (b) Payment for Maintenance shall be made in accordance with the provisions of Clause 19.7.

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Schedule - I

(See Clause 10.2 (iv))

Drawings

1. Drawings

In compliance of the obligations set forth in Clause 10.2 of this Agreement, the Contractor shall furnish to the Authority's Engineer, free of cost, all Drawings listed in Annex-I of this Schedule-I.

2. Additional Drawings

If the Authority's Engineer determines that for discharging its duties and functions under this Agreement, it requires any drawings other than those listed in Annex-I, it may by notice require the Contractor to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Contractor shall promptly prepare and furnish such drawings to the Authority's Engineer, as if such drawings formed part of Annex-I of this Schedule-I.

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Annex - I

(Schedule - I)

List of Drawings

A minimum list of the drawings of the various components / elements of the Project Highway and project facilities required to be submitted by the Concessionaire is given below:

- a) Typical Road section as PLAN-1
- b) Drawing of Plan & Profile for Road - N.A
- c) Detailed Drawings of CC stepped wall, Gabion wall, Slope Protection Measures as TCS-1, TCS-2, and Culvert is TCS-3 and TCS-4 and any other if required in this regard.
- d) Any other drawing relevant to the Project Highway as desired by Authority/Client.

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Schedule - J

(See Clause 10.3 (ii))

Project Completion Schedule

1. Project Completion Schedule

During Construction period, the Contractor shall comply with the requirements set forth in this Schedule-J for each of the Project Milestones and the **Scheduled Completion Date**. Within 15 (fifteen) days of the date of each Project Milestone, the Contractor shall notify the Authority of such compliance along with necessary particulars thereof.

2. Project Milestone-I

(i) Project Milestone-I shall occur on the date falling on the **90th (Ninety) days** from the Appointed Date (the “**Project Milestone- I**”).

(ii) Prior to the occurrence of Project Milestone-I, the Contractor shall have commenced construction of the Project Highway and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 10% (ten per cent) of the Contract Price.

(iii) Completed 100% of the pre-construction UAV/LIDAR topographical strip surveys, completed the sealing of all identified ground tension cracks within the 300-meter influence zone.

3. Project Milestone-II

(i) Project Milestone-II shall occur on the date falling on the **150th (One Hundred and Fifty) days** from the Appointed Date (the “**Project Milestone- II**”).

(ii) Prior to the occurrence of Project Milestone-II, the Contractor shall have continued with construction of the Project Highway and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 35% (thirty-five per cent) of the Contract Price Furthermore, the Contractor must demonstrate 100% physical completion of slope profiling and cutting works for the designated first-stage road length.

4. Project Milestone-III

(i) Project Milestone-III shall occur on the date falling on the **270th (Two Hundred and Seventy) day** from the Appointed Date (the “**Project Milestone- III**”).

(ii) Prior to the occurrence of Project Milestone-III, the Contractor shall have continued with construction of the Project Highway and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 70% (seventy per cent) of the Contract Price.

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5. Scheduled Completion Date

(i) The Scheduled Completion Date shall occur on the 365th (Three Hundred and Sixty Five) day from the Appointed Date.

(ii) On or before the Scheduled Completion Date, the Contractor shall have completed construction in accordance with this Agreement.

6. Extension of time

Upon extension of any or all of the aforesaid Project Milestones or the Scheduled Completion Date, as the case may be, under and in accordance with the provisions of this Agreement, the Project Completion Schedule shall be deemed to have been amended accordingly.

Schedule - K

(See Clause 12.1 (ii))

Tests on Completion

1. Schedule for Tests

- (i) The Contractor shall, no later than 30 (thirty) days prior to the likely completion of construction, notify the Authority's Engineer and the Authority of its intent to subject the Project Highway to Tests, and no later than 10 (ten) days prior to the actual date of Tests, furnish to the Authority's Engineer and the Authority detailed inventory and particulars of all works and equipment forming part of Works.
- (ii) The Contractor shall notify the Authority's Engineer of its readiness to subject the Project Highway to Tests at any time after 10 (ten) days from the date of such notice, and upon receipt of such notice, the Authority's Engineer shall, in consultation with the Contractor, determine the date and time for each Test and notify the same to the Authority who may designate its representative to witness the Tests. The Authority's Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 12 and this Schedule-K. Cost towards all the tests shall be borne by EPC Contractor.

