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Schedule-A
(See Clause 10.1)
SITE OF THE PROJECT

1. The Site

1.1 Site of the project shall include the land, building, structures and road works as described in Annex-I of this Schedule-A.

1.2 An inventory of the Site including the land, building, structures, road works, trees and any other immovable property on or attached to, the Site shall be prepared jointly by the MSRDCs Representative and the Contractor.
Annexure- 1
(Schedule-A)
THE SITE

1. **Site**
The site of the project comprises cable stayed bridge and approach bridges from Bandra to Worli and Toll Plaza. The land, carriageway and structures comprising the site are described below.

2. **Land**
   Deleted

3. **Carriageway**
The present project is a Eight lane divided carriageway.

4. **Major Bridges**
The site includes following major bridges:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Location/chaining</th>
<th>Span Detail</th>
<th>Total Length (In m)</th>
<th>Width (In m)</th>
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<tr>
<td>1</td>
<td>Main cable stayed bridge</td>
<td>1 x 600 m cable stayed bridge</td>
<td>600</td>
<td>2x14</td>
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<tr>
<td>2</td>
<td>On north side of cable stayed bridge</td>
<td>800 m long approach bridge</td>
<td>16 spans x 50 m</td>
<td>800</td>
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<tr>
<td>3</td>
<td>On south side of cable stayed bridge</td>
<td>200 m long approach bridge</td>
<td>4 spans x 50 m</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>350 m cable stayed bridge</td>
<td>1 x 350 m</td>
<td>350</td>
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<td></td>
<td></td>
<td>1400 m long Worli approach bridge</td>
<td>28 spans x 50 m</td>
<td>1400</td>
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<td></td>
<td></td>
<td>939 m long link bridge connecting main bridge to KAGK road near pratiksha building</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>1600 m long extension of approach bridge upto worli dairy</td>
<td>30 spans x 50 m</td>
<td>1600</td>
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<tr>
<td></td>
<td></td>
<td>939 m long link bridge connecting main bridge to KAGK road near Worli dairy</td>
<td></td>
<td>939</td>
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</tbody>
</table>

5. **Toll Plaza**
The site includes Toll Plaza on north side of cable stayed bridge having 389 m length. The plaza is having 16 no lanes, eight on either side. Toll plaza is designed for automatic toll collection system.
Schedule- B
(See Clause 2.1)
PROJECT FACILITIES

1. Project Facilities

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

   (a) Toll Plazas
       
       (i) Operation and maintenance of toll plaza having 16 no lanes.

   (b) Control room and Traffic aid Post

   (c) Exhibition centre

   (d) Landscaping

   (e) Road Signage, Signals and Marking

   (f) Street lights and lighting on bridge including Beacon and Toll Plaza

   (g) C.C.T.V. Cameras on Bridge and Toll Plaza

   (h) Lift at Pylon of main cable stayed bridge.

1.1.2 Project Facilities to be maintained by the Contractor as described in Annex- I of this Schedule- B.

1.2 Major Maintenance Works – Deleted

1.3 Exclusive of defects and deficiencies : Nil
Annex- I

(Schedule-B)

PROJECT FACILITIES FOR PROJECT HIGHWAY

1. Project Facilities

The Contractor shall maintain the Project Facilities described in this Annex-I. The Project Facilities shall include:

(a) Operation and maintenance of Toll Plazas
(b) Operation and maintenance of control room and Traffic aid post
(c) Operation and maintenance of exhibition centre
(d) Maintenance of Landscaping
(e) Maintenance Road Signage, signals and marking
(f) Operation and maintenance of Street lights over entire bridge including Beacon and C.C.T.V Cameras on Bridge and Toll Plaza.
(g) Lift at Pylon of main cable stayed bridge.

2. Description of Project Facilities

2.1 Each of the Project Facilities is briefly described below:

a) Toll Plazas

The existing Toll Plaza shall be maintained in accordance with manual of specification and standard.

b) Traffic Aid Post, Control Room and exhibition Centre shall be maintained at Toll Plaza in accordance with clause 17.3 of the Draft Contract Agreement and the manual of specifications and standards.

c) Deleted

d) Landscaping

Landscaping, shrubs and plantation shall be maintained as per standard, specifications and direction of I/C. The work shall be taken up after the work order and shall be maintained throughout Contract period.

e) Road Signage, signal and markings

The boards, signals and markings shall be maintained as per norms if required to be replaced by new.

f) Street Lights and C.C.T.V. Cameras

The street lights, lighting on bridge and C.C.V.T. Cameras fixed on bridge and toll plaza shall be maintained as per norms if required to be replaced by new.
(h) Lift at Pylon of main cable stayed bridge.

Lift at Pylon of main cable stayed bridge shall be maintained as per standard, specifications and direction of I/C.
Schedule- C

(See Clause 2.1)

SPECIFICATIONS AND STANDARDS

1. Operation and Maintenance of Project
   The Contractor shall comply with the Specifications and Standards set forth in Annex- I of this Schedule C wherever required and whatever is relevant for work to be carried out for maintenance of the Sea Link and operation of Toll Plaza.
### Annex-I

