# EPC

# (ENGINEERING PROCUREMENT AND CONSTRUCTION)

# AGREEMENT

# FOR

**Rehabilitation /Treatment of Landslide & Sinking Zone Locations with Slope Protection works , Drainage improvement at Kameda-1 (Km 384.680 to 384.880), Kameda-2 (Km 385.500 to 385.640),Gauchar (Km 387.190 to 387.260),Dharinagar (Km 392.450 to 392.500), Karnprayag-1 (Km 400.45 to Km 400.600), Karnprayag-2 (Km 400.75 to 400.850),Langasu (Km 406.310 to 406.330),Devlibagad-1 (Km 411.380 to 411.440), Devlibagad-2(Km 411.490 to 411.530) & construction of new RCC minor bridge at BRO DETT Gauchar (Km 394.800 to 394.830)on NH-58 (NEW NH-07) under Package-01 in Chamoli District in the state of Uttarakhandthrough an Engineering Procurement and Construction (EPC) Contract**

राष्ट्रीय राजमार्ग एवं अवसंरचना विकास निगम लिमिटेड

National Highways & Infrastructure Development Corporation Limited

**FEB, 2021**

# Contents

**Overview of the Framework** 1

**PART I**

**Preliminary**

**Recitals** 9

**1 DEFINITIONS AND INTERPRETATION** **3**

1.1 Definitions 3

1.2 Interpretation 3

1.3 Measurements and Arithmetic Conventions 5

1.4 Priority of Agreements and Errors/Discrepancies 5

1.5 Joint and Several Liability 6

**PART II**

**Scope of the Project**

**2 SCOPE OF THE PROJECT** **7**

2.1 Scope of the Project 7

**3 OBLIGATIONS OF THE CONTRACTOR** **8**

3.1 Obligations of the Contractor 8

3.2 Obligations Relating to Sub-contracts and any other Agreements 9

3.3 Employment of Foreign Nationals 10

3.4 Contractor's Personnel 10

3.5 Advertisement on Project Highway 10

3.6 Contractor's Care of the Works 11

3.7 Electricity, Water and other Services 11

3.8 Unforeseeable Difficulties 11

**4 OBLIGATIONS OF THE AUTHORITY** **12**

4.1 Obligations of the Authority 12

4.2 Maintenance Obligations Prior to the Appointed Date 13

4.3 Environmental Clearances 13

**5 REPRESENTATIONS AND WARRANTIES** **14**

5.1 Representations and Warranties of the Contractor 14

5.2 Representations and Warranties of the Authority 15

5.3 Disclosure 16

**6 DISCLAIMER** **17**

6.1 Disclaimer 17

**PART III**

**Construction and Maintenance**

**7 PERFORMANCE SECURITY 18**
7.1 Performance Security 18
7.2 Extension of Performance Security 18
7.3 Appropriation of Performance Security 18
7.4 Release of Performance Security 19
7.5 Retention Money 19

**8 RIGHT OF WAY 21**
8.1 The Site 21
8.2 Procurement of the Site 21
8.3 Damages for Delay in Handing Over the Site 22
8.4 Site to be Free from Encumbrances 23
8.5 Protection of Site from Encroachments 23
8.6 Special/Temporary Right of Way 23
8.7 Access to the Authority and the Authority's Engineer 23
8.8 Geological and Archaeological Finds 24

**9 UTILITIES AND TREES 25**
9.1 Existing Utilities and Roads 25
9.2 Shifting of Obstructing Utilities 25
9.3 New Utilities 25
9.4 Felling of Trees 26

**10 DESIGN AND CONSTRUCTION OF THE PROJECT HIGHWAY 27**
10.1 Obligations prior to Commencement of Works 27
10.2 Design and Drawings 28
10.3 Construction of the Project Highway 30
10.4 Maintenance during Construction Period 31
10.5 Extension of Time for Completion 32
10.6 Incomplete Works 33
10.7 Maintenance Manual 33

**11 QUALITY ASSURANCE, MONITORING AND SUPERVISION 34**
11.1 Quality of Materials and workmanship 34
11.2 Quality Control System 34
11.3 Methodology 34
11.4 Inspection and Technical Audit by the Authority 35
11.5 External TECHNICAL audit 35
11.6 Inspection of Construction Records 35
11.7 Monthly Progress Reports 35
11.8 Inspection 35
11.9 Samples 36
11.10 Tests 36
11.11 Examination of Work before Covering Up 36
11.12 Rejection 36

11.13 Remedial Work 37
11.14 Delays during Construction 37
11.15 Quality Control Records and Documents 37
11.16 Video Recording 37
11.17 Suspension of Unsafe Construction Works 38

**12 COMPLETION CERTIFICATE 39**
12.1 Tests on Completion 39
12.2 Provisional Certificate 39
12.3 Completion of Remaining Works 40
12.4 Completion Certificate 40
12.5 Rescheduling of Tests 41

**13 CHANGE OF SCOPE 42**
13.1 Change of Scope 42
13.2 Procedure for Change of Scope 42
13.3 Payment for Change of Scope 43
13.4 Restrictions on Change of Scope 44
13.5 Power of the Authority to Undertake Works 44

**14 MAINTENANCE 45**
14.1 Maintenance Obligations of the Contractor 45
14.2 Maintenance Requirements 46
14.3 Maintenance Programme 46
14.4 Safety, Vehicle Breakdowns and Accidents 46
14.5 Lane Closure 46
14.6 Reduction of Payment for non-performance of Maintenance Obligations 47
14.7 Authority's Right to Take Remedial Measures 47
14.8 Restoration of Loss or Damage to Project Highway 47
14.9 Overriding Powers of the Authority 47

**15 SUPERVISION AND MONITORING DURING MAINTENANCE 49**
15.1 Inspection by the Contractor 49
15.2 Inspection and Payments 49
15.3 Tests 49
15.4 Reports of Unusual Occurrence 50

**16 TRAFFIC REGULATION 51**
16.1 TrafficRegulation by the Contractor 51

**17 DEFECTS LIABILITY 52**
17.1 Defects Liability Period 52
17.2 Remedying Defects 52
17.3 Cost of Remedying Defects 52
17.4 Contractor's Failure to Rectify Defects 52
17.5 Contractor to Search Cause 53

17.6 Extension of Defects Liability Period 53

**18 AUTHORITY'S ENGINEER 54**

18.1 Appointment of the Authority's Engineer 54
18.2 Duties and Authority of the Authority's Engineer 54
18.3 Delegation by the Authority's Engineer 54
18.4 Instructions of the Authority's Engineer 55
18.5 Determination by the Authority's Engineer 55
18.6 Remuneration of the Authority's Engineer 55
18.7 Termination of the Authority's Engineer 56

**PART IV**

**Financial Covenants**

**19 PAYMENTS 57**

19.1 Contract Price 57
19.2 Advance Payment 57
19.3 Procedure for Estimating the Payment for the Works 58
19.4 Stage Payment Statement for Works 59
19.5 Stage Payment for Works 59
19.6 Monthly Maintenance Statement of the Project Highway 60
19.7 Payment for Maintenance of the Project Highway 60
19.8 Payment of Damages 60
19.9 Time of Payment and Interest 61
19.10. Price Adjustment for the Works 61
19.11 Restrictions on Price Adjustment 64
19.12. Price Adjustment for Maintenance of Project Highway 64
19.13 Final Payment Statement 64
19.14 Discharge 65
19.15 Final Payment Certificate 65
19.16 Final Payment Statement for Maintenance 65
19.17 Change in Law 66
19.18 Correction of Interim Payment Certificates 66
19.19 Authority's Claims 66
19.20 Bonus for Early Completion 66

**20 INSURANCE 67**

20.1 Insurance for Works and Maintenance 67
20.2 Notice to the Authority 68
20.3 Evidence of Insurance Cover 68
20.4 Remedy for Failure to Insure 68
20.5 Waiver of Subrogation 68
20.6 Contractor's Waiver 69
20.7 Cross Liabilities 69
20.8 Accident or Injury to Workmen 69
20.9 Insurance Against Accident to Workmen 69

20.10 Application of Insurance Proceeds 69
20.11 Compliance with Policy Conditions 70

**Part V**
**Force Majeure and Termination**

**21 FORCE MAJEURE 71**
21.1 Force Majeure 71
21.2 Non-Political Event 71
21.3 Indirect Political Event 71
21.4 Political Event 72
21.5 Duty to Report Force Majeure Event 72
21.6 Effect of Force Majeure Event on the Agreement 73
21.7 Termination Notice for Force Majeure Event 74
21.8 Termination Payment for Force Majeure Event 74
21.9 Dispute Resolution 74
21.10 Excuse from Performance of Obligations 75

**22 SUSPENSION OF CONTRACTOR'S RIGHTS 76**
22.1 Suspension upon Contractor Default 76
22.2 Authority to Act on Behalf of the Contractor 76
22.3 Revocation of Suspension 76
22.4 Termination 76

**23 TERMINATION 77**
23.1 Termination for Contractor Default 77
23.2 Termination for Authority Default 79
23.3 Termination for Authority's convenience 79
23.4 Requirements after Termination 80
23.5 Valuation of Unpaid Works 80
23.6 Termination Payment 80
23.7 Other Rights and Obligations of the Parties 81
23.8 Survival of Rights 82

**PART VI**
**Other Provisions**

**24 ASSIGNMENT AND CHARGES 83**
24.1 Restrictions on Assignment and Charges 83
24.2 Hypothecation of Materials or Plant 83

**25 LIABILITY AND INDEMNITY 84**
25.1 General Indemnity 84
25.2 Indemnity by the Contractor 84
25.3 Notice and Contest of Claims 85
25.4 Defence of Claims 85

25.5 No Consequential Claims 86
25.6 Survival on Termination 86

**26 DISPUTE RESOLUTION 87**
26.1 Dispute Resolution 87
26.2 Conciliation 87
26.3 Arbitration 87
26.4 Adjudication by Regulatory Authority, Tribunal or Commission 88

**27 MISCELLANEOUS 89**
27.1 Governing Law and Jurisdiction 89
27.2 Waiver of Immunity 89
27.3 Delayed Payments 89
27.4 Waiver 89
27.5 Liability for Review of Documents and Drawings 90
27.6 Exclusion of Implied Warranties etc. 90
27.7 Survival 90
27.8 Entire Agreement 91
27.9 Severability 91
27.10 No Partnership 91
27.11 Third Parties 91
27.12 Successors and Assigns 91
27.13 Notices 91
27.14 Language 92
27.15 Counterparts 92
27.16 Confidentiality 92
27.17 Copyright and Intellectual Property Rights 92
27.18 Limitation of Liability 93

**28 DEFINITIONS 94**
28.1 Definitions 94

**Schedules**

**A Site of the Project** 102
1. The Site 102
Annex-I:Site 103
Annex-II: Dates for Providing Right of Way 106
Annex-III: Alignment Plans 107
Annex-IV : Environmental Clearances 110

**B Development of the Project Highway** 111
1. Development of the Project Highway 111
2. [Rehabilitation / treatment and Augmentation] 111
3. Specifications and Standards 111
Annex-I: Description of [Two-Laning and Strengthening] 112

| | | |
|---|---|---|
| **C** | **Project Facilities** | 123 |
| | 1. Project Facilities | 123 |
| | 2. Description of Project Facilities | |
| **D** | **Specifications and Standards** | 124 |
| | 1. Construction | 124 |
| | 2. Design Standards | 124 |
| | Annex-I: Specifications and Standards for Construction | 125 |
| | 1. Specification and Standard | 125 |
| | 2. Deviations from the Specifications and Standard | 125 |
| **E** | **Maintenance Requirements** | 155 |
| | 1. Maintenance Requirements | 155 |
| | 2. Repair/Rectification of Defects and Deficiencies | 155 |
| | 3. Other Defects and Deficiencies | 155 |
| | 4. Extension of Time Limit | 155 |
| | 5. Emergency Repairs/Restoration | 155 |
| | 6. Daily Inspection by the Contractor | 156 |
| | 7. Pre-monsoon Inspection/Post-monsoon Inspection | 156 |
| | 8. Repairs on Account of Natural Calamities | 156 |
| | Annex-I:Repair/rectification of Defects and Deficiencies | 157 |
| **F** | **Applicable Permits** | 160 |
| | 1. Applicable Permits | 160 |
| **G** | Annex-I: Form of Guarantee for Performance Security | 161 |
| | Annex-II: Form of Guarantee for Withdrawal of Retention Money | 164 |
| | Annex-III:Form of Guarantee for Advance Payment | 167 |
| **H** | **Contract Price Weightages** | 170 |
| **I** | **Drawings** | 174 |
| | 1. Drawings | 174 |
| | 2. Additional Drawings | 174 |
| | Annex-I: List of Drawings | 175 |
| **J** | **Project Completion Schedule** | 176 |
| | 1. Project Completion Schedule | 176 |
| | 2. Project Milestone-I | 176 |
| | 3. Project Milestone-II | 176 |
| | 4. Project Milestone-III | 176 |
| | 5. Scheduled Completion Date | 176 |
| | 6. Extension of Time | 176 |

**K** **Tests on Completion** 177
1. Schedule for Tests 177
2. Tests 177
3. Agency for Conducting Tests 177
4. Completion Certificate 177

**L** **Provisional/ Completion Certificate** 178-179

**M** **Payment reduction for non-compliance** 180
1. Payment Reduction for Non-compliance with theMaintenance Requirements 180
2. Percentage Reductions in Lump Sum Payments 180

**N** **Selection of Authority's Engineer** 181
1. Selection of Authority's Engineer 181
2. Terms of Reference 181
3. Appointment of Government Entity as Authority's Engineer 181
Annex-I: Terms of Reference for Authority's Engineer 182

**O** **Forms ofPaymentStatements** 189
1. Stage Payment Statement for Works 189
2. Monthly Maintenance Payment Statement 189
3. Contractor's Claim for Damages 189

**P** **Insurance** 190
1. Insurance during Construction Period 190
2. Insurance for Contractor's Defects Liability 190
3. Insurance Against Injury to Persons and Damage to Property 190
4. Insurance to be in Joint Names 190

# Schedules

SCHEDULE - A

*(See Clauses 2.1 and 8.1)*

# SITE OF THE PROJECT

## 1 The Site

1.1 Site "Rehabilitation /Treatment of Landslide & Sinking Zone Locations with Slope Protection works and Drainage improvement at Kameda to Devlibagad-2 (Km 384.680 to 411.530) of NH-07 in Chamoli District in the state of Uttarakhand through an Engineering Procurement and construction (EPC) Contract" Project shall include existing status of the land, buildings, structures and road works as described in Annex-I of this Schedule-A.

1.2 The dates of handing over the Right of Way to the Contractor are specified in Annex-II of this Schedule-A.

1.3 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 8.2.1 of this Agreement.

1.4 The alignment plans of the Project sites are specified in Appendix-B1, where the restoration / rehabilitation / treatment work of landslide and Sinking zone is contemplated.

1.5 The status of the environment clearances obtained or awaited is given in Annexure IV.

1.6 The subject project is excluding of highway construction work. All the works are exclusive of carriage way, shoulder and drain, which is a part of existing highway contract.

Annex - I
*(Schedule-A)*

# SITE

**1.** The Site for the Project comprises the section of National Highway-07 for Rehabilitation /Treatment of Landslide & Sinking Zone Locations with Slope Protection works and Drainage improvement at Kameda (Km 384.680 to 384.880) to Devlibagad-2 (Km 411.490 to 411.530) of NH-07 in Chamoli District in the state of Uttarakhand through an Engineering Procurement and construction (EPC) Contract. The land, carriageway and structures comprising the site are described below:

## 2. Land

The Site of the Project comprises the land described below. The project work is exclusive of highway construction project.

| S.No | Name of Landslide | Chainage (Km) | | Total length (m ) | Remarks |
|---|---|---|---|---|---|
| | | From | To | | |
| 1-S | Kameda-1 | 384.680 | 384.880 | 200 | |
| 2-S | Kameda-2 | 385.500 | 385.640 | 140 | |
| 3-L | Gauchar | 387.190 | 387.260 | 70 | |
| 4-L | Dharinagar | 392.450 | 392.500 | 50 | |
| 5-B | BRO Dett Bridge | 394.800 | 394.830 | 30 | |
| 6-L | Karnprayag-1 | 400.450 | 400.600 | 150 | |
| 7-L | Karnprayag-2 | 400.750 | 400.850 | 100 | |
| 8-L | Langasu | 406.310 | 406.330 | 20 | |
| 9-L | Devlibagad-1 | 411.380 | 411.440 | 60 | |
| 10-L | Devlibagad-2 | 411.490 | 411.530 | 40 | |

## 3. Carriageway

The present carriageway of the Project is being developed by other agencies and not part of this project.

## 4. Culverts

The Site has the following culverts:NA

| Sl. No. | Name of Landslide | Chainage (km) | Type of Culvert | Span /Opening with span length (m) | Width (m) |
|---|---|---|---|---|---|
| 1 | NA | | | | |

## 5. Road side drains:- NIL

Road side drains being executed by other agencies under highway contract

| S. No. | Name of Landslide | Location | | Side of Road | Type | |
|---|---|---|---|---|---|---|
| | | From km | to km | | Masonry/cc (Pucca) | Earthen( Kutcha) |
| 1 | NA | | | | | |

## 6. Railway Lines

Not Applicable

**(Annexure-I to Schedule-A)**

(i) Electrical utilities

The site includes the following electrical utilities:

(a) Extra High Tension Lines (EHT Lines)*

NIL

(b) High Tension/Low Tension Lines (H/LT Lines) *

NIL

(c) Public Health utilities (Water/ Sewage Pipe lines) *

NIL

(iii) Any other line

NIL

(* This is illustrative and may change as per feature of existing utilities)

Annex - II

*(Schedule-A)*

## DATES FOR PROVIDING RIGHT OF WAY

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

| S. No. | Name of Landslide | Location | | Length (m) | Slaight height | Date of providing ROW* |
|---|---|---|---|---|---|---|
| | | From km | to km | | | |
| 1-S | Kameda-1 | 384.680 | 384.880 | 200 | 30 | On appointed date |
| 2-S | Kameda-2 | 385.500 | 385.640 | 140 | 62 | On appointed date |
| 3-L | Gauchar | 387.190 | 387.260 | 70 | 75 | On appointed date |
| 4-L | Dharinagar | 392.450 | 392.500 | 50 | 28 | On appointed date |
| 5-B | BRO Dett Bridge | 394.800 | 394.830 | 30 | .. | On appointed date |
| 6-L | Karnprayag-1 | 400.450 | 400.600 | 150 | 63 | On appointed date |
| 7-L | Karnprayag-2 | 400.750 | 400.850 | 100 | 68 | On appointed date |
| 8-L | Langasu | 406.310 | 406.330 | 20 | 15 | On appointed date |
| 9-L | Devlibagad-1 | 411.380 | 411.440 | 60 | 55 | On appointed date |
| 10-L | Devlibagad-2 | 411.490 | 411.530 | 40 | 62 | On appointed date |

Annex - IV
*(Schedule-A)*

# ENVIRONMENT CLEARANCES

The environment clearances for this work are not required as per MOEF gazette notification No. S.O.2559 (E dated 22.08.2013).

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SCHEDULE - B

*(See Clause 2.1)*

# DEVELOPMENT OF THE PROJECT HIGHWAY

Development of the Project Highway is not part of this project.

## 1 Development of the Project

Development of the project shall include design and construction of the Rehabilitation/Treatment of landslide and sinking zones at 10 locations as specified in Annexure-I of schedule-B.

## 2 Rehabilitation / treatment / Restoration and augmentation

Rehabilitation / treatment and augmentation shall including, hill slope with proper drainage works as described in schedule-B.

## 3 Specifications and Standards

The Project Rehabilitation/Treatment of Landslide conformity with the specification and standards specified in Annexure-I of schedule-D.

Annex - I
*(Schedule-B)*

# DESCRIPTION OF THE PROEJCT

## 1 Widening of the existing highway

NA

## 2.0 Geometric design and general features

**2.1** The alignment of project work shall follow the proposed alignment of the project work

## 2.2 Alignment of Protection work

The alignment plan of the project shall be in accordance with Appendix-B1 of this schedule.

**2.3.1** For the purpose of setting out coordinates of the proposed center line of the project shall be as per Appendix-B2.

### 2.3.2 Features of Landslide and Sinking Zone works

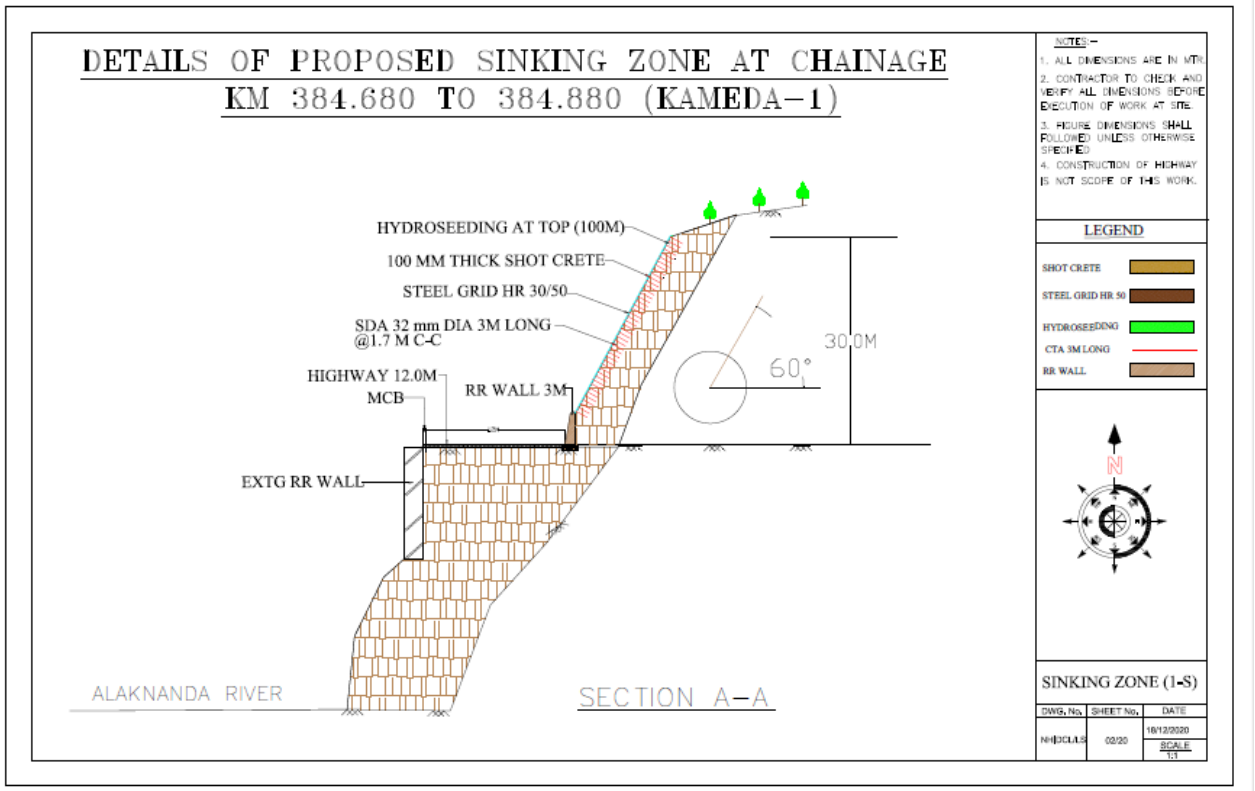
Protection work shall be provided for the following stretch:-