2. Tests

- (i) Visual and physical test: The Authority's Engineer shall conduct a visual and physical check of construction to determine that all works and equipment forming part thereof conform to the provisions of this Agreement. The physical tests shall include to be decided with Authority's Engineer and (any test for slope protection measures) at the time of physical tests as per standard.
- (ii) Riding quality test: Riding quality of each lane of the carriageway shall be checked with the help of a Network Survey Vehicle (NSV) fitted with latest equipment's and the maximum permissible roughness for purposes of this Test shall be 2,000 (two thousand) mm for each kilometre.
- (iii) Tests for bridges: All major and minor bridges shall be subjected to the rebound hammer and ultrasonic pulse velocity tests, to be conducted in accordance with the procedure described in Special Report No. 17: 1996 of the IRC Highway Research Board on Non-destructive Testing Techniques, at two spots in every span, to be chosen at random by the Authority's Engineer. Bridges with a span of 15 (fifteen) metres or more shall also be subjected to load testing.
- (iv) Other tests (any test for slope protection measures): The Authority's Engineer may require the Contractor to carry out or cause to be carried additional tests, in accordance with Good Industry Practice, for determining the compliance of the Project Highway with Specifications and Standards, except tests as specified in clause 5, but shall include measuring the reflectivity of road markings and road

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signs; and measuring the illumination level (lux) of lighting using requisite testing equipment.

- (v) **Test on Slope Protection Work:** The Authority's Engineer may require to carry out the visual inspection/any other test on Slope Protection Work prior to issuance of the Completion Certificate.
- (vi) **Environmental audit:** The Authority's Engineer shall carry out a check to determine conformity of the Project Highway with the environmental requirements set forth in Applicable Laws and Applicable Permits.
- (vii) **Safety Audit:** The Authority's Engineer shall carry out, or cause to be carried out, a safety audit to determine conformity of the Project Highway with the safety requirements and Good Industry Practice.

3. Agency for conducting Tests

All Tests set forth in this Schedule-K shall be conducted by the Authority's Engineer or such other agency or person as it may specify in consultation with the Authority.

4. Completion Certificate

Upon successful completion of Tests, the Authority's Engineer shall issue the Completion Certificate in accordance with the provisions of Article 12.

5. The Authority Engineer will carry out tests with following equipment at his own cost in the presence of contractor's representative.

Sr. No.	Key metrics of Asset	Equipment to be used	Frequency of condition survey
1	Surface defects of pavement	Network Survey Vehicle (NSV)	At least twice a year (As per survey months defined for the state basis rainy season)
2	Roughness of pavement	Network Survey Vehicle (NSV)	At least twice a year (As per survey months defined for the state basis rainy season)
3	Strength of pavement	Falling Weight Deflectometer (FWD)	At least once a year
4	Bridges	Mobile Bridge Inspection Unit (MBU)	At least twice a year (As per survey months defined for the state basis rainy season)
5	Road signs	Retro-reflectometer	At least twice a year (As per survey months defined for the state basis rainy season)

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The first testing with the help of NSV shall be conducted at the time of issue of Completion Certificate.

Schedule - L

(See Clause 12.2)

Completion Certificate

- 1 I, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for "Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27." basis through (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been successfully undertaken to determine compliance of the Project Highway with the provisions of the Agreement, and I am satisfied that the Project Highway can be safely and reliably placed in service of the Users thereof.
- ~~2 It is certified that Rain water harvesting and artificial recharging arrangements have been provided by the contractor as per Schedule "C" of the contract agreement and are functional. Details (with location chainage) are as given in Annex.~~
- 3 It is certified that, in terms of the aforesaid Agreement, all works forming part of Project Highway have been completed, and the Project Highway is hereby declared fit for entry into operation on this the day of 20...., Scheduled Completed Date for which was the day of20....

SIGNED, SEALED AND DELIVERED

For and on behalf of the Authority's Engineer by:

(Signature)

(Name)

(Designation) (Address)

Schedule - M

(See Clauses 14.6, 15.2 and 19.7)

Payment Reduction for Non-Compliance

1. Payment reduction for non-compliance with the Maintenance Requirements

- (i) Monthly lump sum payments for maintenance shall be reduced in the case of non-compliance with the Maintenance Requirements set forth in Schedule-E.
- (ii) Any deduction made on account of non-compliance with the Maintenance Requirements shall not be paid even after compliance subsequently. The deductions shall continue to be made every month until compliance is done.
- (iii) The Authority's Engineer shall calculate the amount of payment reduction on the basis of weightage in percentage assigned to non-conforming items as given in Paragraph 2.

2. Percentage reductions in lump sum payments on monthly basis

- (i) The following percentages shall govern the payment reduction:

S. No.	Item/Defect/Deficiency	Percentage
(a)	Carriageway/Pavement	
(i)	Potholes, cracks, other surface defects	15%
(ii)	Repairs of Edges, Rutting	5%
(b)	Road, Embankment, Cuttings, Shoulders	
(i)	Edge drop, inadequate cross fall, undulations, settlement, potholes, ponding, obstructions	10%
(ii)	Deficient slopes, raincuts, disturbed pitching, vegetation growth, pruning of trees	5%
(c)	Bridges and Culverts	
(i)	Desilting, cleaning, vegetation growth, damaged pitching, flooring, parapets, wearing course, footpaths, any damage to foundations	20%
(ii)	Any Defects in superstructures, bearings and sub-structures	10%

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S. No.	Item/Defect/Deficiency	Percentage
(iii)	Painting, repairs/replacement kerbs, railings, parapets, guideposts/crash barriers	5%
(iv)	Any Defects in Special slope protection works	20%
(d)	Roadside Drains	
(i)	Cleaning and repair of drains	5%
(e)	Road Furniture	
(i)	Cleaning, painting, replacement of road signs, delineators, road markings, 200 m/km/5 th km stones	5%
(f)	Miscellaneous Items	
(i)	Removal of dead animals, broken down/accidented vehicles, fallen trees, road blockades or malfunctioning of mobile crane	10%
(ii)	Any other Defects in accordance with paragraph 1.	5%
(g)	Defects in Other Project Facilities	5%

- (ii) The amount to be deducted from monthly lump-sum payment for non-compliance of particular item shall be calculated as under:

$$R = \frac{P}{100} \times (M1 \text{ or } M2) \times \frac{L1}{L}$$

Where,

P= Percentage of particular item/Defect/deficiency for deduction

M1= Monthly lump-sum payment in accordance para 1.2 above of this Schedule

M2= Monthly lump-sum payment in accordance para 1.2 above of this Schedule

L1= Non-complying length L = Total length of the road,

R= Reduction (the amount to be deducted for non-compliance for a particular item/Defect/deficiency)

The total amount of reduction shall be arrived at by summation of reductions for such items/Defects/deficiency or non-compliance.

For any Defect in a part of one kilometer, the non-conforming length shall be taken as one kilometer.

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Schedule - N

(See Clause 18.1 (i))

Selection of Authority's Engineer

1. Selection of Authority's Engineer

- (i) The provisions of the Model Request for Proposal for Selection of Technical Consultants, issued by the Ministry of Finance in May 2009, or any substitute thereof shall apply for selection of an experienced firm to discharge the functions and duties of an Authority's Engineer.
- (ii) In the event of termination of the Technical Consultants appointed in accordance with the provisions of Paragraph 1.1, the Authority shall appoint another firm of Technical Consultants forthwith and may engage a government-owned entity in accordance with the provisions of Paragraph 3 of this Schedule-N.

2. Terms of Reference

- (iii) The Terms of Reference for the Authority's Engineer (the "TOR") shall substantially conform with Annex 1 to this Schedule N.

3. Appointment of Government entity as Authority's Engineer

- (iv) Notwithstanding anything to the contrary contained in this Schedule, the Authority may in its discretion appoint a government-owned entity as the Authority's Engineer; provided that such entity shall be a body corporate having as one of its primary functions the provision of consulting, advisory and supervisory services for engineering projects; provided further that a government-owned entity which is owned or controlled by the Authority shall not be eligible for appointment as Authority's Engineer.