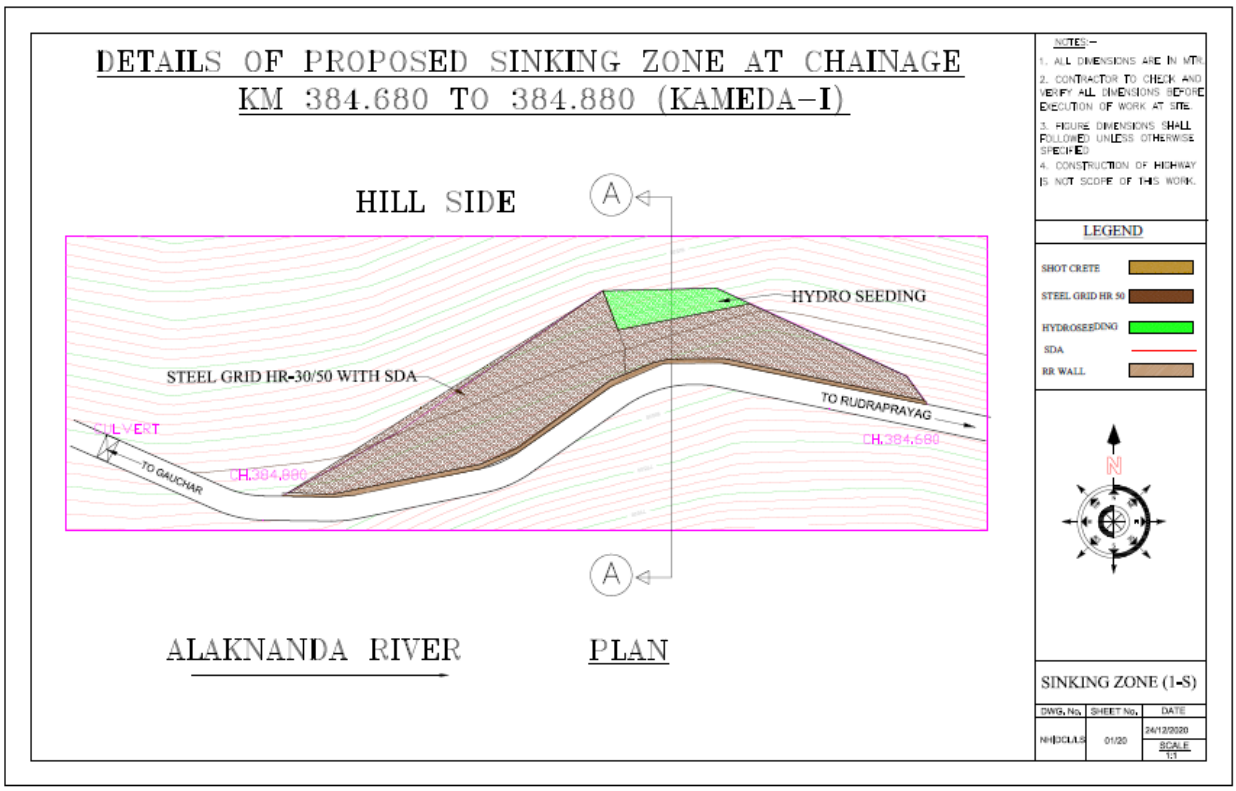
stretches of the Site are stated below:

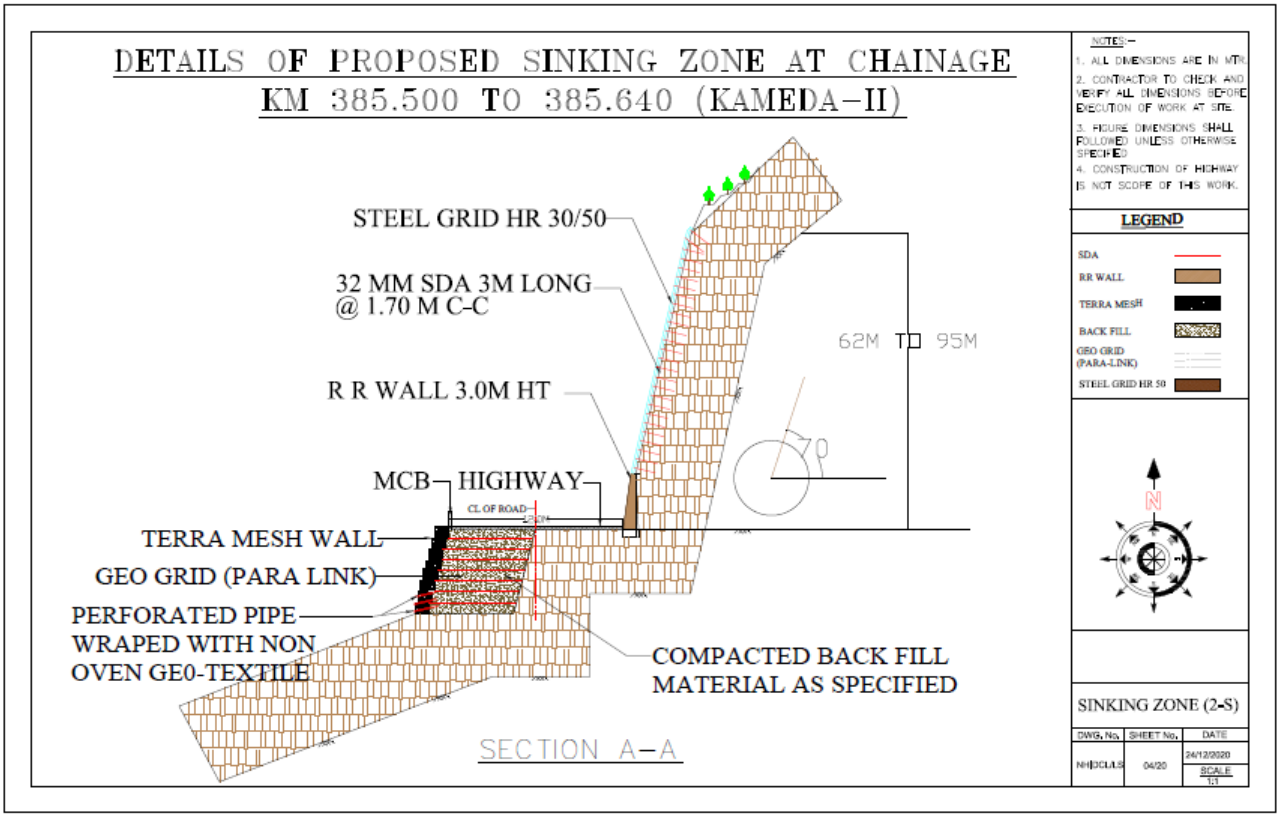
| S. No. | Name of Landslide | Location | | Length (m) |
|---|---|---|---|---|
| | | From km | To km | |
| 1-S | Kameda-1 | 384.680 | 384.880 | 200 |
| 2-S | Kameda-2 | 385.500 | 385.640 | 140 |
| 3-L | Gauchar | 387.190 | 387.260 | 70 |
| 4-L | Dharinagar | 392.450 | 392.500 | 50 |
| 5-B | BRO Dett Bridge | 394.800 | 394.830 | 30 |
| 6-L | Karnprayag-1 | 400.450 | 400.600 | 150 |
| 7-L | Karnprayag-2 | 400.750 | 400.850 | 100 |
| 8-L | Langasu | 406.310 | 406.330 | 20 |
| 9-L | Devlibagad-1 | 411.380 | 411.440 | 60 |
| 10-L | Devlibagad-2 | 411.490 | 411.530 | 40 |

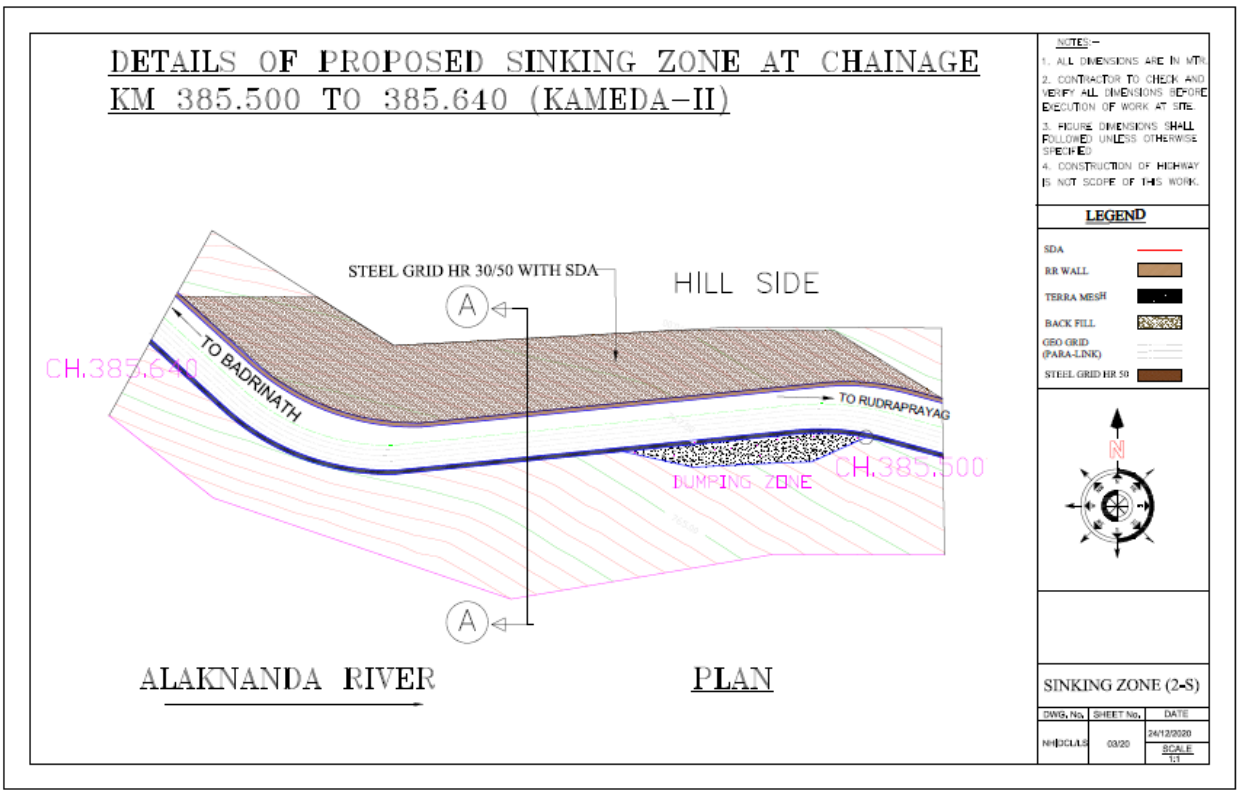
## 2.4 Typical Cross-sections of Treatment area

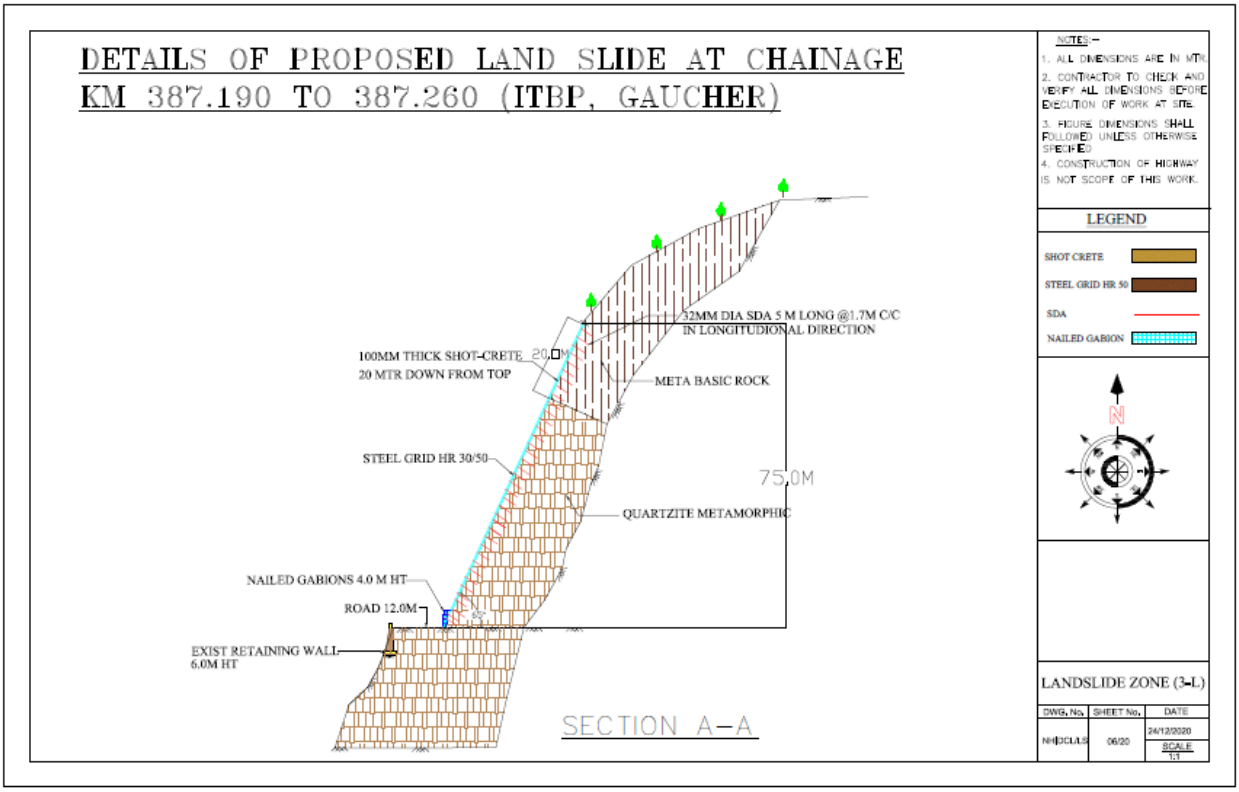
The typical cross sections for each landslide treatment and Sinking zone treatment is given include Appendix-B1.

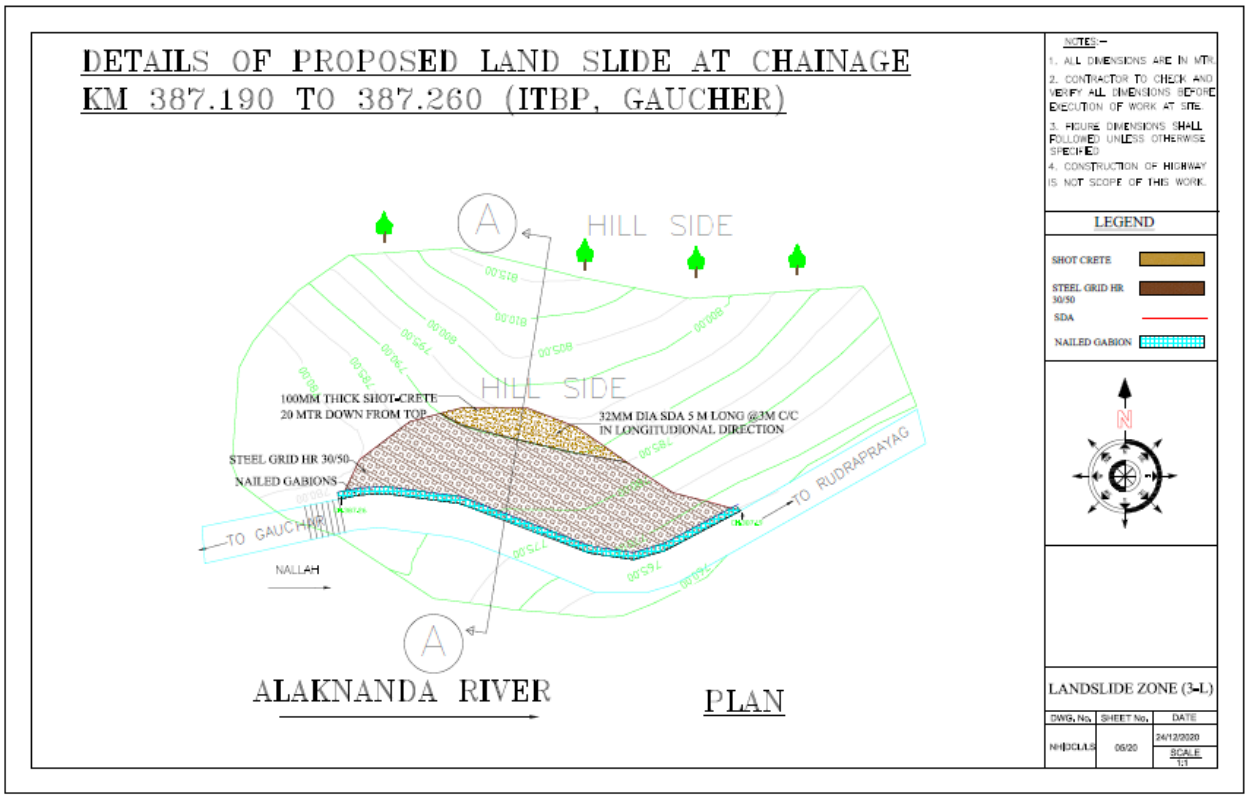


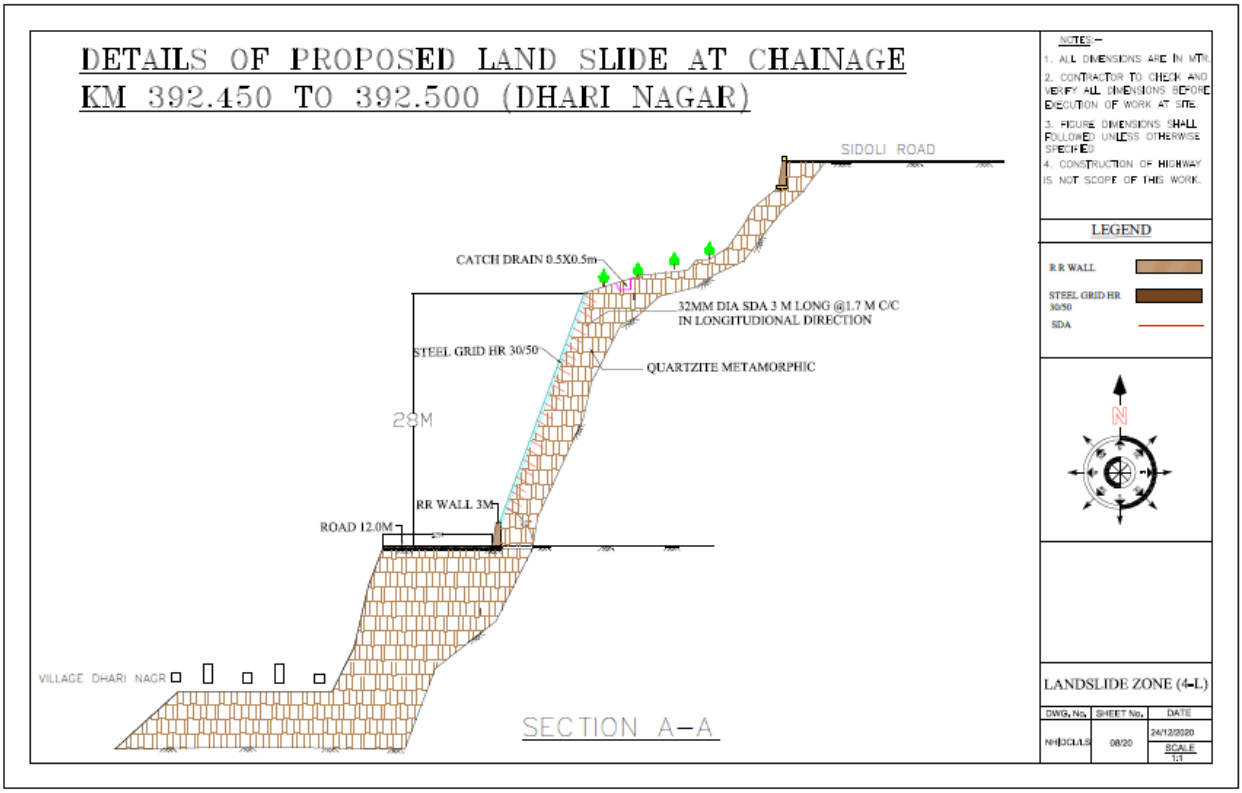



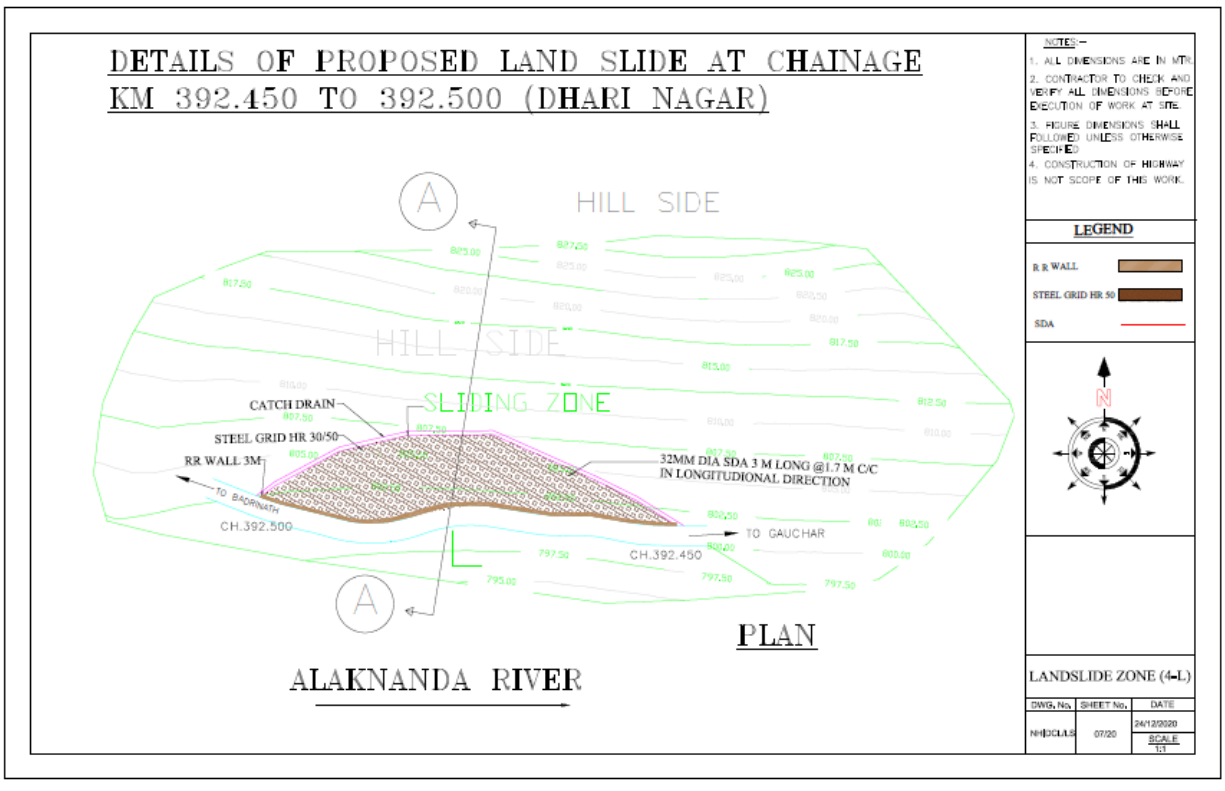

DETAILS OF PROPOSED SINKING ZONE AT CHAINAGE KM 385.500 TO 385.640 (KAMEDA–II)
STEEL GRID HR 30/50
32 MM SDA 3M LONG @ 1.70 M C-C
R R WALL 3.0M HT
62M TO 95M
70
MCB
HIGHWAY
CL OF ROAD
TERRA MESH WALL
GEO GRID (PARA LINK)
PERFORATED PIPE WRAPED WITH NON OVEN GE0-TEXTILE
COMPACTED BACK FILL MATERIAL AS SPECIFIED
SECTION A–A
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
SDA
RR WALL
TERRA MESH
BACK FILL
GEO GRID (PARA-LINK)
STEEL GRID HR 50
N
SINKING ZONE (2-S)
DWG. No.
SHEET No.
04/20
DATE
24/12/2020
SCALE
1:1


DETAILS OF PROPOSED SINKING ZONE AT CHAINAGE KM 385.500 TO 385.640 (KAMEDA–II)
STEEL GRID HR 30/50 WITH SDA
HILL SIDE
A
TO BADRINATH
CH.385.640
TO RUDRAPRAYAG
CH.385.500
DUMPING ZONE
ALAKNANDA RIVER
PLAN
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
SDA
RR WALL
TERRA MESH
BACK FILL
GEO GRID (PARA-LINK)
STEEL GRID HR 50
N
SINKING ZONE (2-S)
DWG. No.
SHEET No.
03/20
DATE
24/12/2020
SCALE
1:1

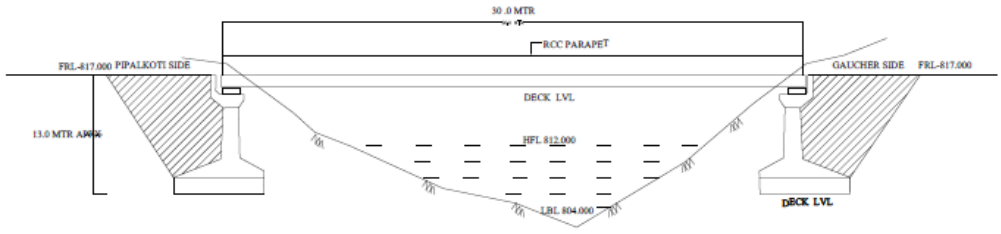

DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 387.190 TO 387.260 (ITBP, GAUCHER)
32MM DIA SDA 5 M LONG @1.7M C/C IN LONGITUDIONAL DIRECTION
100MM THICK SHOT-CRETE 20 MTR DOWN FROM TOP
META BASIC ROCK
STEEL GRID HR 30/50
75.0M
QUARTZITE METAMORPHIC
NAILED GABIONS 4.0 M HT
ROAD 12.0M
EXIST RETAINING WALL 6.0M HT
SECTION A–A
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
SHOT CRETE
STEEL GRID HR 50
SDA
NAILED GABION
N
LANDSLIDE ZONE (3-L)
DWG. No. SHEET No. DATE
NH3CLLS 06/20 24/12/2020
SCALE 1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 387.190 TO 387.260 (ITBP, GAUCHER)
HILL SIDE
HILL SIDE
100MM THICK SHOT-CRETE 20 MTR DOWN FROM TOP
32MM DIA SDA 5 M LONG @3M C/C IN LONGITUDIONAL DIRECTION
STEEL GRID HR 30/50
NAILED GABIONS
TO GAUCHAR
TO RUDRAPRAYAG
NALLAH
ALAKNANDA RIVER
PLAN
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
SHOT CRETE
STEEL GRID HR 30/50
SDA
NAILED GABION
N
LANDSLIDE ZONE (3-L)
DWG. No. SHEET No. DATE
NH3CLLS 06/20 24/12/2020
SCALE 1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 392.450 TO 392.500 (DHARI NAGAR)
SIDOLI ROAD
CATCH DRAIN 0.5X0.5m
32MM DIA SDA 3 M LONG @1.7 M C/C IN LONGITUDIONAL DIRECTION
STEEL GRID HR 30/50
QUARTZITE METAMORPHIC
29M
RR WALL 3M
ROAD 12.0M
VILLAGE DHARI NAGR
SECTION A–A
NOTES–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
R R WALL
STEEL GRID HR 30/50
SDA
N
LANDSLIDE ZONE (4-L)
DWG. No. SHEET No. DATE
NH3DCL/LS 08/20 24/12/2020
SCALE 1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 392.450 TO 392.500 (DHARI NAGAR)
A
HILL SIDE
HILL SIDE
SLIDING ZONE
CATCH DRAIN
STEEL GRID HR 30/50
RR WALL 3M
32MM DIA SDA 3 M LONG @1.7 M C/C IN LONGITUDIONAL DIRECTION
TO BADRINATH
CH.392.500
CH.392.450
TO GAUCHAR
A
PLAN
ALAKNANDA RIVER
NOTES–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
R R WALL
STEEL GRID HR 50
SDA
N
LANDSLIDE ZONE (4-L)
DWG. No. SHEET No. DATE
NH3DCL/LS 07/20 24/12/2020
SCALE 1:1

## DETAILS OF PROPOSED BRIDGE AT CHAINAGE KM 394.800 TO 394.830 (BRO DETT. GAUCHER)




L–SECTION OF 30 MTR MINOR BRIDGE

NOTES –
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
5. MAINTENANCE OF EXISTING CULVERT WILL BE ENSURED BY HIGHWAY CONSTRUCTION AGENCY.