Annex - I

(Schedule - N)

Terms of Reference for Authority's Engineer

Scope

- (i) These Terms of Reference (the “**TOR**”) for the Authority’s Engineer are being specified pursuant to the EPC Agreement dated (the “**Agreement**”), which has been entered into National Highways & Infrastructure Development Corporation, 1st & 2nd Floor, Tower A, World Trade Centre, Nauroji Nagar, New Delhi - 110029 (the “**Authority**”) and (the “**Contractor**”)[#] “Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.”, and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

- In case the bid of Authority’s Engineer is invited simultaneously with the bid of EPC project, then the status of bidding of EPC project only to be indicated

- (ii) The TOR shall apply to construction and maintenance of the Project Highway.

Definitions and interpretation

- (i) The words and expressions beginning with or in capital letters and not defined herein but defined in the Agreement shall have, unless repugnant to the context, the meaning respectively assigned to them in the Agreement.
- (ii) References to Articles, Clauses and Schedules in this TOR shall, except where the context otherwise requires, be deemed to be references to the Articles, Clauses and Schedules of the Agreement, and references to Paragraphs shall be deemed to be references to Paragraphs of this TOR.
- (iii) The rules of interpretation stated in Article 1 of the Agreement shall apply, mutatis mutandis, to this TOR.

General

- (i) The Authority’s Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.
- (ii) The Authority’s Engineer shall perform the duties and exercise the authority in accordance with the provisions of this Agreement, but subject to obtaining prior written approval of the Authority before determining:

a). any Time Extension;

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- b). any additional cost to be paid by the Authority to the Contractor;
 - c). the Termination Payment; or
 - d). issuance of Completion Certificate or
 - e). Any other matter which is not specified in (a), (b), (c) or (d) above and which creates a financial liability on either Party.
- (iii) The Authority's Engineer shall submit regular periodic reports, at least once every month, to the Authority in respect of its duties and functions under this Agreement. Such reports shall be submitted by the Authority's Engineer within 10 (ten) days of the beginning of every month.
- (iv) The Authority's Engineer shall inform the Contractor of any delegation of its duties and responsibilities to its suitably qualified and experienced personnel; provided, however, that it shall not delegate the authority to refer any matter for the Authority's prior approval in accordance with the provisions of Clause 18.2.
- (v) The Authority's Engineer shall aid and advise the Authority on any proposal for Change of Scope under Article 13.
- (vi) In the event of any disagreement between the Parties regarding the meaning, scope and nature of Good Industry Practice, as set forth in any provision of the Agreement, the Authority's Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

Construction Period

- (i) During the Construction Period, the Authority's Engineer shall review and approve the Drawings furnished by the Contractor along with supporting data, including the geo-technical and hydrological investigations, characteristics of materials from borrow areas and quarry sites, topographical surveys, and the recommendations of the Safety Consultant in accordance with the provisions of Clause 10.1 (vi). The Authority's Engineer shall complete such review and approval and send its observations to the Authority and the Contractor within 15 (fifteen) days of receipt of such Drawings; provided, however that in case of a Major Bridge or Structure, the aforesaid period of 15 (fifteen) days may be extended upto 30 (thirty) days. In particular, such comments shall specify the conformity or otherwise of such Drawings with the Scope of the Project and Specifications and Standards.
- (ii) The Authority's Engineer shall review and approve any revised Drawings sent to it by the Contractor and furnish its comments within 10 (ten) days of receiving such Drawings.
- (iii) The Authority's Engineer shall review and approve the Quality Assurance Plan submitted by the Contractor and shall convey its comments to the Contractor

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within a period of 21 (twenty one) days stating the modifications, if any, required thereto.