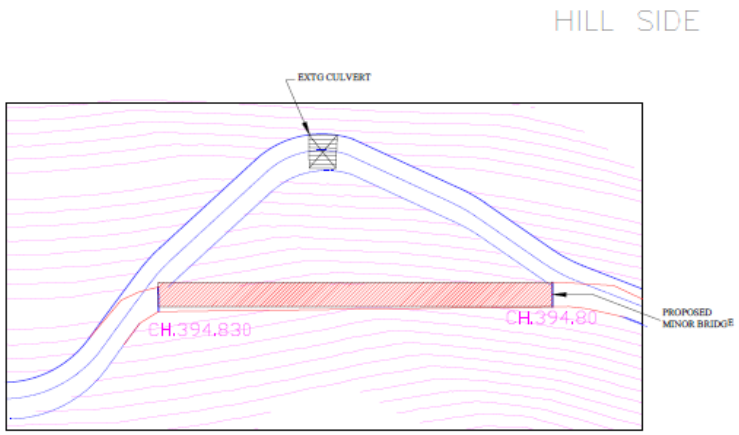
LEGEND

GABION WALL
NALLAH
CULVERT

30 M SPAN BRIDGE(5-B)

| DWG. No. | SHEET No. | DATE |
|---|---|---|
| NHIDCL/LS | 10/20 | 24/12/2020 |
| | | SCALE 1:1 |

## DETAILS OF PROPOSED BRIDGE AT CHAINAGE KM 394.800 TO 394.830 (BRO DETT. GAUCHER)




PLAN

ALAKNANDA RIVER

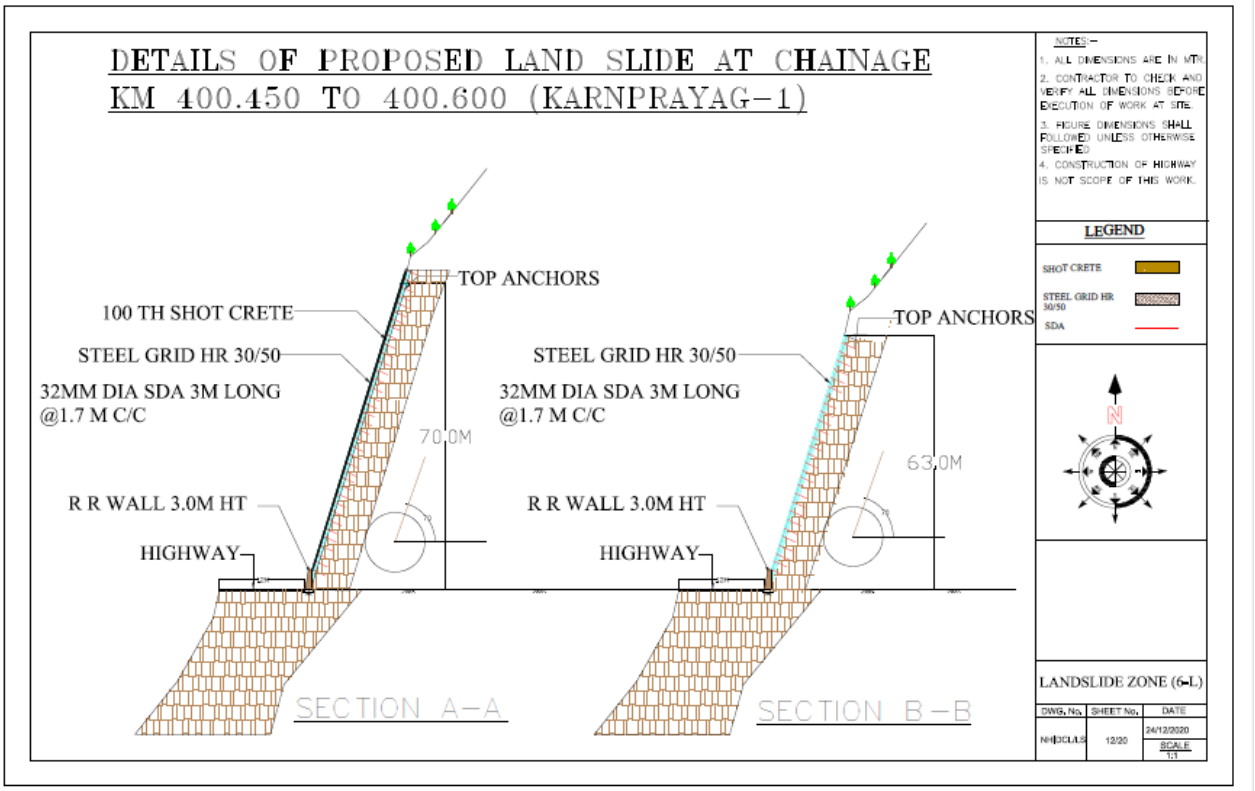
NOTES –
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
5. MAINTENANCE OF EXISTING CULVERT WILL BE ENSURED BY HIGHWAY CONSTRUCTION AGENCY.

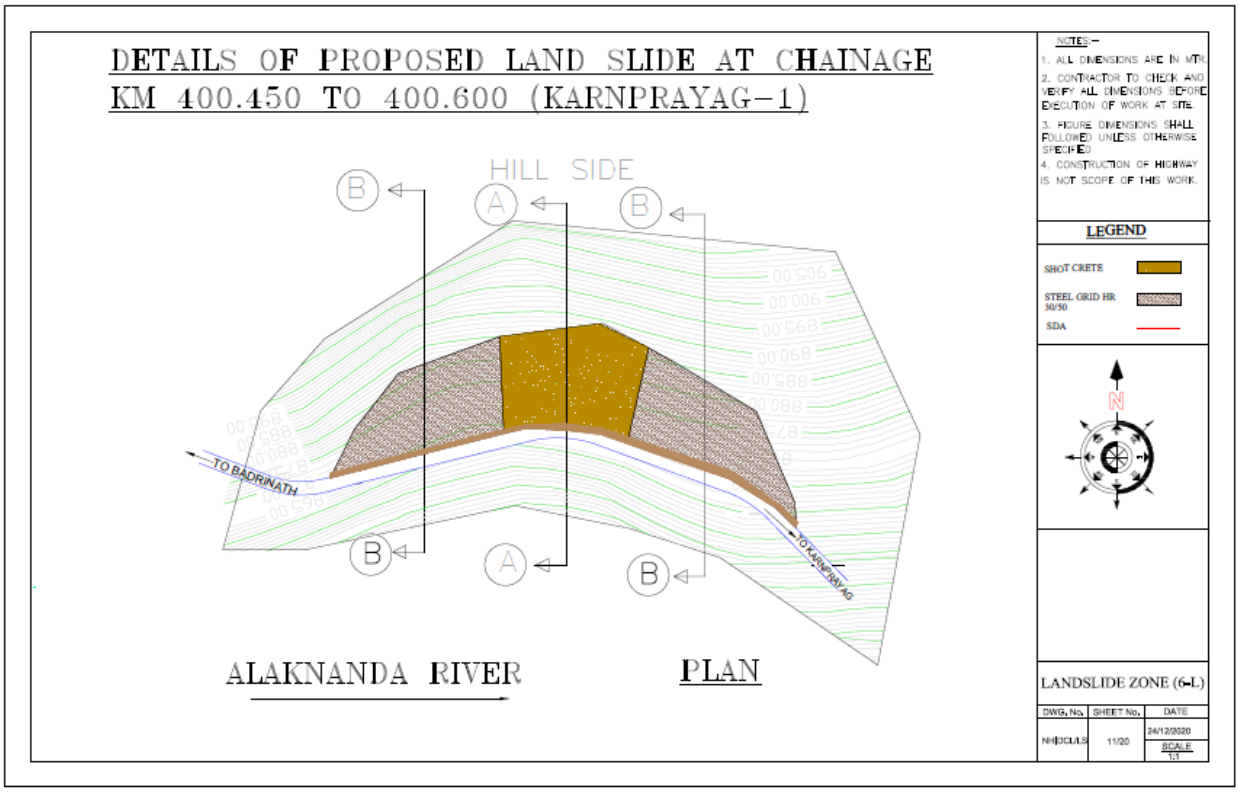
LEGEND

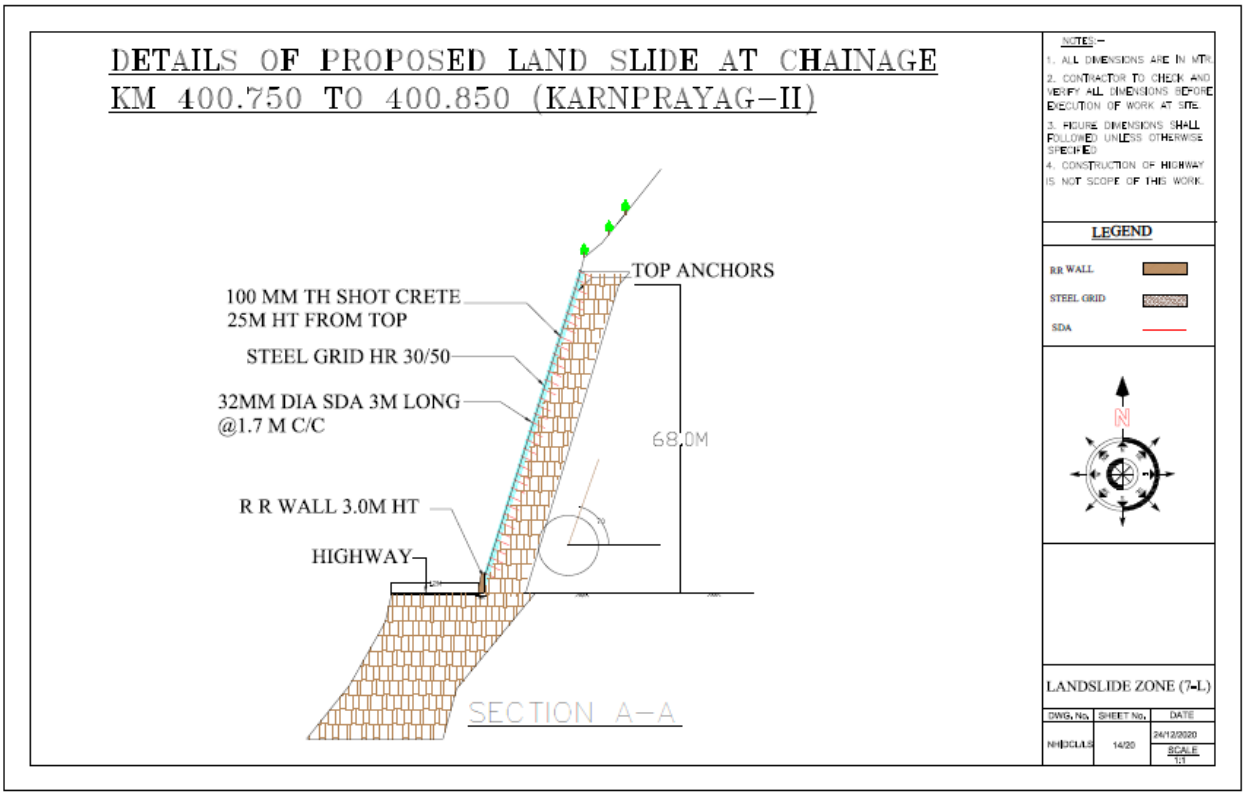
GABION WALL
NALLAH
CULVERT

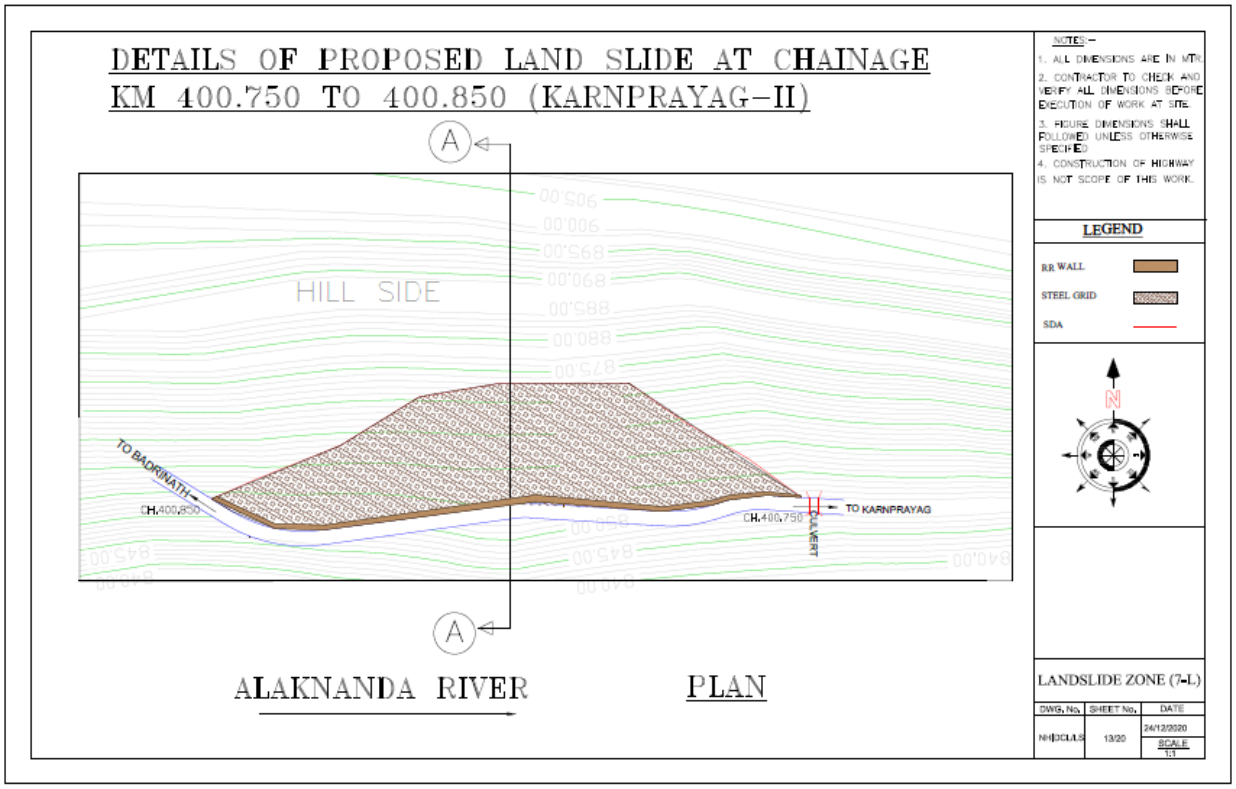
30 M SPAN BRIDGE(5-B)

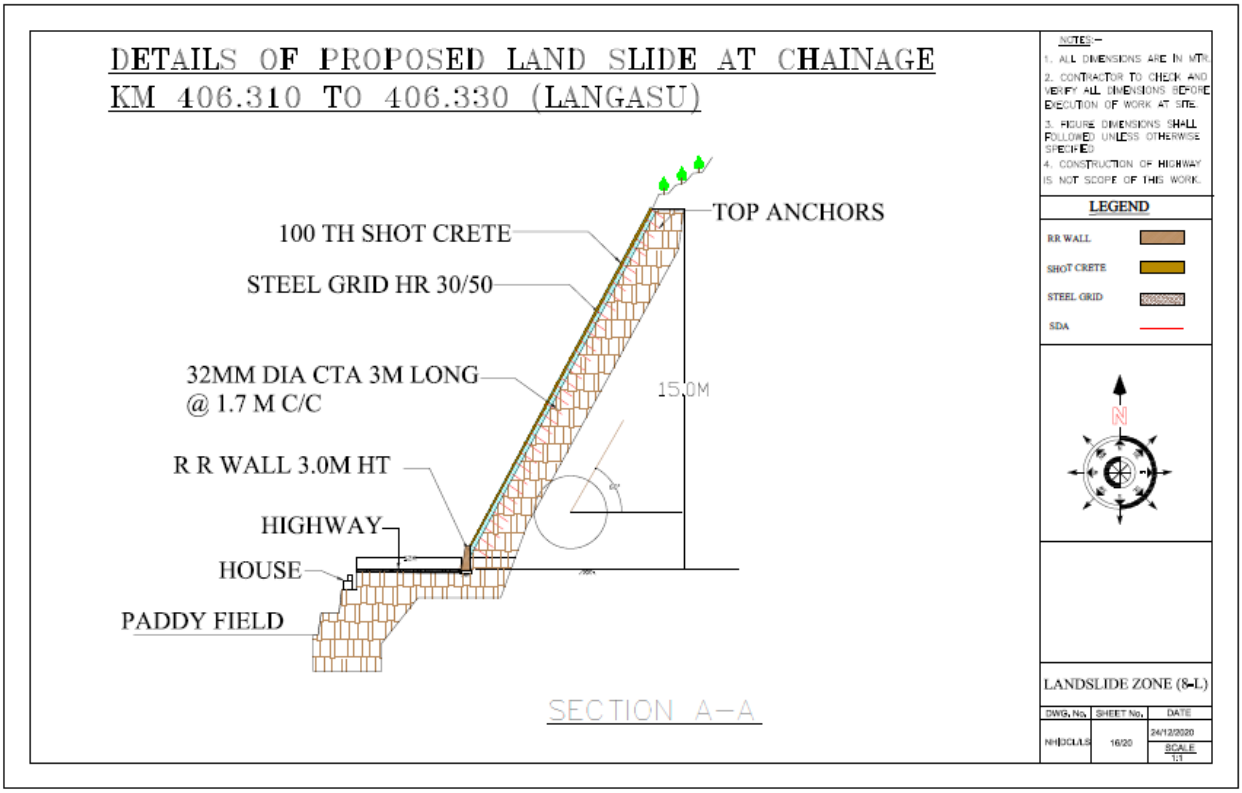
| DWG. No. | SHEET No. | DATE |
|---|---|---|
| NHIDCL/LS | 09/20 | 24/12/2020 |
| | | SCALE 1:1 |

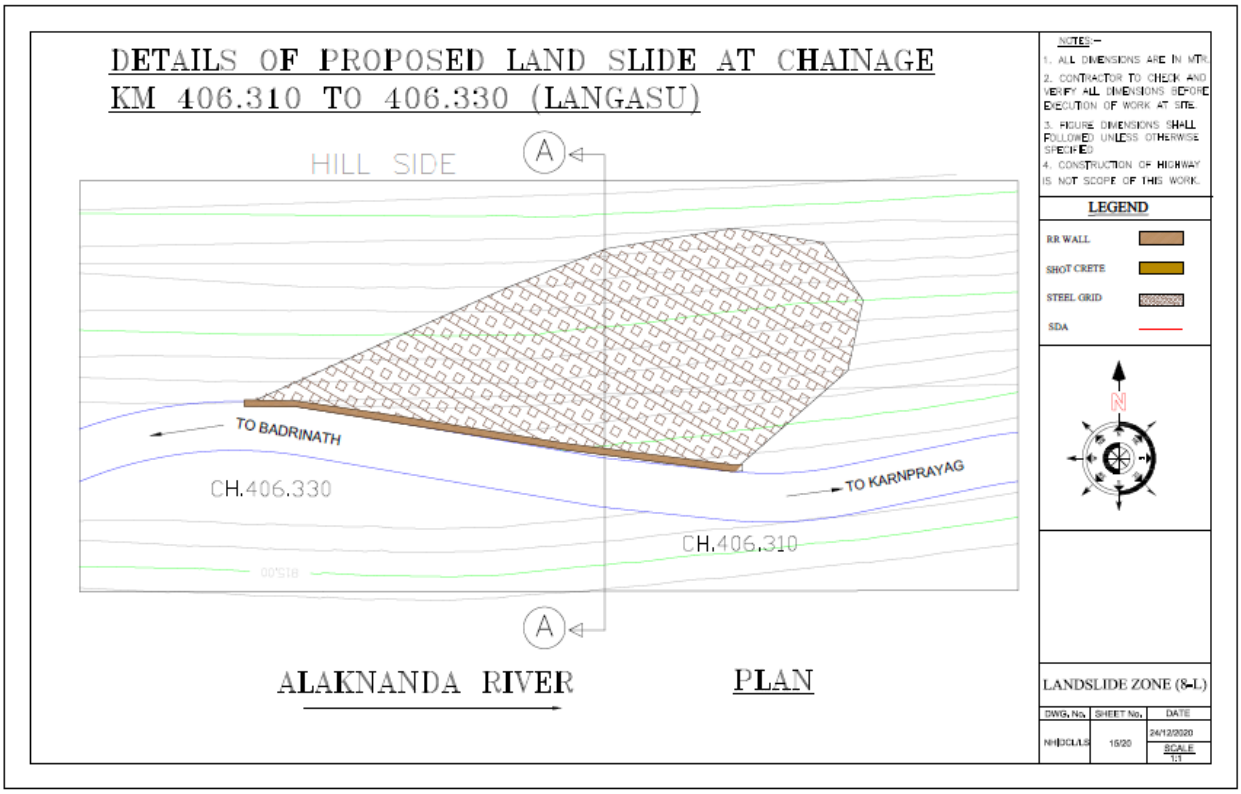

DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE
KM 400.450 TO 400.600 (KARNPRAYAG-1)
TOP ANCHORS
100 TH SHOT CRETE
STEEL GRID HR 30/50
32MM DIA SDA 3M LONG
@1.7 M C/C
70.0M
R R WALL 3.0M HT
HIGHWAY
SECTION A-A
TOP ANCHORS
STEEL GRID HR 30/50
32MM DIA SDA 3M LONG
@1.7 M C/C
63.0M
R R WALL 3.0M HT
HIGHWAY
SECTION B-B
NOTES:-
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
SHOT CRETE
STEEL GRID HR 30/50
SDA
N
LANDSLIDE ZONE (6-L)
DWG. No.
SHEET No.
DATE
NH3DCLILS
12/20
24/12/2020
SCALE
1:1

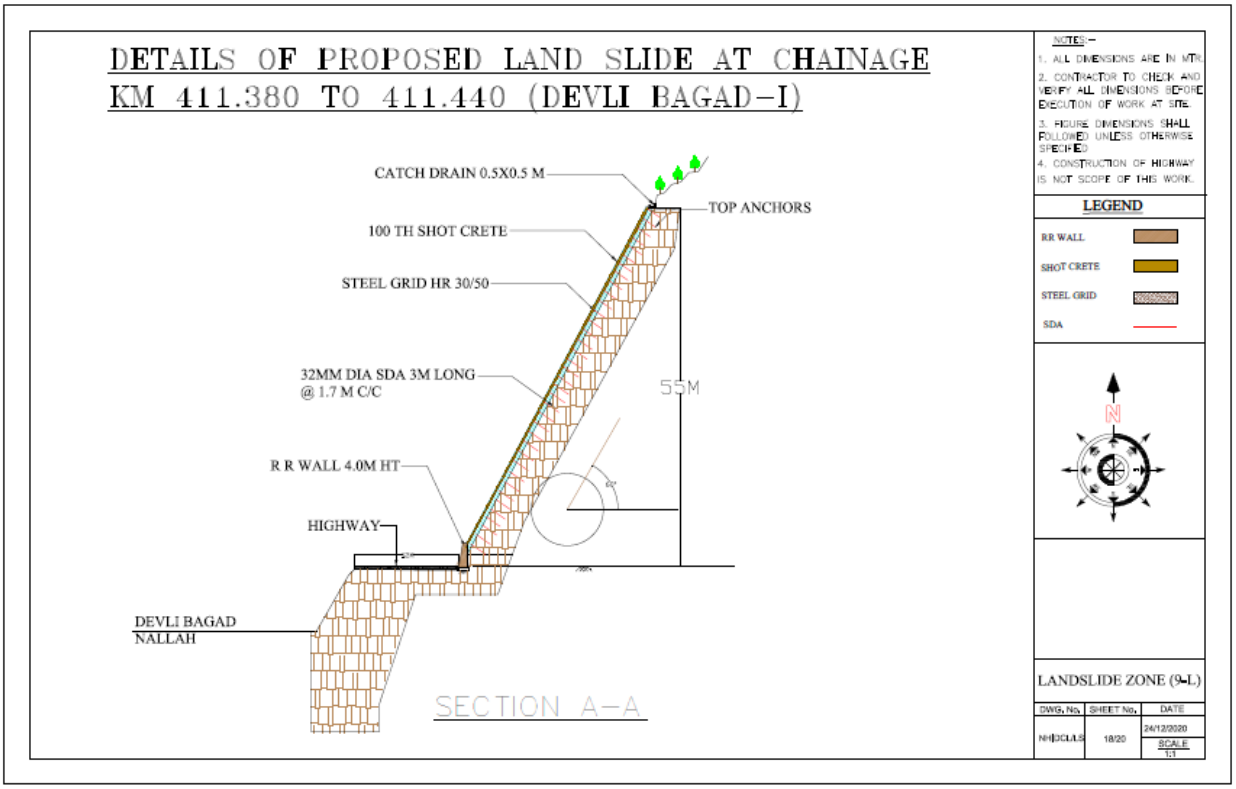

DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE
KM 400.450 TO 400.600 (KARNPRAYAG-1)
HILL SIDE
B
A
B
TO BADRINATH
TO KARNPRAYAG
B
A
B
ALAKNANDA RIVER
PLAN
NOTES:-
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
SHOT CRETE
STEEL GRID HR 30/50
SDA
N
LANDSLIDE ZONE (6-L)
DWG. No.
SHEET No.
DATE
NH3DCLILS
11/20
24/12/2020
SCALE
1:1

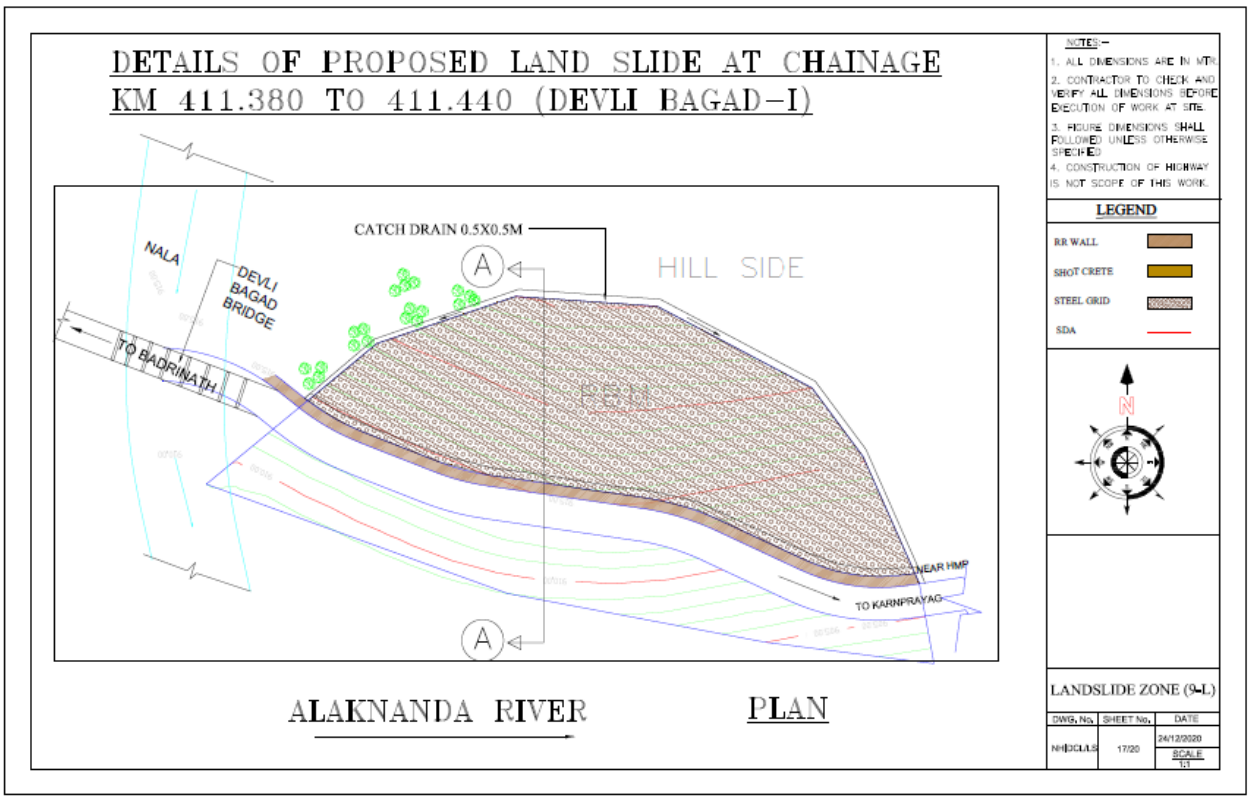

DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 400.750 TO 400.850 (KARNPRAYAG–II)
TOP ANCHORS
100 MM TH SHOT CRETE 25M HT FROM TOP
STEEL GRID HR 30/50
32MM DIA SDA 3M LONG @1.7 M C/C
68.0M
R R WALL 3.0M HT
HIGHWAY
SECTION A–A
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
STEEL GRID
SDA
N
LANDSLIDE ZONE (7-L)
DWG. No.
SHEET No.
DATE
NHIDCL/LS
14/20
24/12/2020
SCALE
1:1

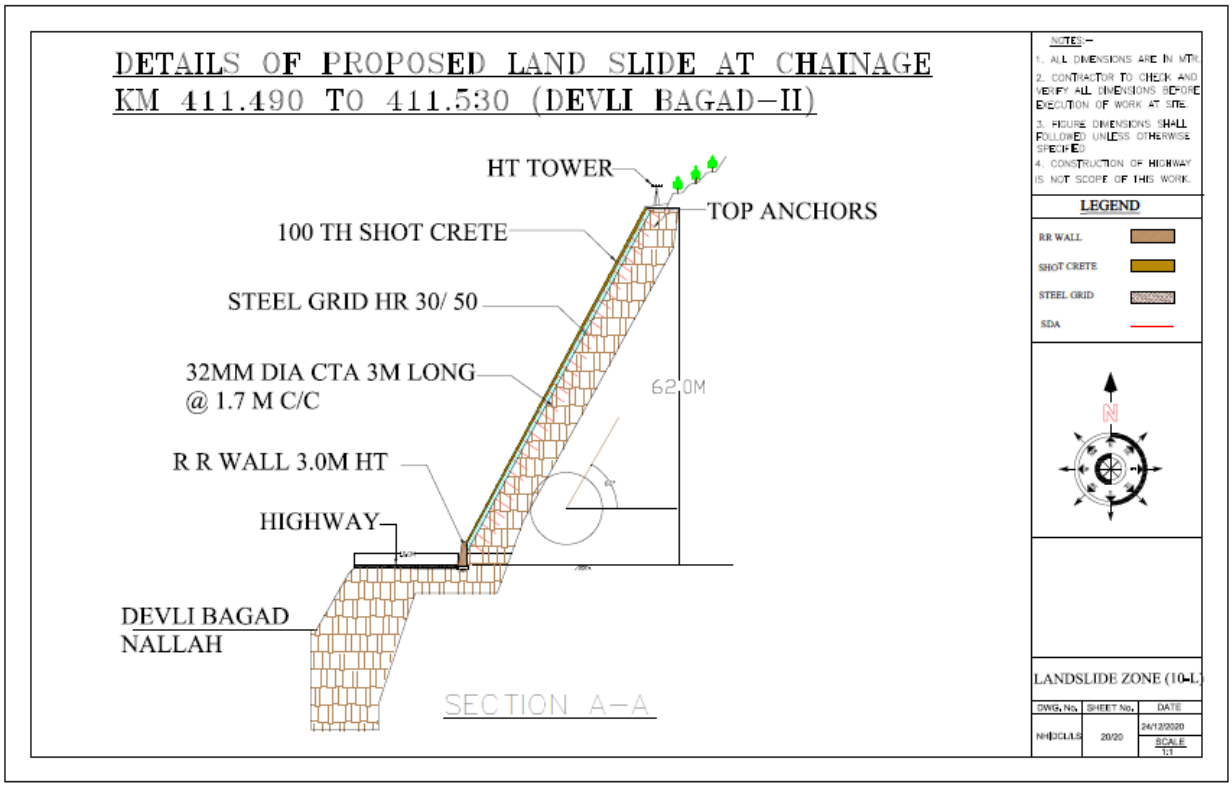

DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 400.750 TO 400.850 (KARNPRAYAG–II)
A
HILL SIDE
TO BADRINATH
CH.400.850
CH.400.750
CULVERT
TO KARNPRAYAG
A
ALAKNANDA RIVER
PLAN
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
STEEL GRID
SDA
N
LANDSLIDE ZONE (7-L)
DWG. No.
SHEET No.
DATE
NHIDCL/LS
13/20
24/12/2020
SCALE
1:1

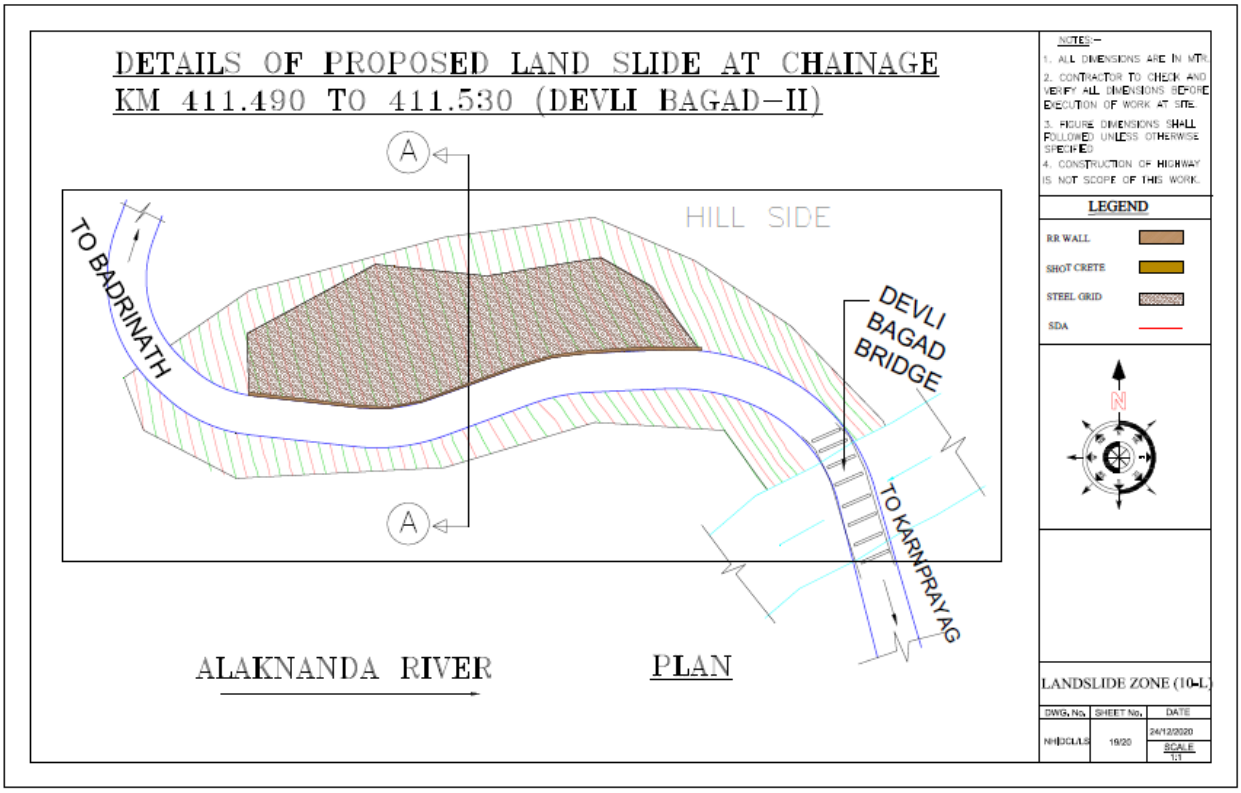

DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 406.310 TO 406.330 (LANGASU)
100 TH SHOT CRETE
STEEL GRID HR 30/50
32MM DIA CTA 3M LONG @ 1.7 M C/C
R R WALL 3.0M HT
HIGHWAY
HOUSE
PADDY FIELD
TOP ANCHORS
15.0M
SECTION A–A
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
SHOT CRETE
STEEL GRID
SDA
N
LANDSLIDE ZONE (8-L)
DWG. No.
SHEET No.
DATE
NH3CLLS
16/20
24/12/2020
SCALE
1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 406.310 TO 406.330 (LANGASU)
HILL SIDE
A
TO BADRINATH
CH.406.330
TO KARNPRAYAG
CH.406.310
A
ALAKNANDA RIVER
PLAN
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
SHOT CRETE
STEEL GRID
SDA
N
LANDSLIDE ZONE (8-L)
DWG. No.
SHEET No.
DATE
NH3CLLS
15/20
24/12/2020
SCALE
1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 411.380 TO 411.440 (DEVLI BAGAD–I)
CATCH DRAIN 0.5X0.5 M
TOP ANCHORS
100 TH SHOT CRETE
STEEL GRID HR 30/50
32MM DIA SDA 3M LONG @ 1.7 M C/C
55M
R R WALL 4.0M HT
HIGHWAY
DEVLI BAGAD NALLAH
SECTION A–A
NOTES –
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
SHOT CRETE
STEEL GRID
SDA
N
LANDSLIDE ZONE (9-L)
DWG. No.
SHEET No.
DATE
NH3CLLS
18/20
24/12/2020
SCALE
1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 411.380 TO 411.440 (DEVLI BAGAD–I)
CATCH DRAIN 0.5X0.5M
A
HILL SIDE
NALA
DEVLI BAGAD BRIDGE
TO BADRINATH
NEAR HMP
TO KARNPRAYAG
ALAKNANDA RIVER
PLAN
NOTES –
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
SHOT CRETE
STEEL GRID
SDA
N
LANDSLIDE ZONE (9-L)
DWG. No.
SHEET No.
DATE
NH3CLLS
17/20
24/12/2020
SCALE
1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 411.490 TO 411.530 (DEVLI BAGAD–II)
HT TOWER
TOP ANCHORS
100 TH SHOT CRETE
STEEL GRID HR 30/ 50
32MM DIA CTA 3M LONG @ 1.7 M C/C
62.0M
R R WALL 3.0M HT
HIGHWAY
DEVLI BAGAD NALLAH
SECTION A–A
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
SHOT CRETE
STEEL GRID
SDA
N
LANDSLIDE ZONE (10-L)
DWG. No.
SHEET No.
DATE
NH(O)CL/LS
20/20
24/12/2020
SCALE
1:1


DETAILS OF PROPOSED LAND SLIDE AT CHAINAGE KM 411.490 TO 411.530 (DEVLI BAGAD–II)
A
A
HILL SIDE
TO BADRINATH
DEVLI BAGAD BRIDGE
TO KARNPRAYAG
ALAKNANDA RIVER
PLAN
NOTES:–
1. ALL DIMENSIONS ARE IN MTR.
2. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK AT SITE.
3. FIGURE DIMENSIONS SHALL FOLLOWED UNLESS OTHERWISE SPECIFIED.
4. CONSTRUCTION OF HIGHWAY IS NOT SCOPE OF THIS WORK.
LEGEND
RR WALL
SHOT CRETE
STEEL GRID
SDA
N
LANDSLIDE ZONE (10-L)
DWG. No.
SHEET No.
DATE
NH(O)CL/LS
19/20
24/12/2020
SCALE
1:1

*General Arrangement of proposed protection work is presented in Appendix-B1. The protection arrangement shown is indicative only. Contractor shall submit detailed design and drawing along with the requisite field investigation and test reports like geophysical investigation, geotechnical investigations, topographic survey, and hydrological survey etc. to Authority Engineer and shall obtain approval for the design before execution. Any change in location shall be subject to approval from Authority Engineer.*

## 2.5 Instrumentation of Monitoring

Following monitoring instruments shall be provided at Landslide protection work

| **Protection work height range** | **Type of Instrument** | |
|---|---|---|
| | **Piezometer** | **Inclinometer** |
| Upto 25 m | 2 nos. | 3 nos. |
| 25 m to 40 m | 2 nos. | 3 nos. |
| 40 m to 60 m | 2 nos. | 6 nos. |

# 3 ROAD EMBANKMENT AND CUT SECTION

3.1 NA

## 3.2 Type of Instrumentation

| **Type of Instrumentation** | | |
|---|---|---|
| **Sl.No.** | **Type of instrument** | **Numbers** |
| 1 | Reflector | **Type: bi-reflex target model**<br>**Measuring Range (m): 12m to 140m** (Maximum measuring distance is highly dependent<br>on atmospheric conditions and EDM Model used)<br>**Manufacturing Accuracy: ± 0.1 mm**<br>**Overall Accuracy: ± 1 mm** (within the measuring section)<br>**The targets must be replaceable without loss of accuracy.** |
| 2 | Strain Gauges | **Standard Type with Accuracy** |
| 3 | Inclinometer | **Type: Vertical In-Place Inclinometer system (with sensors)**<br>**Accuracy: + 0.1% fs** (as tested under lab conditions)<br>**Range (degree): 15 0**<br>**Temperature Limit: -20 0C to 80 0C** |
| 4 | Piezometer | **Type: Vertical In-Place Inclinometer system (with sensors)**<br>**Accuracy: + 0.1% fs** (as tested under lab conditions)<br>**Range (degree): 15 0**<br>**Temperature Limit: -20 0C to 80 0C** |
| 5 | Load Cell | **Type: Vibrating wire type earth pressure cell**<br>**Accuracy: + 0.5% fs normal**<br>**Range (MPa): 0.5MPa -10MPa**<br>**Resolution: 10 kPa ( with read-out unit)**<br>**Operating temperature range: -10 to 70oC**<br>**Compensated temperature range: 0 to 55 oC**<br>**Over Range Limit: 150% of range** (Maximum over pressure without damage) |

# 4 PAVEMENT DESIGN

NA

# 5 ROADSIDE DRAINAGE

NA

# 6 DESIGN OF STRUCTURES

i. Construction of Major bridges

| S.No | Bridge at km | Span Arrangement (m) | Remarks |
|---|---|---|---|
| NIL | | | |

ii. Construction of Minor bridges: Total 1 bridges (Total 30 m)

| Sl.No | Bridge at km | Span Arrangement (m) | Width (m) | Remarks |
|---|---|---|---|---|
| 1. | **Ch. 394.800 to ch. 394.830** | **1 X 30 mtr** | 12 | To bypass slide at Gaucher |

iii. Construction of Viaduct (NA)

| Sl. | Start Chainage | End Chainage | Span Arrangement upto Expansion joint (m) | Type | Remark |
|---|---|---|---|---|---|
| Nil | | | | | |

iv. Widening of Existing bridges

| S.No | Bridge at km | Span Arrangement (m) | Remarks |
|---|---|---|---|
| NIL | | | |

# 7 TRAFFIC CONTROL DEVICES AND ROAD SAFETY WORKS

NA

# 8 ROADSIDE FURNITURE

NA

## 9 HAZARDOUS LOCATIONS

NA

## 10. COMPULSORY AFFORESTATION

**NIL**

## 11. HAZARDOUS LOCATIONS

**NIL**

## 12 SPECIAL REQUIREMENT FOR HILL ROADS

NA

## 13 CHANGE OF SCOPE

The length of proposed restoration / rehabilitation / treatment specified hereinabove shall be treated as minimum requirement. The actual lengths 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.

**NOTE:**

1. The Contractor shall be responsible for accurate assessment/investigations of the site situation and prepare design for slope protection as per specifications and standards stipulated in the Schedule-D of the Agreement on its own cost and submit the same to the Authority's Engineer/Authority for review through Proof Consultant and implement it accordingly.

2. Any increase in quantity over and above the tentative quantity as mentioned in above table or through change in specifications will not be considered as change of scope. Therefore, Contractor shall make through investigations at site on its own cost and assess the requirement of slope protection and slide prone zone and other safety features before submission of bid.

## Annexure-I to Schedule-B1

**Utility Shifting:**

Not required

***Coordiantes of proposed center line of road is given in Appendix-B2.***

| S. No. | Name of Landslide | Location | | Co-ordinate | | | |
|---|---|---|---|---|---|---|---|
| | | From km | To km | Easting From | Northing To | Easting From | Northing To |
| 1-S | Kameda-1 | 384.680 | 384.880 | 30.29059 | 79.11851 | 30.289432 | 79.119038 |
| 2-S | Kameda-2 | 385.500 | 385.640 | 30.2875 | 79.1306 | 30.2850 | 79.1319 |
| 3-L | Gauchar | 387.190 | 387.260 | 30.28870 | 79.1493 | 30.28856 | 79.15026 |
| 4-L | Dharinagar | 392.450 | 392.500 | 30.27426 | 79.16699 | 30.27379 | 79.16726 |
| 5-B | BRO Dett Bridge | 394.800 | 394.830 | 30.267421 | 79.180280 | 30.267571 | 79.180642 |
| 6-L | Karnprayag-1 | 400.450 | 400.600 | 30.2695 | 79.2246 | 30.27057 | 79.22508 |
| 7-L | Karnprayag-2 | 400.750 | 400.850 | 30.17051 | 79.22560 | 30.27182 | 79.2262 |
| 8-L | Langasu | 406.310 | 406.330 | 30.288414 | 79.272835 | 30.288379 | 79.27349 |
| 9-L | Devlibagad-1 | 411.380 | 411.440 | 30.299567 | 79.301528 | 30.300316 | 79.301821 |
| 10-L | Devlibagad-2 | 411.490 | 411.530 | 30.360659 | 79.301988 | 30.300467 | 301831 |

SCHEDULE- C

*(See Clause 2.1)*

# PROJECT FACILITIES

NIL

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.

## 2 Design Standards

The Project including Project Facilities shall conform to design requirements set out in the following documents:

Manual of Specifications and Standards for Two Laning of Highways (IRC: SP: 73-2015), referred to herein as the Manual

As regards, the work of utility shifting, the relevant specification, relevant rules, regulations and acts of Utility Owning Department/Agencies shall be applicable.

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 Two-Laning of Highways (IRC:SP:73-2007), referred to as the Manual MORTH Specifications for Road and Bridge Works,Fifth Revision 2013, Relevant British standards and FHWA standards. Where the specification for a work is not given, Good Industry Practice shall be adopted to the satisfaction of the Authority's Engineer.