- (iv) The Authority's Engineer shall complete the review and approve of the methodology proposed to be adopted by the Contractor for executing the Works, and convey its comments to the Contractor within a period of 10 (ten) days from the date of receipt of the proposed methodology from the Contractor.
- (v) The Authority's Engineer shall grant written approval to the Contractor, where necessary, for interruption and diversion of the flow of traffic in the existing lane(s) of the Project Highway for purposes of maintenance during the Construction Period in accordance with the provisions of Clause 10.4.
- (vi) The Authority's Engineer shall review the monthly progress report furnished by the Contractor and send its comments thereon to the Authority and the Contractor within 7 (seven) days of receipt of such report.
- (vii) The Authority's Engineer shall inspect the Construction Works and the Project Highway and shall submit a monthly Inspection Report bringing out the results of inspections and the remedial action taken by the Contractor in respect of Defects or deficiencies. In particular, the Authority's Engineer shall include in its Inspection Report, the compliance of the recommendations made by the Safety Consultant.
- (viii) The Authority's Engineer shall conduct the pre-construction review of manufacturer's test reports and standard samples of manufactured Materials, and such other Materials as the Authority's Engineer may require.
- (ix) For determining that the Works conform to Specifications and Standards, the Authority's Engineer shall require the Contractor to carry out, or cause to be carried out, tests at such time and frequency and in such manner as specified in the Agreement and in accordance with Good Industry Practice for quality assurance. For purposes of this Paragraph 4 (ix), the tests specified in the IRC Special Publication-11 (Handbook of Quality Control for Construction of Roads and Runways) and the Specifications for Road and Bridge Works issued by MORTH (the "Quality Control Manuals") or any modification/substitution thereof shall be deemed to be tests conforming to Good Industry Practice for quality assurance.
- (x) The Authority's Engineer shall test check at least 100 (Hundred) percent) percent of the quantity or number of tests prescribed for each category or type of test for quality control by the Contractor.
- (xi) The timing of tests referred to in Paragraph 4 (ix), and the criteria for acceptance/rejection of their results shall be determined by the Authority's Engineer in accordance with the Quality Control Manuals. The tests shall be undertaken on a random sample basis and shall be in addition to, and independent of, the tests that may be carried out by the Contractor for its own quality assurance in accordance with Good Industry Practice.

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- (xii) In the event that results of any tests conducted under Clause 11.10 establish any Defects or deficiencies in the Works, the Authority's Engineer shall require the Contractor to carry out remedial measures.
- (xiii) The Authority's Engineer may instruct the Contractor to execute any work which is urgently required for the safety of the Project Highway, whether because of an accident, unforeseeable event or otherwise; provided that in case of any work required on account of a Force Majeure Event, the provisions of Clause 21.6 shall apply.
- (xiv) In the event that the Contractor fails to achieve any of the Project Milestones, the Authority's Engineer shall undertake a review of the progress of construction and identify potential delays, if any. If the Authority's Engineer shall determine that completion of the Project Highway is not feasible within the time specified in the Agreement, it shall require the Contractor to indicate within 15 (fifteen) days the steps proposed to be taken to expedite progress, and the period within which the Project Completion Date shall be achieved. Upon receipt of a report from the Contractor, the Authority's Engineer shall review the same and send its comments to the Authority and the Contractor forthwith.
- (xv) The Authority's Engineer shall obtain from the Contractor a copy of all the Contractor's quality control records and documents before the Completion Certificate is issued pursuant to Clause 12.2.
- (xvi) Authority's Engineer may recommend to the Authority suspension of the whole or part of the Works if the work threatens the safety of the Users and pedestrians. After the Contractor has carried out remedial measure, the Authority's Engineer shall inspect such remedial measures forthwith and make a report to the Authority recommending whether or not the suspension hereunder may be revoked.
- (xvii) In the event that the Contractor carries out any remedial measures to secure the safety of suspended works and Users, and requires the Authority's Engineer to inspect such works, the Authority's Engineer shall inspect the suspended works within 3 (three) days of receiving such notice, and make a report to the Authority forthwith, recommending whether or not such suspension may be revoked by the Authority.
- (xviii) The Authority's Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-K and issue a Completion Certificate, as the case may be. For carrying out its functions under this Paragraph 4 (xviii) and all matters incidental thereto, the Authority's Engineer shall act under and in accordance with the provisions of Article 12 and Schedule-K.

Maintenance Period

- (i) The Authority's Engineer shall aid and advise the Contractor in the preparation of its monthly Maintenance Programme and for this purpose carry out a joint monthly inspection with the Contractor.

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- (ii) The Authority's Engineer shall undertake regular inspections, at least once every month, to evaluate compliance with the Maintenance Requirements and submit a Maintenance Inspection Report to the Authority and the Contractor.
- (iii) The Authority's Engineer shall specify the tests, if any, that the Contractor shall carry out, or cause to be carried out, for the purpose of determining that the Project Highway is in conformity with the Maintenance Requirements. It shall monitor and review the results of such tests and the remedial measures, if any, taken by the Contractor in this behalf.
- (iv) In respect of any defect or deficiency referred to in Paragraph 3 of Schedule- E, the Authority's Engineer shall, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards and shall also specify the time limit for repair or rectification of any deviation or deterioration beyond the permissible limit.
- (v) The Authority's Engineer shall examine the request of the Contractor for closure of any lane(s) of the Project Highway for undertaking maintenance/repair thereof, and shall grant permission with such modifications, as it may deem necessary, within 5 (five) days of receiving a request from the Contractor. Upon expiry of the permitted period of closure, the Authority's Engineer shall monitor the reopening of such lane(s), and in case of delay, determine the Damages payable by the Contractor to the Authority under Clause 14.5.