The following specification and standard as laid down in various documents listed below be referred and the design and project facilities should confirm to the requirements given in these specifications:-

**a.** BS 8006-1:2010-Code of Practice for Strengthened/Reinforced Soil and other fills. The structure category is considered as 3 (High) and design temperature is considered as 20.
BS 8006 (2010) – is suggested by MORTH as the first priority code (refer annexure to section 3100 A1-1.1) to be considered.

**b.** FHWA-NHI-10-24 – Design and Construction of mechanically stabilized earth walls and reinforced soil slopes –Volume-I (For seismic loading condition).

**c.** HRB-Special report-23. State of Art: Design and Construction of Rock fall Mitigation System, 2014.

**d.** HRB-15 : State of Art : Landslide correction technique.

**e.** Washington State Department of Transport (WSDOT) – Geotechnical Design manual, May 2015

**f.** IRC-SP-48 : 1998 – "Hill Road Manual".

**g.** IRC-SP-42 – "Guidelines of Road Drainage".

**h.** IS 1893 (Part-3) : 2014 – Criteria for Earthquake Resistant Design of Structures.

**i.** IRC:6-2014-Standard Specifications and Code of Practice for Road Bridges.

**j.** IRC:SP:73-2015 – Manual of Specifications and Standards for two laning of Highways with Paved Shoulder.

**k.** IRC:37:2012 – Guidelines for the design of flexible pavements.

**l.** IRC:89-1997 – Guidelines for design and construction of river training and control works for road bridges.

**m.** IRC:SP:13-2013 – Guidelines for the design of small bridges and culverts.

Notwithstanding above, certain specific details are given in succeeding paragraphs.

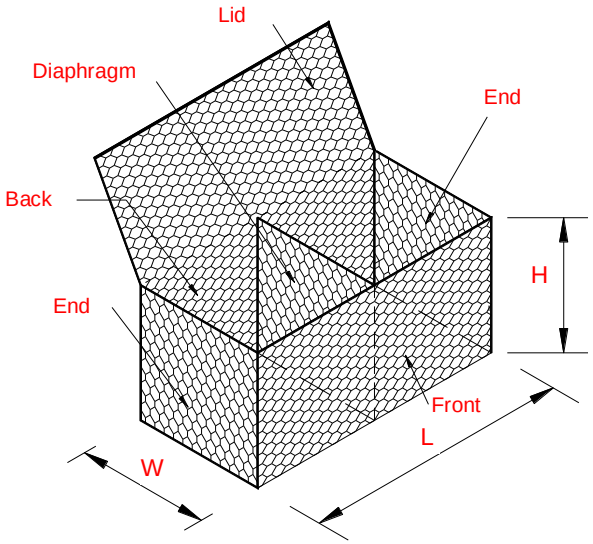
### 1.1 Gabions for Retaining Wall:

#### 1.1.1 Description

This work shall consist of furnishing, assembling, and filling mechanically woven double twist hexagonal wire mesh gabions with rock as specified in the contract to the dimensions, lines and grades shown on the plans, or as determined by the engineer. These specifications are mainly in accordance with Indian Standards IS 16014 and MoRTH (Fifth Revision) 2013, Clause 2500.

### 1.1.2 Material- Gabions

**Fig. 1**




### 1.1.3 Wire:

All tests on the mesh, lacing wire and selvedge wire must be performed prior to manufacturing themesh.

Tensile strength: The wire used for the manufacture of Mesh shall have a tensile strength minimum 350 N/mm2 in accordance with IS 280. Wire tolerances (Table 1) shall be in accordance with IS 16014:2012 (Class T1).

Elongation: Elongation shall not be less than 10%, in accordance with IS 16014:2012 and MoRTH(Fifth Revision) Clause 3100. Test must be carried out on a sample at least 20 cm long.

### 1.1.4 Internal Connecting Wires:

Cross Ties/ stiffener wire: Diameter 2.2 mm, Zn+ 10% Al alloy coated wire with PVC coating, 3.2mm when measured with PVC coating.

### 1.15 Zn+ 10% Al alloy Coating

- Zn+ 10% Al alloy coating: Minimum quantities of Zn+ 10% Al alloy shall be as shown in table in clause 1.2.6
- Adhesion of Zn+ 10% Al alloy coating: The adhesion of the Zn+ 10% Al alloy coating to the wire shall be such that, when the wire is wrapped ten turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers in accordance with IS 4826:1979.

### 1.1.6 PVC (Polyvinyl Chloride) Coating

PVC coating thickness: Nominal – 0.5 mm, Minimum – 0.38 mm;

Specific weight: 1.3 kg/dm3 – 1.35 kg/dm3 in accordance with ISO 1183.

Hardness: between 50 and 60 Shore D, according to ISO 868.

Tensile strength: Higher than 21 MPa, according to ISO 527

Elongation at break: not less than 200% in accordance with ISO 527.

### 1.1.7 Wire mesh (10x12 mesh type):

| Mesh type | "D"(mm) | (Zn+ Al alloy) +PVC coated |
|---|---|---|

| | | Diameter of wire (Inner / Outer wire) | | |
|---|---|---|---|---|
| | | Mesh wire(mm) | Selvedge wire (mm) | Lacing wire(mm) |
| 10X12 | 100mm | 2.7/3.7 | 3.4/4.4 | 2.2/3.2 |

Mesh opening: Nominal Dimension D = 100, as per Fig. 2

Tolerances in Mesh Opening size: - 2% to +2%

DT mesh shall have minimum 10 numbers of mesh openings per meter of mesh perpendicular to twist of mesh.

Procedure for verification of mesh opening

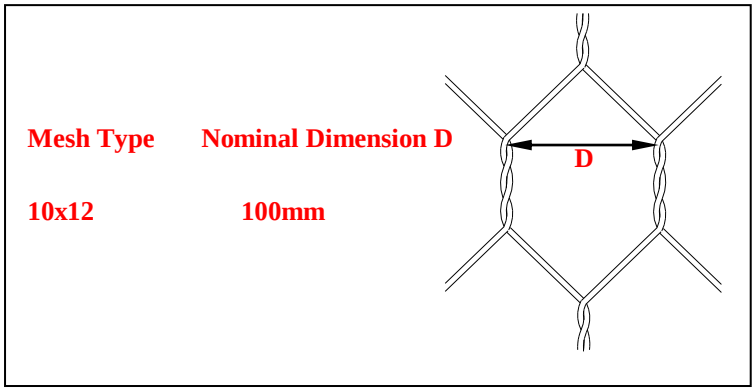
a. Gabion Box/Mattress shall be unfolded on the plain ground.

b. Any shrink in the unfolded Gabion Mesh shall be removed, by stretching the Mesh panel.

c. Marking on the ground shall be made from the Centre of the twist of one mesh and the second. Marking shall be done at 1 m distance.

d. The number of mesh Openings in the 1 m shall be counted & verified.

Figure (2)




### 1.1.8 Tolerances

Wire: wire diameter tolerance and minimum Zn+ 10% Al alloy coating requirement shall be as per following table

Table (1)

| Wire Diameter mm | 2.2 mm | 2.7 mm | 3.4 mm |
|---|---|---|---|
| Wire Tolerance(+)mm | 0.06 | 0.06 | 0.07 |
| Minimum Qty of Zn+ 10% Al alloy (gm/m2 ) | 230 | 245 | 265 |

### 1.19 Standard Sizes

Standard sizes (Length x Breadth x Heigth) of gabions are 4mx1mx1m, 3mx1mx1m, 2mx1mx1m, 1.5mx1mx1m, 4mx1mx0.5m, 3mx1mx.5m and 2mx1mx0.5m

### 1.1.10 Tolerance in gabion dimensions

+ 5% in all dimensions (length, breadth and height) shall be allowed as tolerance for Gabion units.

### 1.1.11 Fabrication

Gabions shall be manufactured with all components mechanically connected at the production facility. The front, base, back and lid of the gabions shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base. The lid may be a separate piece made of the same type mesh as the basket. All perimeter edges of the mesh forming the basket and top, or lid, shall be selvedged with wire having a larger diameter.

Gabion is divided into cells by means of diaphragms positioned at approximately 1m centers. The diaphragms shall be secured in position to the base so that no additional lacing is necessary at the jobsite.

Table (2) Typical Gabion sizes (10 X 12 -mesh type)

| Length, m | Width, m | Height, m | Number of Diaphragms |
|---|---|---|---|
| 4.0 | 1.0 | 1.0 | 3 |
| 3.0 | 1.0 | 1.0 | 2 |
| 2.0 | 1.0 | 1.0 | 1 |
| 1.5 | 1.0 | 1.0 | 0 |
| 4.0 | 1.0 | 0.5 | 3 |
| 3.0 | 1.0 | 0.5 | 2 |
| 2.0 | 1.0 | 0.5 | 1 |

### 1.1.12 Construction Requirements

Gabion filling and lacing and erection at site should be strictly as per the instruction of approved (by engineer) manufacturer's instructions as per the site specific requirements.

### 1.1.13 Assembly

Gabions are supplied folded flat and packed in bundles. Larger units may be supplied in rolls. The units are assembled individually by erecting the sides, ends, and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are satisfactorily aligned. The four corners shall be connected first, followed by the internal diaphragms to the outside walls.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening, pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting. Refer figure 3.

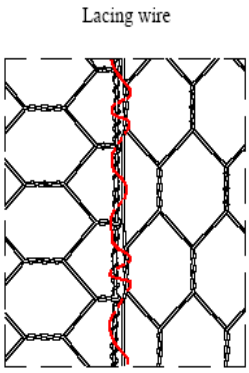



Figure (3)

### 1.1.14 Installation

After initial assembly, the gabions are carried to their final position and are securely joined together along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described earlier. Whenever a structure requires more than one layer, the upper empty baskets shall also be connected to the top of the lower layer along the front and back edges of the contact surface using the same connecting procedure(s) described in Section 1.3.1.

### 1.1.15 Filling

Rock for the Gabion facia shall be hard, angular to round, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. The rocks shall range between 150 mm to 250 mm for 10x12 type mesh. Each range of sizes may allow for a variation of 5% oversize rock by number of particles, or 5% undersize rock by number of particles, or both. The size of any oversize rock shall allow for the placement of minimum of three layers of rock must be achieved when filling the 1 m high units and a minimum of two layers for the 0.50 m high units. The rock used for filling the gabion facia shall have a minimum density of 24kN/m3 and Los Angeles abrasion value not more than 45.

The facing section shall be filled with rock in a careful way to get good horizontal and vertical alignment. During the filling operation skilled manual stone placement is required to minimize voids. The maximum permitted porosity of stone filling shall be 40%. For vertical or near vertical structures the exterior of the basket may be carefully hand placed to give a neat, flat, and compact appearance. Care shall be taken when placing fill material to ensure that the sheathing on the PVC coated baskets is not damaged. The facing stones should orient in such a way to get their flat surfaces facing to the front.

The cells shall be filled in stages so that local deformation may be avoided. At no time shall any cell be filled to a depth exceeding 0.30 m higher than the adjoining cell. It is also recommended to slightly overfill the baskets by 25mm to 50 mm to allow for settlement of the rock.

### 1.1.16 Internal Connecting Wires installation

Internal connecting wires shall connect the exposed face of a cell to the opposite side of the cell. An exposed face is any side of a gabion cell that will remain exposed or unsupported after the structure is completed. Lacing wire or prefabricated internal connecting wires shall be used as internal connecting wires.

1. **1meter High Gabions**

1meter high gabions shall be filled in three layers, 300 mm at a time. Connecting wires shall be installed after the placement of each layer, that is, at 300 mm high.

2. **0.5m High Gabions**

0.5 meter high gabions do not require connecting wires unless the baskets are used to build vertical structures. These units shall be filled in two layers 250mm at a time. Connecting wires shall be installed after the placement of the first layer, which is at 250mm high.

3. **Lid Closing**

Once the gabion baskets are completely full, the lids will be pulled tight until the lid meets the perimeter edges of the basket. The lid must then be tightly laced and/or fastened along all edges, ends and tops of diaphragm(s) in the same manner as described in earlier sections.

4. **Mesh cutting and folding**

Where shown on the drawings or otherwise directed by the engineer, the gabions shall be cut, folded and fastened together to suit existing site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners in the manner described in earlier Section. Any reshaped gabions shall be assembled, installed, filled and closed as specified in the previous sections.

### 1.1.17 Method of Measurement

The payment quantities for excavation shall be determined by the outside limits of the gabion structure. Quantities will be determined from cross sections and the linear distance, and paid for under the appropriate bid items.

The quantity to be paid for “In place gabions” shall be the number of cubic meters of gabions. Project conditions and material availability will determine the actual size of gabions to be used.

Excavated material beyond the limits of the gabions shall be backfilled with gravel, crushed rock or other material approved by the engineer.

### 1.1.18Testing and Acceptance criteria

The material should get approval from the client before the actual supply start. The manufacturer of the Gabion facing unit should provide “Manufacturers Test Certificate’ and Quality Conformity Certificate for the material with every lot/shipment. Tensile strength test, and Zn+ Al alloy coating test on basic wire shall be done on one sample per every 10,000 numbers of units supplied. The tests shall be conducted in an accredited lab with proper testing facility or alternatively the tests shall be conducted in Manufacturer’s facility witnessed by an expert authorized by the client.

PVC Coating Thickness: The thickness of the PVC coating shall be determined on a randomly chosen individual piece of wire removed from the coil at 3 places 1 metre apart.

Measure with a micrometer the diameter of the galvanized steel wire with PVC coating. Determine the thickness of the PVC coating by stripping the PVC coating from the wire and measure the reduced diameter with a micrometer. The thickness of the coating is the difference between the diameter of the galvanized steel wire with PVC coating and the measured diameter of the galvanized steel wire divided by two. The thickness values should be as per clause 1.2.4. While removing the PVC coating by stripping, take care not to remove any of the metallic surfaces.

The punch strength test results shall be 17.8 kN in accordance with MoRTH section 2500 and test

specified therein.

### 1.1.19 Selvedge strength test:

A tensile test on mesh sample shall be carried out in order to estimate selvedge strength test. The test shall be carried out as per procedure outlined below. The selvedge strength shall be minimum 25 kN/m.

a. Take a DT mesh of approximately 1.0 m width.
b. The height of the sample shall be such that after selvedging on both the sides (1m), there shall be at least two mesh repetitions between the two selvedged wires, so that effective height of the sample shall be more than 300 mm.
c. Sample shall be loaded on the UTM in a direction parallel to twist, with the samples being gripped at the two selvedged wires & not mesh twist.
d. The distance between the two selvedge wires shall be recorded as Initial gauge length.
e. Distance between the two end gripping points (pins) along the width of the sample shall be recorded as the unit width under test. The width shall be at least 700 mm.
f. The load shall be applied gradually to the sample and the test be continued till the break point.
g. The peak load and the % elongation shall be recorded.
h. The strength of the selvedge connection shall be (peak load/unit width under test) expressed in kN/m.

**NB.** If the sample slips at any of the gripping point during the test, such a test shall be discarded and a new sample shall be taken.

### 1.1.20 Measurement for Payments

SCHEDULE H is to be considered for the measurement of payments of Gabion Works including all the different associated activities as mentioned above.

### 1.1.21 Eligibility of Manufacturer

Manufacturer of woven steel wire double twist hexagonal mesh gabions shall have:

- In-house facility to test the tensile strength of the basic GI wire and mechanically woven double twisted mesh panels using computerized testing facilities
- In-house test facility for Zn+ 10%Al alloy coating.
- A valid ISO 9001:2008 accreditation for manufacturing unit from an internationally accredited organization for its Gabion manufacturing facilities.
- Manufacturing experience of mechanically woven Gabions of minimum 10 years in India as per International standards.
- Existence in India for more than 10 years from the date of this tender notice.
- Proven experience in supply and designing of retention works in India for at least 10 years.
- Experience of supplying minimum 29,000 cum of Gabions & 1,75,000 sqm of geotextile. Manufacturer shall have supplied the material to government department for construction of Gabion structure that is minimum 10 years old on date of tender notice and shall furnish performance certificate of material for the same.

The Manufacturer / Supplier should not have a history of poor performance such as abandoning the works, financial failures, blacklisting. If it is observed, Manufacturer / Supplier will be automatically disqualified.

## 1.2 Non-woven Geotextile for filtration and separation :

### 1.2.1 Material

The nonwoven needle punched or thermally bonded or or any equivalent geotextile shall be used. The geotextile shall be made of polyester or polypropylene manufactured through machine made process of needle punching techniques. The mean Values of Geotextile shall be as shown in Table 1.

**Table 1**

| PROPERTIES: | MARV Values | Test Method |
|---|---|---|
| **Mechanical:** | | |
| **Tensile Strength** | 7kN/m | ASTM D 4595 |
| **Elongation at maximum load** | > 50 % | ASTM D 4595 |
| **Grab Tensile Strength** | 500 N | ASTM D 4632/IS 13162 Part 5 |
| **Grab Elongation** | > 55 % | ASTM D 4632/ IS 13162 Part 5 |
| **Puncture Strength (CBR)** | 1200 N | ASTM D 6241 |
| **Hydraulic:** | | |
| **Apparent Opening Size, AOS90** | 0.4 mm | ASTM D 4751 |
| **Permittivity** | 0.02 $sec^{-1}$ | ASTM D 4491 |

### 1.2.2 Method of measurement

Quantity of filter geotextile shall be determined from cross sections and the linear distance, and paid for under the appropriate bid items.

### 1.2.3 Method of Testing

The supplier has to submit a Certificate of conformity for the parameters indicated in Table 1 for every lot/shipment.

### 1.2.4 Basis of Payment

Accepted filter geotextile shall be paid for at the unit price (per square meter area) for each pay item included in the contract.

SCHEDULE H is to be considered for the measurement of payments of Gabion Works including all the different associated activities as mentioned above.

## 1.3 Gabion Facia Unit

### 1.3.1 Material:

These units are fabricated soft flexible heavily galvanized and PVC coated double twisted steel woven wire mesh units (Figure 1). The facing section of the unit is formed by connecting the back panel and a diaphragm to the main unit. This creates rectangular shaped cells used for stone confinement.

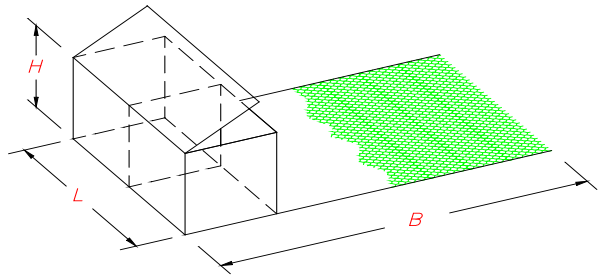



**Figure (1)**

### 1.3.2 Wire

All tests on the mesh, lacing wire and selvedge wire must be performed prior to manufacturing the mesh.

*Tensile strength:* The wire used for the manufacture of Mesh shall have a tensile strength minimum 350 N/mm$^2$ in accordance with IS 280. Wire tolerances (Table 1) shall be in accordance with IS 16014:2012 (Class T1).

*Elongation:* Elongation shall not be less than 10%, in accordance with IS 16014:2012 and MoRTH(Fifth Revision) Clause 3100. Test must be carried out on a sample at least 20 cm long.

### 1.3.3 Zn+ 10% Al alloy Coating

- Zn+ 10% Al alloy coating: Minimum quantities of Zn+ 10% Al alloy shall be as shown in table in clause 6.
- Adhesion of Zn+ 10% Al alloy coating: The adhesion of the Zn+ 10% Al alloy coating to the wire shall be such that, when the wire is wrapped ten turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers in accordance with IS 4826:1979.

### 1.3.4 PVC (Polyvinyl Chloride) Coating

1. PVC coating thickness: Nominal – 0.5 mm, Minimum – 0.38 mm;
2. Specific weight: 1.3 kg/dm$^3$ – 1.35 kg/dm$^3$ in accordance with ISO 1183.
3. Hardness: between 50 and 60 Shore D, according to ISO 868.
4. Tensile strength: Higher than 21 MPa, according to ISO 527
5. Elongation at break: not less than 200% in accordance with ISO 527.

### 1.3.5 Wire mesh (10x12 mesh type):

Mesh wire: Diameter – 2.70 mm Zn+10% Al alloy coated wire inside PVC coating and 3.70 mm when measured with external PVC coating;(ID/OD - 2.7mm/3.7mm)

Selvedge and reinforcement steel wire: Diameter – 3.40 mm Zn+10% Al alloy coated wire inside PVC coating and 4.40 mm when measured with external PVC coating;(ID/OD - 3.4mm/4.4mm).

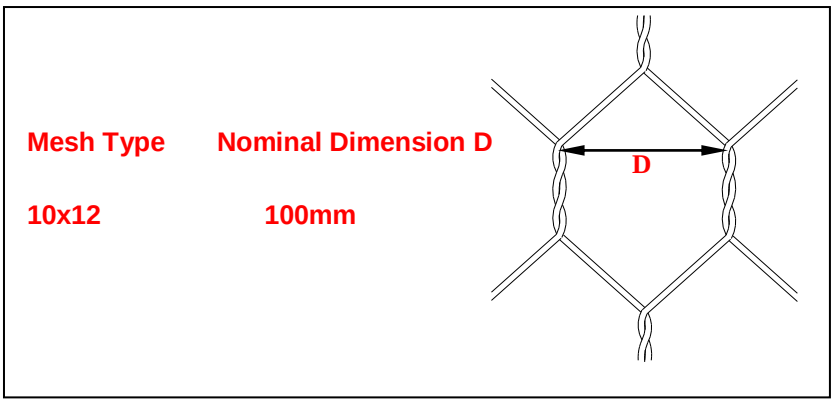
Mesh opening: Nominal Dimension D = 100, as per Fig. 2

Tolerances in Mesh Opening size: -2% to + 2%

DT mesh shall have minimum 10 numbers of mesh openings per meter of mesh perpendicular to twist of mesh.
Procedure for verification of mesh opening

a. Reinforced gabion facia shall be unfolded on the plain ground.
b. Any shrink in the unfolded Gabion Mesh shall be removed, by stretching the Mesh panel.
c. Marking on the ground shall be made from the Centre of the twist of one mesh and the second. Marking shall be done at 1 m distance.
d. The number of mesh Openings in the 1 m shall be counted & verified.

**Figure 2**




**Tolerances**

***Wire*:** The wire shall meet diameter tolerance and minimum zinc coating requirement mentioned in the following table

Gabion facia and tail unit tolerance: ± 5 % on the length, width, and height.

**Table (1)**

| | | | |
|---|---|---|---|
| Internal Wire Dia mm | 2.2 mm | 2.7 mm | 3.4 mm |
| Wire Tolerance(±) mm | 0.06 | 0.06 | 0.07 |
| Minimum Qty of Zn+ 10% Al alloy ($gm/m^2$ ) | 230 | 245 | 265 |

### 1.3.6 Standard size

Gabion facia and tail with double twist hexagonal mesh units shall have the following dimensions

| Length of reinforcement | Width (L), m | Height (H), m |
|---|---|---|

| (B), m | | |
|---|---|---|
| 3 | 2 | 1 |
| 4 | 2 | 1 |
| 5 | 2 | 1 |
| 6 | 2 | 1 |
| 3 | 2 | 0.5 |
| 4 | 2 | 0.5 |
| 5 | 2 | 0.5 |
| 6 | 2 | 0.5 |

### 1.3.7 Fabrication

Gabion facia and tail with double twist hexagonal mesh units shall be manufactured with all components mechanically connected at the production facility. The external face, reinforcing panel, and lid of the unit shall be woven into a single unit. The ends, back, and diaphragm shall be factory connected to the base. All perimeter edges of the mesh forming the basket shall be selvedge with wire having a larger diameter.

The facing element of a Gabion facia and tail with double twist hexagonal mesh unit is divided into two cells by means of a diaphragm positioned at approximately 1 m centres. The diaphragm shall be secured in position to the base so that no additional lacing is necessary at the job-site.

### 1.3.8 Structural Backfill in between reinforcement

The structural backfill shall be of good quality, free draining granular soil and plasticity index should be less than 9. The percentage of fines passing 75 micron sieve should not be greater than 15%. The maximum particle size in the structural fill shall not be more than 75 mm. The structural fill material should be basically free draining and it should be devoid of dirt and deleterious material.

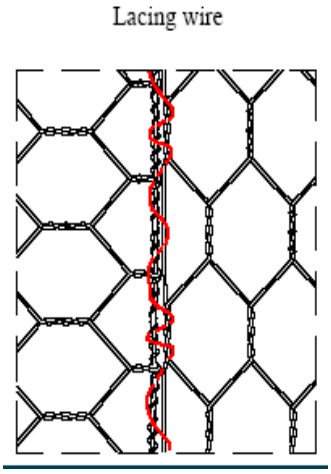
### 1.3.9 Construction Requirements

**1. Assembly**

Gabion facia and tail with double twist hexagonal mesh units are supplied folded flat and packed in bundles. The facing section of the units are assembled individually by erecting the sides, back, ends, and diaphragm, ensuring that all panels are in the correct position, and the tops of all sides are aligned. The four corners of the basket shall be connected first, followed by the internal diaphragm to the outside walls. All connections shall be made using lacing wire or ring fasteners.

The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting to secure the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening approximately every 150 mm pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting. Refer Figure 3.

**Figure (3)**




The use of ring fasteners shall be in accordance with the manufacturer's recommendations.

Following assembly of the facing section the reinforcing panel shall be unfolded to the required length and the shipping folds removed. Folds can be removed by placing the fold over a 50 mm x 100 mm board and walking along the sides.

**2. Installation of units**

Prior to installing the assembled units, the foundation on which these units are to be placed shall be cut or filled and graded to the lines and grades shown on the construction drawings. Surface irregularities, loose material, and vegetation shall be removed during the preparation of the foundation.

The units are carried to their final position and connected with the adjoining empty units along the vertical and top edges of their contact surfaces using the same connecting procedure(s) described in second paragraph Section 4.8.1. Whenever a structure requires more than one layer of units, the upper layer shall be connected to the top of the lower layer along the front and back edges of the contacts.

**3. Internal Connecting Wires**

Internal Connecting Wires shall connect the exposed face of a cell to the opposite side of the cell. An exposed face is any side of a gabion cell that will remain exposed or unsupported after the structure is completed. Lacing wire or prefabricated internal connecting wires shall be used as internal connecting wires.

**4. Placement of the Structural Backfill**

The soil reinforcement mesh panel should be unfolded; the shipping folds flattened out, and pulled tight to minimize further creepage. Prior to starting this operation, a filter geotextile shall be placed at backfill interface. The geotextile should have a 250 cm return at both top and bottom.

The granular backfill specified by the engineer shall be installed in lifts of approximately 30 cm, and dumped in the middle section of the soil reinforcement mesh panel. Compacting is to precede parallel to the wall, ensuring that the compacting machine does not come in contact with the mesh panel or within 1 m of the rear of the face section. The homogeneity of the backfill and the level of compaction required shall be verified.

**5. Lid Closing**

Once the baskets are completely full, the lids shall be pulled tight until the lid meets the perimeter edges of the basket. A tool like a lid closer can be used. The lid must then be tightly laced and/or fastened along all edges, ends, and tops of diaphragm(s) in the same manner as described in the above sections.

**6. Mesh Cutting and Folding**

Where shown on the drawings or otherwise directed by the engineer, the Gabion facia and tail with double twist hexagonal mesh units may be cut, folded and fastened together to suit existing site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners in the manner described earlier. Any reshaped Gabion facia and tail with double twist hexagonal mesh units shall be assembled, installed, filled and closed as specified in the previous sections.

### 1.3.10 Method of Measurement

The quantity to be paid for "gabion facia and mechanically woven, double twisted, hexagonal shaped Zn+PVC coated steel wire mesh tail as reinforcement" shall be the number of units supplied and installed in their final position. Project conditions and design will determine the actual size of units to be used.

The bid price shall include the in place cost of all materials, equipment, and labour, including gabion facia and integrated tail mechanically woven, double twisted, hexagonal shaped Zn+PVC coated steel wire mesh tail as reinforcement.

### 1.3.11 Testing

The material should get approval from the client before the actual supply start. The manufacturer of the Gabion facing unit should provide "Manufacturers Test Certificate' for the material with every lot/shipment.

Tensile strength test and zinc coating test on basic wire shall be done on one sample per every 10,000 numbers of units supplied. The sample of wire for all the tests shall be taken from raw material before manufacturing.

**PVC Coating Thickness:** The thickness of the PVC coating shall be determined on a randomly chosen individual piece of wire removed from the coil at 3 places 1 metre apart.

Measure with a micrometer the diameter of the galvanized steel wire with PVC coating. Determine the thickness of the PVC coating by stripping the PVC coating from the wire and measure the reduced diameter with a micrometer. The thickness of the coating is the difference between the diameter of the galvanized steel wire with PVC coating and the measured diameter of the galvanized steel wire divided by two. The thickness values should be as per clause 4. While removing the PVC coating by stripping, take care not to remove any of the metallic surface.

**Selvedge strength test:**

A tensile test on mesh sample shall be carried out in order to estimate selvedge strength test. The test shall be carried out as per procedure outlined below. The selvedge strength shall be minimum 25 kN/m.

- Take a DT mesh of approximately 1.0 m width.
- The height of the sample shall be such that after salvaging on both the sides (1m), there shall be at least two mesh repetitions between the two selvedged wires, so that effective height of the sample shall be more than 300 mm.

- Sample shall be loaded on the UTM in a direction parallel to twist, with the samples being gripped at the two selvedged wires & not mesh twist.
- The distance between the two selvedge wires shall be recorded as Initial gauge length.
- Distance between the two end gripping points (pins) along the width of the sample shall be recorded as the unit width under test. The width shall be at least 700 mm.
- The load shall be applied gradually to the sample and the test be continued till the break point.
- The peak load and the % elongation shall be recorded.
- The strength of the selvedge connection shall be (peak load/unit width under test) expressed in kN/m.

**NB.** If the sample slips at any of the gripping point during the test, such a test shall be discarded and a new sample shall be taken**.**

### 1.3.12 Eligibility of Manufacturer

The Manufacturer of Gabion facia with integrated tail mesh shall have:

- In-house facility in the manufacturer's plant in to test the tensile strength of the basic wire which forms mechanically woven double twisted mesh panels.
- In-house test facility in the manufacturer's plant for zinc +10% Alloy coating test.
- In-house facility in the manufacturer's plant to test selvedge strength and mesh panel strength.
- Proven experience in supplying and designing for structures with composite soil reinforcement systems, in which gabion is one of facia component for a minimum height of 25m, with supporting documentary evidence.
- The supplier shall produce performance certificate of Gabion facia with integrated tail of at least 10 year old structure from government department.
- The Manufacturer / Supplier shall be manufacturing / supplying the system for more than 10 years from the date of this tender notice.
- In-house design capability & same shall be ISO9001:2008 certified by an internationally accredited organization.
- Manufacturer of mesh should provide a performance bond for material for minimum 5 years to the client.
- Manufacturer should undertake for site supervision during the execution of RS wall work.
- The Manufacturer / Supplier should not have a history of poor performance such as abandoning the works, financial failures, blacklisting. If it is observed, Manufacturer / Supplier will be automatically disqualified.

### 1.3.13 Basis of Payment

Accepted gabion facia and integrated tail mechanically woven, double twisted, hexagonal shaped

Zn+PVC coated steel wire mesh tail as reinforcement unit will be paid for at the unit price for each pay item included in the contract.

SCHEDULE H is to be considered for the measurement of payments of mattress including all the different associated activities as mentioned above.

## 1.4 High Strength Geogrid/Strap for Reinforcement

**1.4.1Description:**The primary soil reinforcement shall be high strength flexible geogrid/strap with a high quality coating like LDPE or equivalent. Latex or PVC coating or geotextile shall not be permitted. The selection of the geogrid/strap need to be strictly based on the long term design strength values for a design life of 120 years at 20°C. The primary soil reinforcement shall conform to the details given in table 1.The Ultimate tensile strength values indicated in table 1 are short term, which needs to be reduced to long term strength for design purpose by applying suitable partial material factors or reduction factors (RF) as explained in clause 2.2 . The selection of the geogrid/strap need to be strictly based on the long term design strength values for a design life of 120 years at 20°C.

Table – Long Term Design Strength of Geogrids/Strap

| Geogrid/Strap Grade | 1 | 2 | 3 |
|---|---|---|---|
| Ultimate Tensile strength corresponding to 12% strain (kN/m) | 100 | 200 | 300 |
| Long Term Design Strength at 20°C Temperature for 120 year design life (minimum) (kN/m) | 60 | 121 | 181 |
| Roll Width (minimum) (m) | 4.5 | 4.5 | 4.5 |

NOTE:

Tensile strength per metre should be based on tests performed as per ISO 10319 test procedure.

### 1.4.2 Long term design strength properties

The long term design strength shall be derived as per guidelines given in ISO TR 20432 for design life of 120 years and design temperature of 20ºC considering following factors

$T_{allow} = T_{UTS} / R_F$

$R_F = RF_{CR} \times RF_{ID} \times RF_W \times RF_{CH} \times F_S$

$T_{allow}$ = Allowable tensile strength

$T_{UTS}$ = Ultimate tensile strength

$R_F$ = Reduction factor

$RF_{CR}$ = Reduction factor for creep

$RF_{ID}$ = Reduction factor for the effect of installation damage

$RF_W$ = Reduction factor for weathering

$RF_{CH}$ = Reduction factor environmental degradation (chemical and biological) at the service temperature

$F_S$ = Reduction factor related to the mass of information available and to the production quality.

Use of default reduction factors mentioned in codes like FHWA or MoRTH shall not be permitted. The adoption of reduction factors should be strictly based on reliable test data and performance data available with the manufacturer from accredited independent agency or the manufacturer should provide a valid third party accredited certification like BBA (British Board of Agreement) certifying the Reduction Factor (RF) value for their geogrid for design temperature of 20°C and design life of 120 years. Manufacturer should have creep test data from independent accredited laboratory for period over 10 years at design temperature of 20°C.

**1.4.3 Installation of Primary soil reinforcement**

1. Care should be taken in the handling, lifting and positioning of geogrid/strap rolls. Since the weight of the rolls is high, mechanical lifting arrangements are necessary. This should be done using a lifting beam.

2. To ease the laying, and proper performance of the geogrid/strap, the formation on which it is to be laid should be flat without ruts and sharp undulations.

3. The structural backfill shall be of good quality, free draining granular soil and plasticity index should be less than 9. The percentage of fines passing 75 micron sieve should not be greater than 15%. The maximum particle size in the structural fill shall not be more than 75 mm. The structural fill material should be basically free draining and it should be devoid of dirt and deleterious material.

4. The rolls should be placed near the facia and started to roll back perpendicular to the wall direction as shown in the construction drawings.

5. The roll should be unwound a small amount by pushing the roll in the direction of the tensile strength requirement. The base end of the geogrid/strap now exposed should be secured by weighting or pinning it to the formation. The roll should then be unwound carefully ensuring that no slack or undulations occur in the geogrid/strap as it is laid. If these do occur they should be corrected immediately before proceeding. When the roll is completely unwound the free end of the geogrid/strap should be hand tightened and secured by weighting or pinning.

6. The run of primary soil reinforcement should be reasonably straight and all elements should be flat and not twisted. No undulations in the geogrid/strap should be evident.

7. There shall not be any active connection between primary soil reinforcement and secondary soil reinforcement by means of joining. The stress transfer shall happen by the frictional interaction between the primary and secondary soil reinforcement as per MoRTH Cl. 3105.2

paragraph 2 and IRC:SP:102-2014 Cl. 3.4. For this, a minimum overlap length of 3m shall be provided between the primary and secondary soil reinforcement.. (Figure 1).

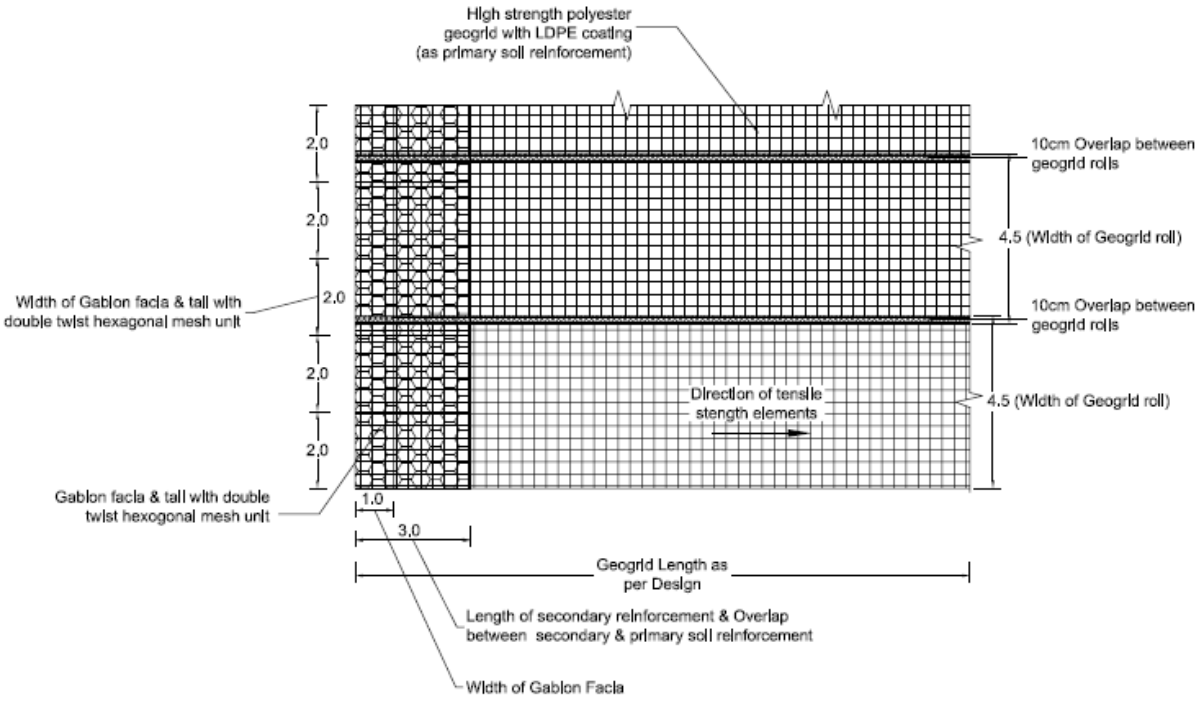
8. Minimum overlap of 10cm shall be provided between two adjacent rolls of the primary soil reinforcement geogrid/strap, as shown in the figure below. Joining of different rolls in tensile stress direction of the structure shall not be permitted.

### 1.4.4 Testing and acceptance criteria

The material should get approval from the client before the actual supply start. Contractor within 30 days of issue of work order shall intimate Engineer in charge about the brand of material he intend to procure along with technical literature, past experience and other details about the manufacturer and arrange a visit of consultant to factory for inspection and testing of the material. The visit expenses (traveling, lodging and boarding) will be borne by client whereas the testing expenses will be born by the Contractor.

Tensile strength test shall be done on one sample per every 20,000 sqm of geogrid/strap supplied. Manufacturer of the geogrid should provide "Manufacturers Test Certificate" for the tensile strength of geogrid/strap elements.

In case of failure of any test /or contractor desire to source material from more than one manufacturer, the cost of visit in respect of additional source or visit for retesting by client and consultant shall be borne by Contractor. The cost of Airfare to &fro, Lodging& Boarding, shall be borne by contractor. It is not advisable to use geogrids/strap of different characteristics and inherent material properties together and that should not be allowed




PLAN DETAIL SHOWING OVERLAP LENGTH BETWEEN PRIMARY SOIL REINFORCEMENT & SECONDARY SOIL REINFORCEMENT (FOR GABION FACIA & TAIL WITH DOUBLE TWIST HEXAGONAL MESH UNIT)

### 1.4.5 Eligibility criteria- Manufacturer

The Manufacturer should have experience in manufacturing, supplying and providing design and technical support for structures with composite soil reinforcement systems for a minimum height of 25m, with supporting documentary evidence for satisfactory performance of completed structures for minimum 5 years. The manufacturer shall have in-house technical support facilities to provide site specific design and required technical assistance at site. The manufacturing plant should be ISO 9001:2008 certified plant. The flow chart of quality procedures adopted in the plant should be submitted to the client for getting the source approval. The manufacturer of the geo grid should have in-house facility to test the tensile strength of the geo grid.

The manufacture should be able to supply the material continuously without any break or delay to the project. The average annual gross financial turnover of manufacture for the 3 years should be more than 70 crore audited and certified by a charted accountant; starting from 2010. Manufacturer of geogrid should provide a performance bond for material for minimum 5 years to the client. Manufacturer should undertake for site supervision during the execution of geogrid work. A copy of contract specification shall also be provided to manufacturer to confirm that his material conforms to the specification for material and placement of primary reinforcement.

### 1.4.6Method of Measurement

Quantities of primary soil geogrid reinforcement shall be determined from cross sections and the linear distance of the structure. The measurement shall be in square meters for different grades of geogrid, measured in their final position in plan area. Site specific design and material availability will determine the actual grade of geogrid to be used.

### 1.4.7 Basis of Payment

Accepted primary soil geogrid reinforcements will be paid per square meter quantity of various grades for each pay item included in the contract.

SCHEDULE H is to be considered for the measurement of payments of Facia Units including all the different associated activities as mentioned above.

## 2. 3D Mechanically Woven Hexagonal Double Twisted Wire Mesh Reinforced Synthetic Erosion Control Mat:

### 2.1 Description

This work shall consist of supplying and installation of approved **3D Mechanically Woven Hexagonal Double Twisted Wire Mesh Reinforced Synthetic Erosion Control Mat** (3D Reinforced Synthetic Erosion Control Mat) or equivalent over the prepared slope which will protect the slope from erosion.

### 2.2 Eligibility Criteria

The Manufacturer / Supplier of 3D reinforced synthetic erosion control mat shall have

1. The Manufacturer / Supplier should have supplied 3D synthetic erosion control matnot less than 10,000 sq.m for a single project in India.
2. The Manufacturer / Supplier shall submit documentary proof of adoption of the proposed technology in India along with proposal.

3. The Manufacturer/Supplier shall have at least 10 years existence in India from the date of this tender.
4. The Manufacturer / supplier shall have a demonstrated capability of providing Technical support and design assistance for synthetic erosion control. In-house design capability & same shall be ISO9001:2008 certified by an internationally accredited organization.
5. The Manufacturer / supplier shall have in-house facility to test the tensile strength of the DT meshes used in 3D wire mesh reinforced mat using computerized testing facilities.
6. The Manufacturer / Supplier should not have a history of poor performance such as abandoning the works, financial failures, blacklisting. If it is observed, Manufacturer / Supplier will be automatically disqualified.

**** The Bidder shall submit the sample 3D Mechanically Woven Hexagonal Wire Mesh Reinforced Synthetic Erosion Control Mat with the bid during submission as per the technical specifications.

## 2.3 Material Properties

3D mechanically woven hexagonal wire mesh Reinforced Synthetic Erosion Control Mat is wire mesh reinforced three dimensional Synthetic Erosion control mat which consists of a mechanically woven double twist steel wire mesh inside a three-dimensional geo-mat composed of UV stabilized; non-degradable synthetic fibers.

A tension element, i.e., a reinforcing element like mechanically woven double twisted steel wire mesh is included along with the three dimensional polymeric mats to provide strength against erosive forces, supplied in roll form, is anchored to the surface, to be protected, using staple/pins. 3D reinforced synthetic mat shall conform to properties listed in Table 1.

## 2.4 Equipment

The equipment required to install the wire mesh reinforced synthetic erosion control mat shall vary as per the site condition. All necessary equipments shall be decided as per the project requirement and site condition. It shall be approved before the work begins by Engineer in Charge.

## 2.5 Construction Requirements

Prior to laying of 3D mechanically woven double twisted wire mesh Reinforced Synthetic Erosion Control Mat on the slope, the surface shall be properly prepared, cleaned and dressed to the specified lines and levels as shown on the drawings. Specified trench keys along the crest and at the bottom of slope area shall be provided to fix the 3D reinforced Synthetic Erosion control mat in the ground. In case the soil is not fertile, it shall be mixed with suitable amount of fertilizer or seeds.

Installation of 3D wire mesh reinforced synthetic erosion control mat shall be in accordance with the manufacturer's instructions. The supplier shall provide a method of statement detailing installation procedure.

**Table 1 Properties of 3D wire mesh Reinforced Synthetic Erosion Control Mat**

| **PROPERTIES** | **TEST METHOD** | **UNIT** | **VALUE** |
|---|---|---|---|
| Polymer | POLYPROPYLENE | | |
| Mass per unit area# | EN ISO 9864 | $g/m^2$ | 600 |
| Melting point | ISO 306 | °C | 150 |
| Density# | ISO 1183 | $kg/m^3$ | 900 |
| UV Resistance | STABILIZED | | |
| **Reinforcement** | | | |
| **Type** | **Double twisted heavily galvanized woven Steel wire mesh** | | |
| Mesh Type | | mm | 8 x 10 |
| Wire Dia | | mm | 2.7 |
| **Mechanical Properties** | | | |
| Mechanical strength - length direction kN/m | EN ISO 10319 | kN/m | 47 |
| **NOMINAL PHYSICAL PROPERTIES** | | | |
| Mass per unit area # | EN ISO 9864 | $g/m^2$ | 2,000 |
| Nominal Thickness # | EN ISO 9863-I | mm | 12 |
| Geomat Color# | Black | | |
| Roll Length | | m | 25 |
| Roll Width | | m | 1.95 |

Values indicated in the table are typical values

# Not performance parameter

## 2.6 Method of Measurement

The 3D wire mesh reinforced synthetic erosion control mat shall be measured by the square meter or fraction thereof in place. Excavation, backfill, bedding and cover material are separate pay items.

## 2.7 Basis of Payment

Unless otherwise noted in the Plans, the accepted quantity of 3D wire mesh reinforced synthetic erosion control mat complete in place shall be paid for at the contract unit price per square meter.

## 2.8 Certificate of Compliance:

The Contractor shall provide the Engineer-In-Charge a Certificate of Compliance from the Manufacturer/supplier for every bill produced. The Certificate of Compliance shall be provided certifying that 3D reinforced synthetic erosion control matconforms to all the Technical and special requirements. The Certificate of Compliance shall be supported by a certified copy of the Manufacturers test certificate.

# 2.4 Technical Specifications For Rock Bolts

The rock bolts shall be designed and arranged in order to stabilize the fractured or jointed

rock mass to induce homogeneity in the behavior. The rock bolts shall have the required grip length in rock. The grout shall be made of OPC grade 53 with suitable admixtures. The rock bolts, nuts, bearing plates shall be epoxy coated.

Drilling shall be carried out by suitable equipment. Size of the hole shall be minimum 40 mm - 60 mm. Diameter of rock bolt shall be 25 mm. The rock bolt shall be made of Fe 415 grade steel as per IS: 1786. The top end of bolt shall be threaded for length of 200mm. For convenience of installation, appropriate arrangement (coupler) shall be made to connect two smaller lengths of rock bolts to achieve the required length.

Installation guideline

1) Hole of required diameter and depth shall be drilled at specified spacing in horizontal and vertical directions. Anymore / lesser length or spacing of bolting shall be carried out as per site condition and as directed by engineer-in-charge.

2) Drilled holes shall be filled with Cement slurry having water/cement ratio 0.5 with admixture. The grouting shall be commenced from the base of drill hole and subsequently raised.

3) The grout shall be placed under gravity in the drilled hole.

4) 25mm diameter steel rock bolts shall be lowered inside the hole.

5) The MS base plates of size 200mm x 200mm x 12 mm shall be placed at rock interface for tightening the nuts.

6) The front end of the grout hole shall be sealed cement mortar after insertion of rock bolt.

Following equipments deployed on site

1) Grout agitator

2) Compressor – 450 to 600CFM

3) Drilling equipment percussion type

Expansive plasticizing agent for cement, grouts and mortars shall be used, typical brand name DR. FIXIT PIDICRETE AM is a shrinkage compensating grout admixture for pressure grouting.

**Basis of Payment**
The measurement and payment of rock bolts shall be as per BoQ item included in the contract.

**Special requirement**
The agency must have experience in working in steep slopes including surface anchoring for a depth of atleast 3m. The agency should also have good experience in drilling and grouting works on steep slopes of more than 100m in height.

## 2.5: Specification for Rhomboidal Steel Wire Rope Net Panels for Rock Fall Protection

### 2.5.1 Scope:

This specification covers the use of rhomboidal steel wire rope net panels (Wire rope net panel)for surface rock fall protection including the scope of furnishing and installation as per the special provisions mentioned in the specifications, instructions from the manufacturer/supplier of the rock fall protection system and as directed by the Engineer-In-Charge.

### 2.5.2 General Requirements:

a) The wire rope net panelshall meet the minimum requirements of steel wire rope laid to form panel mainly mesh size, rhomboidal mesh opening type, knot, diameter of wrapping rope and edge rope, Zn Coating and Knot tear resistance as specified in this document.

b) System Technology:
The wire rope net panelsshall be made up of high strength steel wire rope in a mesh / grid configuration secured with a steel wire 'knot'. This knot shall have two bindings, each one formed by winding a pair of 3.00mm diameter steel wires around the junction between all perpendicular steel cables. The two bindings shall tightly secure the cables where they cross.