Determination of costs and time

- (i) The Authority's Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.
- (ii) The Authority's Engineer shall determine the period of Time Extension that is required to be determined by it under the Agreement.
- (iii) The Authority's Engineer shall consult each Party in every case of determination in accordance with the provisions of Clause 18.5.

Payments

- (i) The Authority's Engineer shall withhold payments for the affected works for which the Contractor fails to revise and resubmit the Drawings to the Authority's Engineer in accordance with the provisions of Clause 10.2 (iv) (d).
- (ii) Authority's Engineer shall -
 - a). within 10 (ten) days of receipt of the Stage Payment Statement from the Contractor pursuant to Clause 19.4, determine the amount due to the Contractor and recommend the release of 90 (ninety) percent of the amount so determined as part payment, pending issue of the Interim Payment Certificate; and
 - b). within 15 (fifteen) days of the receipt of the Stage Payment Statement referred to in Clause 19.4, deliver to the Authority and the Contractor an Interim Payment Certificate certifying the amount due and payable

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to the Contractor, after adjustments in accordance with the provisions of Clause 19.10.

- (iii) The Authority's Engineer shall, within 15 (fifteen) days of receipt of the Monthly Maintenance Statement from the Contractor pursuant to Clause 19.6, verify the Contractor's monthly statement and certify the amount to be paid to the Contractor in accordance with the provisions of the Agreement.
- (iv) The Authority's Engineer shall certify final payment within 30 (thirty) days of the receipt of the final payment statement of Maintenance in accordance with the provisions of Clause 19.16.

Other duties and functions

The Authority's Engineer shall perform all other duties and functions as specified in the Agreement.

Miscellaneous

- (i) A copy of all communications, comments, instructions, Drawings or Documents sent by the Authority's Engineer to the Contractor pursuant to this TOR, and a copy of all the test results with comments of the Authority's Engineer thereon, shall be furnished by the Authority's Engineer to the Authority forthwith.
- (ii) The Authority's Engineer shall retain at least one copy each of all Drawings and Documents received by it, including 'as-built' Drawings, and keep them in its safe custody.
- (iii) Within 90 (ninety) days of the Project Completion Date, the Authority's Engineer shall obtain a complete set of as-built Drawings, in 2 (two) hard copies and in micro film form or in such other medium as may be acceptable to the Authority, reflecting the Project Highway as actually designed, engineered and constructed, including an as-built survey illustrating the layout of the Project Highway and setback lines, if any, of the buildings and structures forming part of Project Facilities; and shall hand them over to the Authority against receipt thereof.
- (iv) The Authority's Engineer, if called upon by the Authority or the Contractor or both, shall mediate and assist the Parties in arriving at an amicable settlement of any Dispute between the Parties.
- (v) The Authority's Engineer shall inform the Authority and the Contractor of any event of Contractor's Default within one week of its occurrence.

Schedule - O

(See Clauses 19.4 (i), 19.6 (i), and 19.8 (i))

Forms of Payment Statements

1. Stage Payment Statement for Works

The Stage Payment Statement for Works shall state:

- a). the estimated amount for the Works executed in accordance with Clause 19.3 (i) subsequent to the last claim;
- b). amounts reflecting adjustments in price for the aforesaid claim;
- c). the estimated amount of each Change of Scope Order executed subsequent to the last claim;
- d). amounts reflecting adjustment in price, if any, for (c) above in accordance with the provisions of Clause 13.2 (iii) (a);
- e). total of (a), (b), (c) and (d) above;
- f). Deductions:
 - i. Any amount to be deducted in accordance with the provisions of the Agreement except taxes;
 - ii. Any amount towards deduction of taxes; and
 - iii. Total of (i) and (ii) above.
- g). Net claim: (e) - (f) (iii);
- h). The amounts received by the Contractor upto the last claim:
 - iv. For the Works executed (excluding Change of Scope orders);
 - v. For Change of Scope Orders, and
 - vi. Taxes deducted

2. Monthly Maintenance Payment Statement

The monthly Statement for Maintenance Payment shall state:

- i). The monthly payment admissible in accordance with the provisions of the Agreement;
- j). The deductions for maintenance work not done;
- k). Net payment for maintenance due, (a) minus (b);
- l). Amounts reflecting adjustments in price under Clause 19.12; and
- m). Amount towards deduction of taxes

3. Contractor's claim for Damages

Note: The Contractor shall submit its claims in a form acceptable to the Authority.