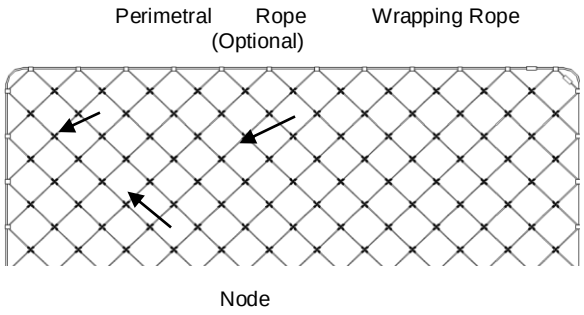



Fig 1a Wire Rope Net Panel

Fig 1b Junction Details with two bindings

Typical Wire Rope Net Panel

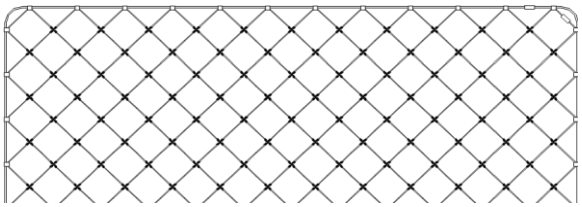
### 2.5.3 Material Specifications:

- **Panels:** Wire rope net panels shall be made with only one steel cable, twisted to form rhomboid mesh. The intersection points shall be reinforced to resist to an eventual static or dynamic stress that can deform the panel. The reinforcement shall be made of double steel wire knots with a diameter of 3 mm, mechanically intersected during production phase on each side of the panel (double binding with double wire), as shown in the figure 1b.

- **Binding System**
  The reinforcement shall be made of double steel wire knots with diameter of 3mm confirming to EN 10218, the wire shall be heavily galvanised for corrosion protection confirming to EN 10244 –Class A. The tensile strength of binding wire shall be in the

range 380 – 550N/mm2. This knot shall be capable of bearing a tear load of not less than 15 kN.

- **Wrapping Rope:**
  A single steel cable of diameter 10mm shall be laid to form a grid of square mesh. The loose ends shall be securedusing an aluminiumsuage/sleeve fastening with resistance of not less than 90% of cable breaking load.



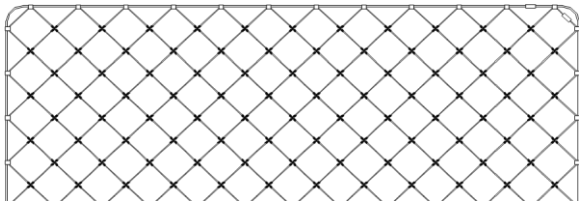
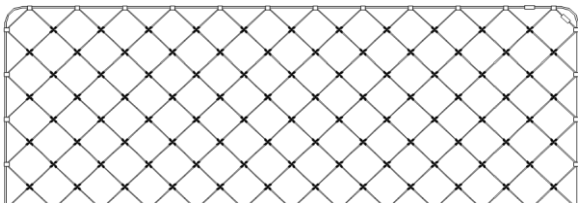


Table 1 Wrapping Rope



| | |
|---|---|
| Diameter(mm) | 10 |
| Rope type (IS 2266/ISO 2408) | 6X19M-CWR/IWR |
| Rope grade | 1770N/mm$^2$ |
| Zinc coating(IS 1835) | Class B |

- **Edge / Perimetral Rope:**
  The perimetral rope shall be used to secure the mesh panel.

**Table *2* Perimetral rope**

| | |
|---|---|
| Diameter(mm) | 10 |
| Rope type (IS 2266/ISO 2408) | 6X19M-CWR/IWR |
| Rope grade | 1770N/mm$^2$ |
| Zinc coating(IS 1835) | Class B |

- **Lacing Rope:**
  The lacing rope shall be of 8mm diameter with a metal centre having 6x19 + IWS configuration. It shall be used to connect the adjacent wire rope net Panels.
- **Junction sleeves at the end of the warping rope**

  The junction sleeves shall be Aluminium sleeves type cylindrical in shape with a resistance equal to a minimum 90% of the rope breaking load.
- **Perimetral rope sleeves**

  The perimetral rope sleeves shall be Aluminium sleeves with an open C shape.

- **Dimensions of Wire rope net panels**

  Wire rope net panels shall be manufactured in a nominal mesh size indicated in Table 3. Width and length of the panel shall be chosen to suit the site specific requirements with tolerance of ±5%.

  Other roll sizes may be required as per site conditions subject to the Engineer's approval. For non-standard roll lengths there may be some variation outside the tolerance limit from the nominal size shown in the contract drawings.

**Table 3 Standard Wire Rope Net Panel Dimension**

| Cable rope diameter | Perimetral Rope diameter | Mesh | Dimension | Knot Galvanization Class |
|---|---|---|---|---|
| (mm) | (mm) | (mm) | (m) | |
| 10 | 10 | 400x400 | 6x3 | A |
| 10 | 10 | 300x300 | 6x3 | A |

### 2.5.4 Special requirements:

a) The Manufacturer / Supplier should have production facility for manufacturing rhomboidal wire rope net panelin India. Manufacturing facility shall be certified for ISO 9001:2008 Quality Management System certification

b) The wire rope net panelrock fall protection system shall have demonstrated satisfactory performance in similar applications and capacities in India or abroad. Valid documentary proof showing the supply of rhomboidal wire rope net panel to at least one project in India / abroad in the form of case study / Certificate from client shall be submitted.

c) The Manufacturer / supplier shall have a demonstrated capability of providing technical support and design assistance for rock fall protection works.

d) The Manufacturer / Supplier should have in-house testing facility to conduct the key testing on wire rope net panels.

e) The Manufacturer / Supplier should have supplied Rhomboidal wire rope panels with double knot connection at junctions not less than 18000 sq.m for a single project in India.

f) The Manufacturer / Supplier shall submit documentary proof of adoption of the proposed technology on at least one project in India along with proposal.

g) The Manufacturer / Supplier should not have a history of poor performance such as abandoning the works, financial failures, blacklisting. If it is observed, Manufacturer / Supplier will be automatically disqualified

**** The Bidder shall submit the sample of Rhomboidal wire rope panels with double knot connection at junctions of minimum size 6m x 3m along with the bid during submission as per the technical specifications.

### 2.5.5 Installation:

The wire rope net panels are generally used in combination with rock bolting. The wire rope net panels shall carefully be draped over the slope and the rock bolts shall be installed, keeping the rock bolt under the mesh intersection. Wherever this is not possible, the rock bolt shall be enclosed within an additional steel cable provided as shown in the manufacturer's installation methodology. The wire rope net panels shall be connected to the top anchors with help of top support rope of 16mm diameter and with anchors at base of the slope with help of bottom support rope of 12mm diameter. Care should be taken to tighten the rhomboidal wire rope net panel mesh around the rock bolt by pulling manually. Longitudinally adjacent panels shall be connected with a steel wire rope, which acts as a lacing cable. The wire rope net panels shall be ideally used in combination with mechanically woven double twist hexagonal wire mesh netting laid on the inner side of wire rope net panels.

After completion of wire rope net panel installation, a heavily zinc coated base plate of a 200x200x12mm size shall be tightened on the rock/soil anchor, taking care that the base plate maintains a tight contact with as much with the wire rope net panel as possible. Manufacturer's installation guideline shall be referred for details.

### 2.5.6 Testing and Acceptance criteria:

Testing shall be done on raw material as per testing plan indicated in Table 4. The material should get approved from the client before the actual start of supply. The manufacturer of the wire rope net panels shall provide Manufacturers Test Certificate for the material with every lot/shipment. The Manufacturers Test Certificate shall be provided for certifying that wire rope net panels rock fall protection system conforms to all the technical and special requirements.

**Table 4 Testing Plan**

| Sr. No | Test | Reference | Frequency of Testing | Sample size | Remarks |
|---|---|---|---|---|---|
| | **ROPE** | | | | |
| 1 | Tensile test on wire rope | IS 2266/ISO 2048 | Once | Three | At wire rope manufacturer lab |
| 2 | Zinc mass of wire used in rope | IS 1835 | Once | Three | At wire rope manufacturer lab |

| Sr. No | Test | Reference | Frequency of Testing | Sample size | Remarks |
|---|---|---|---|---|---|
| | KNOT WIRE | | | | |
| 3 | Tensile strength & Elongation% | EN 10223 | Once | Three | At wire rope net panel manufacturer lab |
| 4 | Mass of Zinc and adhesion | EN 10244 | Once | Three | At wire rope net panel manufacturer lab |
| 5 | Physical dimension of Rhomboidal Wire Rope Net Panel | TDS & Visual checking | | | At wire rope net panel manufacturer lab |
| | KNOT | | | | |
| 6 | Knot tear resistance | Manufacturer procedure | Once | Three | At wire rope net panel manufacturer lab |
| Note: | Testing of wire and rope shall be done on samples from raw material | | | | |

### 2.5.7 Method of Measurement:

Quantity of wire rope net panels shall be determined from cross sections and the linear distance, and paid for under the appropriate bid items

### 2.5.8 Basis of Payment

The quantity of Rhomboidal wire rope panels to be paid for will be determined by the area in Sq.m installed and not the area covered by the netting, owing to wasting due to overlap as well as wastages due to non-conforming surfaces and non-rectangular shapes. The Contract price paid per Unit of Area in Square meter corresponding to supply quantity giving details of height and width of each rhomboidal wire rope panel complete in place of as per Standard specifications and the Special requirements and as directed by the Engineer- In- Charge.

# *4.* Instrumentation and Monitoring

## 4.1 Introduction

Since the landslide rehabilitation / treatment work is to be done by rebuilding of reinforced valley slope of very high heightwhich is very much unique in nature and also be the first time in INDIA, so it is very much necessary to monitor the behaviour of the reinforced valley slope structure during construction and also during post construction i.e. serviceability period of minimum 3 years.

## 4.2 Parameters to be Monitored

The parameters of the reinforced valley slope which are required to be monitored are as given below:

- Horizontal and vertical movement of slope face, surface and overall structure.
- Performance of any structure supported by the reinforced valley slope.

- Deterioration of facing and other soil nailing elements.
- Polymeric reinforcement and Nail force magnitude, maximum polymeric reinforcement and nail force and also change of force distribution with time.
- Drainage behavior of ground.

### 4.3 Composite Slope Performance Monitoring Plan

To monitor the above said different parameters of the valley slope behavior,the instruments namely "SlopeInclinometer", "Strain Gauges", "Earth Pressure / Load Cells", Piezometers and Settlement Gaugesare installed at various positions on the composite structure for such monitoring purpose.

### 4.4 Composite Slope Performance Monitoring Instruments

Composite slope performance monitoring instruments should be selected based on the parameters to be measured, the instrument's reliability and simplicity, and the instrument's compatibility with thereadout devices specified for the project. A brief discussion of the various types of monitoringinstruments typically employed for assessing soil nail wall performance is provided below.

***Inclinometers***

Inclinometers, preferably installed at Toe, midslope and Top of valley slope restoration, provide the most comprehensive data on wall deformations. Inclinometers are a well-established technology and are commercially available from several manufacturers.

***Strain Gauges***

Soil nails and polymeric reinforcement instrumented with strain gauges allow assessment of the soil nail load distribution as the excavation progresses and after the completion of the soil nail slope installation. Conventional strain gauges will measure loads carried by both the grout and nail and will thereby depend to some extent on the in-place deformational characteristics of the grout and the interaction between the grout and drillhole wall, both of which are difficult to evaluate.

This approach could eliminate data interpretation problems associated with grout/nail interaction. It has been suggested that some type of mechanical assembly could be installed at each gauge location to break the grout column and ensure that all load is transferred to the nail bar at this point. Because the grout has some tensile strength, it will carry a portion of the total load. Thus, while strain measurements in the grout and nail are readily achievable, conversion of these measurements into nail loads is difficult to achieve with accuracy.

**Reflectors**

Slope face deformation can be measured directly by optical surveying methods reflector prisms attached to selected nails allow for electronic deformation measurements of discreet points on the soil nail wall face. The survey system is typically capable of measuring horizontal and vertical displacements to accuracy of 3 mm (0.12 in.) or better.

**Load Cells**

Load cells installed at the Soil Nail Head and Polymeric Reinforcement Facing are used to provide reliable information on the actual loads that are developed at the facing.

## Type of Instrumentation

| **Type of Instrumentation** | | |
|---|---|---|
| **Sl.No.** | **Type of instrument** | **Numbers** |
| 1 | Reflector | **Type: bi-reflex target model**<br>**Measuring Range (m): 12m to 140m** (Maximum measuring distance is highly dependent<br>on atmospheric conditions and EDM Model used)<br>**Manufacturing Accuracy: ± 0.1 mm**<br>**Overall Accuracy: ± 1 mm** (within the measuring section)<br>**The targets must be replaceable without loss of accuracy.** |
| 2 | Strain Gauges | **Standard Type with Accuracy** |
| 3 | Inclinometer | **Type: Vertical In-Place Inclinometer system (with sensors)**<br>**Accuracy: + 0.1% fs** (as tested under lab conditions)<br>**Range (degree): 15 0**<br>**Temperature Limit: -20 0C to 80 0C** |
| 4 | Piezometer | **Type: Vertical In-Place Inclinometer system (with sensors)**<br>**Accuracy: + 0.1% fs** (as tested under lab conditions)<br>**Range (degree): 15 0**<br>**Temperature Limit: -20 0C to 80 0C** |
| 5 | Load Cell | **Type: Vibrating wire type earth pressure cell**<br>**Accuracy: + 0.5% fs normal**<br>**Range (MPa): 0.5MPa -10MPa**<br>**Resolution: 10 kPa ( with read-out unit)**<br>**Operating temperature range: -10 to 70oC**<br>**Compensated temperature range: 0 to 55 oC**<br>**Over Range Limit: 150% of range** (Maximum over pressure without damage) |

## Methodology

- Initially, one reading shall be captured per week for first three months. Once readings are observed to be stabilized measuring frequency can be shifted to two readings in a month. After that one reading per month can be captured.
- Monitoring of all the instruments will be done through automatic monitoring and recording devices. Before installing the instruments, Contractor should make sure that the calibration period of all the instruments to be installed is sufficient enough that the instruments will not require calibration for 05 years because once the instruments are embedded, calibration may not be possible.

- Monitoring of all the instruments will be for a period of 05 years which is almost equal to the construction period & the defect liability period of the contractor. However, it is advisable that the monitoring continues further at least 10 more years after DLP.

**Analysis of the Data**

1. **Facia Movement:** Reading from EDM shall beanalyzed for determining the movement of facia in vertical, horizontal & lateral direction.
2. **Existing Slope movement:** On regular basis, the data from inclinometer inserted in the existing nailed portion shall be analyzed. Data shall be plotted with respect to height of structure.
3. **Reinforced Fill / Block movement:** Readings from inclinometer placed in reinforced zone shall be analyzed. Data shall be plotted with respect to height of structure & shall be compared with movement of retained portion. Soil Extensometer also gives the extension happened in reinforced fill/soil.
4. **Pore water pressure:** Reading from piezometer placed in existing slope fill & reinforced fill shall be recorded & plotted against time. Also, graphs for pore water pressure shall indicate the rainfall in a particular month or span.
5. **Earth Pressure:** Readings from earth pressure cells placed near facia shall be analyzed. These readings shall be superimposed on cross section of slope.

4.5 **Deviations from the Specifications and Standards**

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 “Agreement” respectively.

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.

The details of proposed rehabilitation / treatment/restoration as mentioned in schedule B shall supersede the provisions of Manual.

SCHEDULE - E

*(See Clauses 2.1 and 14.2)*

# MAINTENANCE REQUIREMENTS

## 1 Maintenance Requirements

1.1 The Contractor shall, at all times maintain the Project Highway in accordance with the provisions of this Agreement, Applicable Laws and Applicable Permits.

1.2 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-fulfillmentof 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.

1.3 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 bridges, culverts and drainage system before [1st June] every year in accordance with the guidelines contained in IRC: SP35. 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 June] 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 September] 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 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.

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.

| **Nature of Defect or deficiency** | | **Time limit for repair/rectification** |
|---|---|---|
| **Hill side Treatment** | | |
| a) | Cleaning of Debris | 3 days |
| b) | Catch drawing and catch pits | 3 days |
| c) | PVC Pipes | 7 days |
| d) | Damage to Hydroseeding | 30 days |
| e) | Damage to HR-30/50 and Rhomboidal wire | 15 days |
| f) | Damage to RR Breast wall | 7 days |
| g) | Cracks/Damage to shortCrete surface | 21 days |
| h) | Tightening of SDA plate | 5 days |
| **Valley side** | | |
| i) | Damage to Valley side work | 10 days |

The failure to address above measures for any of the defects/deficiency may attract reduction in payment as per Schedule M.

SCHEDULE - F
*(See Clause 3.1.7(a))*

# APPLICABLE PERMITS

## 1 Applicable Permits

1.1 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 Panchayats and Pollution Control Board for installation of crushers;

(c) Licence for use of explosives;

(d) Permission of the State Government for drawing water from river/reservoir;

(e) Licence 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) Permission from the railway department from respective department,and

(j) Any other permits or clearances required under Applicable Laws.

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

SCHEDULE-G
*(See Clauses 7.1.1, 7.5.3 and 19.2)*

# FORM OF BANK GUARANTEE

Annex-I
*(See Clause 7.1.1)*

## PERFORMANCE SECURITY/ ADDITIONAL PERFORMANCE SECURITY

To

_____ [name of Authority]

_____ [address of Authority]

WHEREAS_____[name and address of Contractor] (hereafter called the "Contractor") has undertaken, in pursuance of Letter of Acceptance (LOA) No. _Dated__ for construction of [name of the Project] (hereinafter called the "Contract")

AND WHEREAS the Contract requires the Contractor to furnish an {Performance Security/ Additional Performance Security} for due and faithful performance of its obligations, under and in accordance with the Contract, during the {Construction Period/ Defects Liability Period and Maintenance Period} in a sum of Rs….. cr. (Rupees ……..….. crore) (the "**Guarantee Amount**"[1]).
AND WHEREAS 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 Contract, 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 sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of [General Manager of National Highways & Infrastructure Development Corporation Limited], 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 Contract 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 Contract 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.

[1] Guarantee Amount for Performance Security and Additional Performance Security shall be calculated as per Contract.

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 Contract or to extend the time or period for the compliance with, fulfillment and/ or performance of all or any of the obligations of the Contractor contained in the Contract 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 Contract 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 Contractor for the fulfillment, compliance and/or performance of all or any of the obligations of the Contractor under the Contract.

7. 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.

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.

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 authorized to receive such notice and to effect payment thereof forthwith, and if sent

[$]Insert date atleast 2 (two) years from the date of issuance of this Guarantee (in accordance with Clause 2.21 of the RFP). The Contractors can submit the BG for periods of two years at one time and keep on renewing the same till the DLP is over if they have problems in getting the BG in one go for the entire DLP.

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.

12. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

13. This guarantee shall also be operatable at our……Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

14. Intimation regarding issuance of this Bank Guarantee shall be sent to Authority's Bank through SFMS gateway as per the details below:

| S.No. | Particulars | Details |
|---|---|---|
| 1 | Name of Beneficiary | National Highways & Infrastructure Development Corporation Limited |
| 2 | Beneficiary Bank Account No. | 90621010002659 |
| 3 | Beneficiary Bank Branch | IFSC SYNB0009062 |
| 4 | Beneficiary Bank Branch Name | Transport Bhawan, New Delhi |
| 5 | Beneficiary Bank Address | Canara Bank (erstwhile Syndicate Bank) transport Bhawan, 1st Parliament Street, New Delhi-110001 |

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)

Annex – II
*(Schedule - G)*
*(See Clause 7.5.3)*

# FORM FOR GUARANTEE FOR WITHDRAWAL OF RETENTION MONEY

To

_____ [name of Authority]

_____ [address of Authority]

WHEREAS:

(A) _____ [name and address of contractor] (hereinafter called the "**Contractor**") and **.....,** (hereinafter called the**"Authority"**) have entered into an agreement (hereinafter called the "**Agreement**") for the Construction of [name of the Project] through an Engineering Procurement and Construction (EPC) Contract basis, subject to and in accordance with the provisions of the Agreement

(B) In accordance with Clause 7.5.3 of the Agreement, the Contractor may withdraw the retention money (hereinafter called the "**Retention Money**") after furnishing to the Authority a bank guarantee for an amount equal to the proposed withdrawal.

(C) We, ……..through our branch at ……. (the "**Bank**") have agreed to furnish this bank guarantee (hereinafter called the "**Guarantee**") for the amount of Rs. -------- cr. (Rs.----------crore) (the "**Guarantee Amount**").

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

1. The Bank hereby unconditionally and irrevocably 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 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 for 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 Retention Money and 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 Retention Money.

7. 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.

8. The Guarantee shall cease to be in force and effect 90 (ninety) days after the date of the Completion Certificate specified in Clause 12.4 of the Agreement.

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 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.

12. This guarantee shall also be operatable at our…….Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

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.

(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.

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

# FORM FOR GUARANTEE FOR ADVANCE PAYMENT

To

_____ [name of Authority]

_____ [address of Authority]

WHEREAS:

(A) _____ [name and address of contractor] (hereinafter called the "**Contractor**") and **.....,** (hereinafter called the**"Authority"**) have entered into an agreement (hereinafter called the "**Agreement**") for the Construction of [Name of the Project] through an Engineering Procurement and Construction (EPC) Contract 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 free 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 three 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 suchinstallment 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/third}installment of the Advance Payment is Rs. ------ cr. (Rupees ------ crore) andthe 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 sum specified therein.

[$] The Guarantee Amount should be equivalent to 110% of the value of the applicable instalment.

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 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.

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 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.

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 Advance Payment.

7. 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.

8. The Guarantee shall cease to be in force and effect on ****.$ Unless a demand or claim

$ 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).

under this Guarantee is made in writing on or before the aforesaid date, the Bank shall be discharged from its liabilities hereunder.

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 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.

12. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

13. This guarantee shall also be operatable at our…….Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

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.

(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.

SCHEDULE - H

*(See Clauses10.1.4 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:

| S.No | Description of Work | Percentage weightage to the Contract Price | Description of Items | Percentage weightage item wise |
|---|---|---|---|---|
| 1 | **Sinking Zone Kameda-01** | 4.54 | Loose scaling & removal of vegitation on hill side slopes. | 1.99 |
| | | | Providing & Laying of PCC (M-15 Grade) for base padstal of RR Retaining wall of Hill side. And Supplying & Placing of Randam rubble Masonry in Hill side . | 16.39 |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite | 28.72 |
| | | | Providing & Spraying 100 mm thick shotcrete. | 28.74 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn )including grouting for full length of the drill hole . | 16.97 |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side RR wall. | 1.32 |

| | | | | |
|---|---|---|---|---|
| | | | Hydroseeding/BioEngineering works for slope protection of hill side through vegitation. | 3.38 |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,Inclinometer etc. | 2.49 |
| 2 | **Sinking Zone Kameda - 02** | 5.31 | Earthwork in excavation ordinary rock/displaced muck in valley side by mechenical means | 10.00 |
| | | | Providing & Laying of PCC (M-15 Grade) for bottom Padstal of Tarramesh wall on valley side And Supplying & Placing of Randam rubble Masonry in Hill side | 12.19 |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite | 25.42 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn )including grouting for full length of the drill hole . | 20.29 |
| | | | Supplying & placing of Gabion unit is made with double twisted hexagonal shaped steel woven wire mesh,mechenically edged &selvedged,mesh type 10*12. | 10.61 |
| | | | Supplying & Installation of polyester needle punched non woven geotextile as filter media behind gabion facia As per MoRTH 700 Type-III geotextile. | 0.37 |

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| | | | Providing & backfilling behind gabion facia of terramesh wall with compection of each layer (.80 m) or as specified. | 16.84 |
| | | | Supplying & placing of high strength geogrid of long term design strength 61.37 KN/m Paralink 100 grade as specified. | 1.00 |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill & valley side wall. | 1.58 |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,load cell etc. | 1.70 |
| 3 | **landslide Zone at Gauchar (Near ITBP Camp)** | 18.03 | Earthwork in excavation ordinary rock/deposited at slope and bottom of slide by mechenical means | 0.48 |
| | | | Loose scaling & removal of vegitation on hill side slopes. | 0.25 |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 9.64 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 68.98 |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia. | 14.91 |

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| | | | Supplying & placing of Gabion unit is made with double twisted hexagonal shaped steel woven wire mesh,mechenically edged &selvedged,mesh type 10*12. | 1.08 |
| | | | Supplying & Installation of polyester needle punched non woven geotextile as filter media behind gabion facia. | 0.06 |
| | | | Supply & Installation of the top and bottom support rope of 16 mm. | 0.05 |
| | | | Providing & Spraying 100 mm thick shotcrete. | 3.67 |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in shot creete area. | 0.26 |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,load cell etc. | 0.63 |
| 4 | **landslide Zone at Dharinagar Gauchar** | 3.26 | Loose scaling & removal of vegitation on hill side slopes. | 0.41 |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 17.14 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 73.59 |
| | | | Providing & Laying of PCC (M-15 Grade) for base padstal of RR Retaining wall of Hill side And Supplying & Placing of Randam rubble Masonry. | 6.52 |

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| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in RR wall on hill side area. | 0.92 |
| | | | PCC Drain for drainage from top surface to bottom drain through cascades. | 1.42 |
| 5 | **Minor Bridge near BRO DETT Gauchar** | 11.10 | 1.(i) Earthwork in excavation of foundation for structure complete all lead & lift. | 1.70 |
| | | | 1.(ii) Backfilling behind abutment,wing wall and retainining wall etc. | |
| | | | 1.(iii) Provide & laying plain concrete complete for M15 Grade. | |
| | | | 2. (i) Provide & laying Reinforced concrete complete for M35 Grade. | 57.21 |
| | | | 2. (ii) Providing & fixing in position HYSD Fe 500 d grade reinforcement bars in foundation stuctrure& substructures complete | |
| | | | 3. (i) Providing, fabricating & erecting of strucral steel IS-2062 ,B grade fe 410 B | 38.35 |
| | | | 3. (ii) Supplying & fixing of bearing complete as specified. | |
| | | | 4. (i) Supply & fixing of expension joints complete as per specified strip seal type (50mm) | 1.92 |
| | | | 4. (ii) Reinforced concrete cement crash barrier complete including reinforcement as TS | |
| | | | 4. (iii) Construction of precast RCC Railing of M30 grade vertical post as specified | |
| | | | 5. (i) Provide & laying 75 mm cement concrete wearing coat over bridge deck | 0.82 |
| 6 | **Landslide zone at Karnpraya** | 24.81 | Loose scaling & removal of vegitation on hill side slopes. | 0.49 |

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| | **g-1** | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite. | 13.32 |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 24.03 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn )including grouting for full length of the drill hole . | 53.62 |
| | | | Providing & Spraying 100 mm thick shotcrete with all material,manpowere,machinery etc. | 5.55 |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side And Supplying& Placing of Randam rubble Masonry in Hill side. | 2.29 |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,load cell etc. | 0.23 |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.47 |
| 7 | **Landslide zone at Karnpraya g-2** | 15.43 | Loose scaling & removal of vegitation on hill side slopes. | 0.70 |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite. | 13.28 |

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| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 23.96 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ) | 51.82 |
| | | | Providing & Spraying 100 mm thick shotcrete with all material,manpowere,machinery etc. | 7.38 |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side And Supplying & Placing of Randam rubble Masonry with all material ,manpower & machinery with 1:6 mortar in Hill side. | 2.53 |
| | | | Supplied & installation of PPR pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.33 |
| 8 | **Landslide zone at Langasu** | 0.80 | Loose scaling & removal of vegitation on hill side slopes. | 1.68 |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 14.49 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 49.72 |

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| | | | Providing & Spraying 100 mm thick shotcrete . | 19.34 |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side AndSupplying& Placing of Randam rubble Masonry . | 11.03 |
| | | | Supplied & installation of PVC pipe150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 3.74 |
| 9 | **Landslide zone at Devlibagad-1** | 9.11 | Loose scaling & removal of vegitation on hill side slopes. | 0.89 |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 11.93 |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 21.52 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 51.20 |
| | | | Providing & Spraying 100 mm thick shotcrete | 9.55 |

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| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side AndSupplying& Placing of Randam rubble Masonry . | 3.53 |
| | | | PCC Drain conconcrte M-25 at Top surface of slope for surface water diversion on both side . | 0.72 |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.66 |
| 10 | **Landslide zone at Devlibagad-2** | 7.61 | Loose scaling & removal of vegitation on hill side slopes. | 0.57 |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite. | 12.23 |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 22.07 |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ) | 52.49 |
| | | | Providing & Spraying 100 mm thick shotcrete. | 9.52 |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side and Supplying & Placing of Randam rubble Masonry with all material ,manpower & machinery with 1:6 mortar in Hill side. | 2.33 |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.79 |

### 1.2.1 Procedure of payment

| S.No | Description of Work | Percentage weightage to the Contract Price | Description of Items | Percentage weightage item wise | Payment Procedure |
|---|---|---|---|---|---|
| 1 | **Sinking Zone Kameda-01** | 4.54 | Loose scaling & removal of vegitation on hill side slopes. | 1.99 | Payment shall be made on single stage on completion |
| | | | Providing & Laying of PCC (M-15 Grade) for base padstal of RR Retaining wall of Hill side. And Supplying & Placing of Randam rubble Masonry in Hill side . | 16.39 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% with specified height. |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite | 28.72 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment shall be made after minimum completion of 20% of total area covered. |
| | | | Providing & Spraying 100 mm thick shotcrete. | 28.74 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtr Payment of each stage shall be made after minimum completion of 20% of total quantity. |

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| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn )including grouting for full length of the drill hole . | 16.97 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side RR wall. | 1.32 | Payment shall be made on single stage on completion |
| | | | Hydroseeding/BioEngineering works for slope protection of hill side through vegitation. | 3.38 | Payment shall be made on pro rata basis on completion of a stage measured in Sqm meter length. Payment of each stage shall be made after minimum completion of 50% of total area cover. |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,Inclinometer etc. | 2.49 | 75% Payment shall be released after successful installation of instrument. Remaining 25% shall be released in equal instalment after each quarter in next 4 years/DLP. |
| 2 | **Sinking Zone Kameda - 02** | 5.31 | Earthwork in excavation ordinary rock/displaced muck in valley side by mechenical means | 10.00 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment shall be made after minimum completion of 50% length with 100% height of total length |

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| | | | Providing & Laying of PCC (M-15 Grade) for bottom Padstal of Tarramesh wall on valley side And Supplying & Placing of Randam rubble Masonry in Hill side | 12.19 | Payment shall be made on pro rata basis on completion of a stage measured in running meters length. Payment of each stage shall be made after minimum completion of 20% with specified height. |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite | 25.42 | Payment shall be made on pro rata basis on completion of a stage measured in running meters length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn )including grouting for full length of the drill hole . | 20.29 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |
| | | | Supplying & placing of Gabion unit is made with double twisted hexagonal shaped steel woven wire mesh,mechenically edged &selvedged,mesh type 10*12. | 10.61 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% with specified height. |
| | | | Supplying & Installation of polyester needle punched non woven geotextile as filter media behind gabion facia As per MoRTH 700 Type-III geotextile. | 0.37 | Payment shall be made on single stage on completion |

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| | | | Providing & backfilling behind gabion facia of terramesh wall with compection of each layer (.80 m) or as specified. | 16.84 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of20%with specified height. |
| | | | Supplying & placing of high strength geogrid of long term design strength 61.37 KN/m Paralink 100 grade as specified. | 1.00 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of20% of total area covered. |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill & valley side wall. | 1.58 | Payment shall be made on single stage on completion |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,load cell etc. | 1.70 | 75% Payment shall be released after successful installation of instrument. Remaining 25% shall be released in equal instalment after each quarter in next 4 years/DLP. |
| 3 | **landslide Zone at Gauchar (Near ITBP Camp)** | 18.03 | Earthwork in excavation ordinary rock/deposited at slope and bottom of slide by mechenical means | 0.48 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment shall be made after minimum completion of 50% length with 100% hight of total length |
| | | | Loose scaling & removal of vegitation on hill side slopes. | 0.25 | Payment shall be made on single stage on completion |

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| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 9.64 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 68.98 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia. | 14.91 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Supplying & placing of Gabion unit is made with double twisted hexagonal shaped steel woven wire mesh,mechenically edged &selvedged,mesh type 10*12. | 1.08 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20%with specified height. |
| | | | Supplying & Installation of polyester needle punched non woven geotextile as filter media behind gabion facia. | 0.06 | Payment shall be made on single stage on completion |
| | | | Supply & Installation of the top and bottom support rope of 16 mm. | 0.05 | Payment shall be made on single stage on completion |

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| | | | Providing & Spraying 100 mm thick shotcrete. | 3.67 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtrPayment of each stage shall be made after minimum completion of20% of total quantity. |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in shot creete area. | 0.26 | Payment shall be made on single stage on completion |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,load cell etc. | 0.63 | 75% Payment shall be released after successful installation of instrument. Remaining 25% shall be released in equal instalment after each quarter in next 4 years/DLP. |
| 4 | **landslide Zone at Dharinagar Gauchar** | 3.26 | Loose scaling & removal of vegitation on hill side slopes. | 0.41 | Payment shall be made on single stage on completion |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 17.14 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 73.59 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |

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| | | | Providing & Laying of PCC (M-15 Grade) for base padstal of RR Retaining wall of Hill side And Supplying & Placing of Randam rubble Masonry. | 6.52 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% with specified height. |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in RR wall on hill side area. | 0.92 | Payment shall be made on single stage on completion |
| | | | PCC Drain for drainage from top surface to bottom drain through cascades. | 1.42 | 75% Payment shall be released after successful installation of instrument. Remaining 25% shall be released in equal instalment after each quarter in next 4 years/DLP. |
| 5 | **Minor Bridge near BRO DETT Gauchar** | 11.10 | 1.(i) Earthwork in excavation of foundation for structure complete all lead & lift. | 1.70 | Payment shall be made on single stage on completion of 100% work |
| | | | 1.(ii) Backfilling behind abutment,wing wall and retainining wall etc. | | |
| | | | 1.(iii) Provide & laying plain concrete complete for M15 Grade. | | |
| | | | 2. (i) Provide & laying Reinforced concrete complete for M35 Grade. | 57.21 | Payment shall be made on single stage on completion of 100% work |
| | | | 2. (ii) Providing & fixing in position HYSD Fe 500 d grade reinforcement bars in foundation stuctrure& substructures complete | | |

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| | | | 3. (i) Providing, fabricating & erecting of strucral steel IS-2062 ,B grade fe 410 B | 38.35 | Payment shall be made on single stage on completion of 100% work |
| | | | 3. (ii) Supplying & fixing of bearing complete as specified. | | |
| | | | 4. (i) Supply & fixing of expension joints complete as per specified strip seal type (50mm) | 1.92 | Payment shall be made on single stage on completion of 100% work |
| | | | 4. (ii) Reinforced concrete cement crash barrier complete including reinforcement as TS | | |
| | | | 4. (iii) Construction of precast RCC Railing of M30 grade vertical post as specified | | |
| | | | 5. (i) Provide & laying 75 mm cement concrete wearing coat over bridge deck | 0.82 | Payment shall be made on single stage on completion of 100% work |
| 6 | **Landslide zone at Karnpraya g-1** | 24.81 | Loose scaling & removal of vegitation on hill side slopes. | 0.49 | Payment shall be made on single stage on completion |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite. | 13.32 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |

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| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 24.03 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn )including grouting for full length of the drill hole . | 53.62 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |
| | | | Providing & Spraying 100 mm thick shotcrete with all material,manpowere,machinery etc. | 5.55 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtrPayment of each stage shall be made after minimum completion of20% of total quantity. |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side And Supplying& Placing of Randam rubble Masonry in Hill side. | 2.29 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% with specified height. |
| | | | Supplying,Installed of Monitoring instruments as Pizometer,load cell etc. | 0.23 | 75% Payment shall be released after successful installation of instrument. Remaining 25% shall be released in equal instalment after each quarter in next 4 years/DLP. |

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| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.47 | Payment shall be made on single stage on completion |
| 7 | **Landslide zone at Karnprayag-2** | 15.43 | Loose scaling & removal of vegitation on hill side slopes. | 0.70 | Payment shall be made on single stage on completion |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite. | 13.28 | Payment shall be made on pro rata basis on completion of a stage measured in running metter length. Payment of each stage shall be made after minimum completion of20% of total area covered. |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 23.96 | Payment shall be made on pro rata basis on completion of a stage measured in running metter length. Payment of each stage shall be made after minimum completion of20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ) | 51.82 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of20% of total length of SDA. |
| | | | Providing & Spraying 100 mm thick shotcrete with all material,manpowere,machinery etc. | 7.38 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtrPayment of each stage shall be made after minimum completion of20% of total quantity. |

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| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side And Supplying & Placing of Randam rubble Masonry with all material ,manpower & machinery with 1:6 mortar in Hill side. | 2.53 | Payment shall be made on pro rata basis on completion of a stage measured in running metter length. Payment of each stage shall be made after minimum completion of20%with specified height. |
| | | | Supplied & installation of PPR pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.33 | Payment shall be made on single stage on completion |
| 8 | **Landslide zone at Langasu** | 0.80 | Loose scaling & removal of vegitation on hill side slopes. | 1.68 | Payment shall be made on single stage on completion |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 14.49 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 49.72 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |
| | | | Providing & Spraying 100 mm thick shotcrete . | 19.34 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtrPayment of each stage shall be made after minimum completion of 20% of total quantity. |

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| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side AndSupplying& Placing of Randam rubble Masonry . | 11.03 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% with specified height. |
| | | | Supplied & installation of PVC pipe150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 3.74 | Payment shall be made on single stage on completion |
| 9 | **Landslide zone at Devlibagad-1** | 9.11 | Loose scaling & removal of vegitation on hill side slopes. | 0.89 | Payment shall be made on single stage on completion |
| | | | Supplying & installation of Steel grid HR-30/50 /Steel wire grid mesh Geocomposite made of mechenically woven double twisted Hexagonal shaped steel wiremesh. | 11.93 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 21.52 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ). | 51.20 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA |

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| | | | Providing & Spraying 100 mm thick shotcrete | 9.55 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtrPayment of each stage shall be made after minimum completion of 20% of total quantity. |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side AndSupplying& Placing of Randam rubble Masonry . | 3.53 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20%with specified height. |
| | | | PCC Drain conconcrte M-25 at Top surface of slope for surface water diversion on both side . | 0.72 | Payment shall be made on single stage on completion |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.66 | Payment shall be made on single stage on completion |
| 10 | **Landslide zone at Devlibagad-2** | 7.61 | Loose scaling & removal of vegitation on hill side slopes. | 0.57 | Payment shall be made on single stage on completion |
| | | | Supplying & installation of Steel grid HR-50 /Steel wire grid mesh Geocomposite. | 12.23 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |

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| | | | Providing & laying of galvenised steel rope net of square shape having mesh opening 300 mm *300 mm with wire dia meter 9.0 mm dia . | 22.07 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20% of total area covered. |
| | | | Supplying & installation of Self drilling Anchors (32 mm dia, Yeild load >230 kn ) | 52.49 | Payment shall be made on pro rata basis on completion of a stage measured in running meters. Payment of each stage shall be made after minimum completion of 20% of total length of SDA. |
| | | | Providing & Spraying 100 mm thick shotcrete. | 9.52 | Payment shall be made on pro rata basis on completion of a stage measured in cube mtr Payment shall be made after minimum completion of 20% of total quantity. |
| | | | Providing & Laying of PCC (M-15 Grade) for base of RR wall on Hill side and Supplying & Placing of Randam rubble Masonry with all material ,manpower & machinery with 1:6 mortar in Hill side. | 2.33 | Payment shall be made on pro rata basis on completion of a stage measured in running meter length. Payment of each stage shall be made after minimum completion of 20%with specified height. |
| | | | Supplied & installation of PVC pipe 150 mm dia minimum for drainage system in Hill side shotcrete area and wall. | 0.79 | Payment shall be made on single stage on completion |

SCHEDULE -I
*(See Clause 10.2.4)*

# 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.

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:

- Drawing showing plan and sectional details of valley slope restoration scheme.
- Drawings showing details of soil nail/anchor/soil reinforcement along with its connection details.
- Drawings of drainage work showing drains, details of proposed new culverts and downstream protection works for all the culverts to be adopted for culverts.
- Drawings showing details of erosion protection scheme to be adopted for protection of rebuilt valley slope and below the toe of proposed restoration scheme

SCHEDULE - J
*(See Clause 10.3.2)*

# 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**

2.1 Project Milestone-I shall occur on the date falling on the 150th (one hundred and fiftieth) day from the Appointed Date (the "**Project Milestone-I**").

2.2 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 30% (thirty per cent) of the Contract Price.

**3 Project Milestone-II**

3.1 Project Milestone-II shall occur on the date falling on the 240th (two hundred and fortieth) day from the Appointed Date (the "**Project Milestone-II**").

3.2 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 60% (sixty per cent) of the Contract Price.

**4 Project Milestone-III**

4.1 Project Milestone-III shall occur on the date falling on the [365th (three hundred sixty fifth)] day from the Appointed Date (the "**Project Milestone-III**").

4.2 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 100% (hundred per cent) of the Contract Price.

**5 Scheduled Completion Date**

5.1 The Scheduled Completion Date shall occur on the [365th (three hundred sixty fifth)]day from the Appointed Date.

5.2 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 12.1.2)*

# TESTS ON COMPLETION

**1 Schedule for Tests**

1.1 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.

1.2 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.

**2 Tests**

2.1 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 at the time of physical tests as per relevant IRC/ Code Manual].**

2.2 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 [2,000 (two thousand)] mm for each kilometre.

2.3 Tests on Nails/anchors: Load tests should be carried out as per relevant FHWA/BS codes for checking the strength of nail/anchor after installation.

2.4 Other tests: The Authority's Engineer may require the Contractor to carry out or cause to be carried additional tests, in accordance with the technical specifications and Good Industry Practice, for determining the compliance of the Project Highway with Specifications and Standards.

2.5 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.

2.6 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.

SCHEDULE-L

*(See Clause 12.2 and 12.4)*

# PROVISIONAL 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 construction of the [****section (km ** to km **) of National-Highway No. 55] (the **"Project Highway"**) on Engineering, Procurement andConstruction (EPC) basis through …… (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been undertaken to determine compliance of the Project Highway with the provisions of the Agreement.

2 Works that are incomplete on account of Time Extension have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement.In addition, certain minor works are incomplete and these are not likely to cause material inconvenience to the Users of the Project Highway or affect their safety. The Contractor has agreed and accepted that as a condition of this Provisional Certificate, it shall complete such minor works within 30 (thirty) days hereof. These minor works have also been specified in the aforesaid Punch List.

3 In view of the foregoing, I am satisfied that the Project Highway from km ** to km ** can be safely and reliably placed in service of the Users thereof, and in terms of the Agreement, the Project Highway is hereby provisionally declared fit for entry into operation on this the …… day of …….. 20…...

| | |
|---|---|
| ACCEPTED, SIGNED, SEALED | SIGNED, SEALED AND |
| AND DELIVERED | DELIVERED |
| For and on behalf of | For and on behalf of |
| CONTRACTOR by: | AUTHORITY's ENGINEER by: |
| (Signature) | (Signature) |

# 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 [construction of the ****section (km ** to km **) of National Highway No. 55] (the "**Project Highway**") on Engineering, Procurement and Construction (EPC) 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, 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…..

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

1.1 Monthly lump sum payments for maintenance shall be reduced in the case of non-compliance with the Maintenance Requirements set forth in Schedule-E.

1.2 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.

1.3 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

2.1 The following percentages shall govern the payment reduction:

| S. No. | Item/Defect/Deficiency | Percentage |
|---|---|---|
| **Hill side treatment** | | **10%** |
| a) | Cleaning of Debris | 10% |
| b) | Catch drawing and catch pits | 15% |
| c) | PVC Pipes | 10% |
| d) | Damage to Hydroseeding | 20% |
| e) | Damage to HR-30/50 and Rhomboidal wire | 15% |
| f) | Damage to RR Breast wall | 10% |
| g) | Cracks/Damage to shortCrete surface | |
| h) | Tightening of SDA plate | 5% |
| **Valley side** | | |
| i) | Damage to Valley side work | 10% |

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

R=P/IOO x M x L1/L

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

M = Monthly lump-sum payment in accordance with the Bid

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.

SCHEDULE - N
*(See Clause 18.1.1)*

# SELECTION OF AUTHORITY'S ENGINEER

## 1 Selection of Authority's Engineer

1.1 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.

1.2 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

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

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 Authorityshall not be eligible for appointment as Authority's Engineer.

Annex – I
*(Schedule - N)*

# TERMS OF REFERENCE FOR AUTHORITY'S ENGINEER

## 1 Scope

1.1 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 between the [name and address of the Authority] (the "**Authority**") and ..... (the "Contractor") for the [Name of the Project] through an Engineering Procurement and Construction (EPC) Contract basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

1.2 The TOR shall apply to construction and maintenance of the Project Highway.

## 2 Definitions and Interpretation

2.1 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.

2.2 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.

2.3 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Agreement shall apply, *mutatis mutandis*, to this TOR.

## 3. General

3.1 The Authority'sEngineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.

3.2 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;

(b) any additional cost to be paid by the Authority to the Contractor;

(c) the Termination Payment; or

(d) any other matter which is not specified in (a), (b) or (c) above and which creates an obligation or liability on either Party for a sum exceeding Rs. 5,000,000 (Rs. fifty lakh).

3.3 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.

3.4 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.

3.5 The Authority's Engineer shall aid and advise the Authority on any proposal for Change of Scope under Article 13.

3.6 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.

## 4 Construction Period

4.1 During the Construction Period, the Authority's Engineer shall review 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 10.1.6. The Authority's Engineer shall complete such review 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.

4.2 The Authority'sEngineer shall review any revised Drawings sent to it by the Contractor and furnish its comments within 10 (ten) days of receiving such Drawings.

4.3 The Authority's Engineer shall review the Quality Assurance Plan submitted by the Contractor and shall convey its comments to the Contractor within a period of 21 (twenty-one) days stating the modifications, if any, required thereto.

4.4 The Authority's Engineer shall complete the review 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.

4.5 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.

4.6 The Authority'sEngineer 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.

4.7 The Authority'sEngineer 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.

4.8 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.

4.9 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 4.9, 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.

4.10 The Authority's Engineer shall test check at least 20 (twenty) percent of the quantity or number of tests prescribed for each category or type of test for quality control by the Contractor.

4.11 The timing of tests referred to in Paragraph 4.9, 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.

4.12 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.

4.13 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.

4.14 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.

4.15 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 12.4.

4.16 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.

4.17 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.

4.18 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 or Provisional Certificate, as the case may be. For carrying out its functions under this Paragraph 4.18 and all matters incidental thereto, the Authority's Engineer shall act under and in accordance with the provisions of Article 12 and Schedule-K.

## 5. Maintenance Period

5.1 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.

5.2 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.

5.3 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.

5.4 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.

5.5 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.

## 6 Determination of Costs and Time

6.1 The Authority's Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.

6.2 The Authority's Engineer shall determine the period of Time Extension that is required to be determined by it under the Agreement.

6.3 The Authority's Engineer shall consult each Party in every case of determination in accordance with the provisions of Clause 18.5.

**7. Payments**

7.1 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 10.2.4 (d).

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

7.3 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.

7.4 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.

**8. Other Duties and Functions**

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

**9 Miscellaneous**

9.1 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.

9.2 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.

9.3 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.

9.4 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.

9.5 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 19.4.1, 19.6.1, and 19.8.1)*

# 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 19.3.1 subsequent to the last claim;

(b) amounts reflecting adjustments in price for the aforesaid claim;

(c) theestimated 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 13.2.3 (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

  (i) Total of (i) and (ii) above.

(g) Net claim: (e) – (f) (iii);

(h) The amounts received by the Contractor upto the last claim:

  (i) For the Works executed (excluding Change of Scope orders);

  (ii) For Change of Scope Orders, and

  (iii) Taxes deducted

## 2. Monthly Maintenance Payment Statement

The monthly Statement for Maintenance Payment shall state:

(a) the monthly payment admissible in accordance with the provisions of the Agreement;

(b) the deductions for maintenance work not done;

(c) net payment for maintenance due, (a) minus (b);

(d) amounts reflecting adjustments in price under Clause 19.12; and

(e) 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.

SCHEDULE -P
*(See Clause 20.1)*

# INSURANCE

## 1. Insurance during Construction Period

1.1 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.

1.2 The insurance under paragraph 1.1 (a) and (b) 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 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

3.1 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 1and 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.

The insurance cover shall be not less than: Rs. [*****]

3.2 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.

# End of the Document