(See Clause 20.1)

Insurance

1. Insurance during Construction Period

- (i) The Contractor shall effect and maintain at its own cost, from the Appointed Date till the date of issue of the Completion Certificate, the following insurances for any loss or damage occurring on account of Non Political Event of Force Majeure, malicious act, accidental damage, explosion, fire and terrorism:
 - a). insurance of Works, Plant and Materials and an additional sum of [15 (fifteen)] per cent of such replacement cost to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature; and
 - b). Insurance for the Contractor's equipment and Documents brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.
- (ii) The insurance under sub para (a) and (b) of paragraph 1(i) above shall cover the Authority and the Contractor against all loss or damage from any cause arising under paragraph 1.1 other than risks which are not insurable at commercial terms.

2. Insurance for Contractor's Defects Liability

The Contractor shall effect and maintain insurance cover of not less than 15% of the Contract Price for the Works from the date of issue of the Completion Certificate until the end of the Defects Liability Period for any loss or damage for which the Contractor is liable and which arises from a cause occurring prior to the issue of the Completion Certificate. The Contractor shall also maintain other insurances for maximum sums as may be required under the Applicable Laws and in accordance with Good Industry Practice.

3. Insurance against injury to persons and damage to property

- (i) The Contractor shall insure against its liability for any loss, damage, death or bodily injury, or damage to any property (except things insured under Paragraphs 1 and 2 of this Schedule or to any person (except persons insured under Clause 20.9), which may arise out of the Contractor's performance of this Agreement. This insurance shall be for a limit per occurrence of not less than the amount stated below with no limit on the number of occurrences.
- (ii) The insurance cover shall be not less than: Rs. Rs. 2,00,00,000/- (Rupees Two Crore only)

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

- (iii) The insurance shall be extended to cover liability for all loss and damage to the Authority's property arising out of the Contractor's performance of this Agreement excluding:
 - a). the Authority's right to have the construction works executed on, over, under, in or through any land, and to occupy this land for the Works; and
 - b). Damage which is an unavoidable result of the Contractor's obligations to execute the Works.

4. Insurance to be in joint names

The insurance under paragraphs 1 to 3 above shall be in the joint names of the Contractor and the Authority.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule - Q

(See Clause 14.10)

Tests on Completion of Maintenance Period

1. Riding Quality test:

Riding quality test: Riding quality of each lane of the carriageway shall be checked with the help of a calibrated bump integrator and the maximum permissible roughness for purposes of this Test shall be [2,200 (two thousand and two hundred only)] mm for each kilometre.

2. Visual and physical test:

The Authority's Engineer shall conduct a visual and physical check of construction to determine that all works and equipment forming part thereof conform to the provisions of this Agreement. The physical tests shall include measurement of cracking, rutting, stripping and potholes and shall be as per the requirement of maintenance mentioned in Schedule-E.

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

Schedule - R

(See Clause 14.10)

Taking Over Certificate

I, (Name and designation of the Authority's Representative) under and in accordance with the Agreement dated (the "Agreement"), for "Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27." basis through (Name of Contractor), hereby certify that the Tests on completion of Maintenance Period in accordance with Article 14 of the Agreement have been successfully undertaken to determine compliance of the Project Highway with the provisions of the Agreement and I hereby certify that the Authority has taken over the Project highway from the Contractor on this day.....

SIGNED, SEALED AND DELIVERED

(Signature)

(Name and designation of Authority's Representative)

(Address)

Slope protection and landslide mitigation and Re-construction of culvert from km 23.000 to km 23.200 (200 mtr. approx.) near Tindhariya on NH-110 on EPC mode in the State of West Bengal during FY 26-27.

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