**(Schedule- C)**

**SPECIFICATIONS AND STANDARDS FOR PROJECT HIGHWAY**

**LIST OF SPECIFICATIONS AND STANDARDS TO BE FOLLOWED IS GIVEN BELOW:**

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<td>Performa for Record of Test Values of Locally Available Pavement Construction Material</td>
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<td>Geometrical Design</td>
<td>Standard for Vertical and Horizontal Clearances of Overhead Electric Power and Telecommunication lines as related to roads.</td>
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<td>Lateral and Vertical Clearances at Underpasses for vehicular Traffic</td>
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<td>Guidelines for Pedestrian facilities</td>
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<td>Steel Fiber Reinforced Concrete for Pavements</td>
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<td>Standard plans for 3.0 m to 10.0 m Span Reinforced Cement soiled slab superstructure with and without Footpaths for Highways.</td>
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<td>MORT&amp;H Standard Plans for Single, Double and Triple Cell Box Culverts with and without Earth Cushions.</td>
<td>MORT&amp;H</td>
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<td>67.</td>
<td>State of the Art: Corrosion and Corrosion Protection of Pre stressed Concrete Bridges in Marine Environment</td>
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<td>Standard Letters and Numerals of different heights for use on Highway signs</td>
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<td>Gopi and his road roller guidelines on Maintenance of road rollers</td>
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<td>Addendum to Ministry’s Technical Circulars and Directives on National Highways and Centrally Sponsored Road and Bridge Projects (Aug.88 to Dec. 92)</td>
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<tr>
<td>102.</td>
<td>Addendum to Ministry’s Technical Circulars and Directives on National Highways and Centrally sponsored Road and Bridge Projects (Jan.95 to Dec.97)</td>
<td>MORT&amp;H 1998</td>
</tr>
</tbody>
</table>
### 1. TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>1</th>
<th>PREAMBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>The Technical Specifications contained herein shall be read in conjunction with the other Bidding Documents as specified in Volume-I.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2</th>
<th>Site Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2.1</td>
<td>The information given hereunder and provided elsewhere in these documents is given in good faith by the Employer but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the Employer is erroneous or insufficient.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2.3</th>
<th>General Climatic Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2.3.1</td>
<td>The temperature in this region is as under:</td>
</tr>
<tr>
<td></td>
<td>1. During summer months, the maximum temperature is 37°C</td>
</tr>
<tr>
<td></td>
<td>2. During winter months, the minimum temperature is 11°C</td>
</tr>
<tr>
<td>1.2.3.2</td>
<td>The average annual rainfall in the area is above 2500mm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2.4</th>
<th>Seismic Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The work is located in Seismic Zone-III as defined in IRC: 6-2000.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>GENERAL REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Technical Specifications in accordance with which the entire work described hereinafter shall be constructed and completed by the Contractor shall comprise of the following:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.1</th>
<th>Part A - Additional Technical Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Clauses SP-1 to SP-28 has been added to the ‘Specifications for Road and Bridge Works (Fourth revision, August 2001).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clause Sp-1</th>
<th>Fixing Dowel Bars In Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clause Sp-2</td>
<td>Plant And Equipment For Aggregates And Concrete</td>
</tr>
<tr>
<td>Clause Sp-3</td>
<td>Curing Using Liquid Membrane Forming Compound</td>
</tr>
<tr>
<td>Clause Sp-4</td>
<td>Additional Specifications for use of rockfill in Embankment and behind structures - Deleted</td>
</tr>
<tr>
<td>Clause Sp-5</td>
<td>Specification for Ground Improvement system - Deleted</td>
</tr>
<tr>
<td>Clause Sp-6</td>
<td>Additional Specifications For Traffic Management And Diversion</td>
</tr>
<tr>
<td>Clause Sp-7</td>
<td>Repair Of Cracks Of Width More Than 0.3mm With Sound Concrete Surface</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Clause Sp-8</td>
<td>Repair Of Honeycombs And Spalling</td>
</tr>
<tr>
<td>Clause Sp-9</td>
<td>Geotechnical Investigation (Exploratory) - Deleted</td>
</tr>
<tr>
<td>Clause Sp-10</td>
<td>Specifications For Inter-Locking Concrete Paving Blocks</td>
</tr>
<tr>
<td>Clause Sp-11</td>
<td>External Lighting Installation</td>
</tr>
<tr>
<td>Clause Sp-12</td>
<td>Maintenance Of Work Order Book</td>
</tr>
<tr>
<td>Clause Sp-13</td>
<td>Working Methods And Progress Schedule</td>
</tr>
<tr>
<td>Clause Sp-14</td>
<td>Additional Specifications for maintenance of right of way - Deleted</td>
</tr>
<tr>
<td>Clause Sp-15</td>
<td>Specification for Dynamic Pile Testing - Deleted</td>
</tr>
<tr>
<td>Clause Sp-16</td>
<td>Specification for controlled low strength material - Deleted</td>
</tr>
<tr>
<td>Clause Sp-17</td>
<td>Coal Tar Epoxy Coating For Under Ground Structures - Deleted</td>
</tr>
<tr>
<td>Clause Sp-18</td>
<td>Anti Carbonation Paint - Deleted</td>
</tr>
<tr>
<td>Clause Sp-19</td>
<td>Reinforced Soil Wall - Deleted</td>
</tr>
<tr>
<td>Clause Sp-20</td>
<td>Additional Conditions / Directions For Ready Mix Concrete (RMC) - Deleted</td>
</tr>
<tr>
<td>Clause Sp-21</td>
<td>Additional Technical Specifications for Structural Steel Work</td>
</tr>
<tr>
<td>Clause Sp-22</td>
<td>Concepts &amp; Construction methodology for Flyovers - Deleted</td>
</tr>
<tr>
<td>Clause Sp-23</td>
<td>Specifications For Providing Anti Corrosive Treatment To M.S. or HYSD Reinforcement Bars With Fusion Bonded Epoxy Coating (FBEC) - Deleted</td>
</tr>
<tr>
<td>Clause Sp-24</td>
<td>Specifications for Suspenders and Stay Cables</td>
</tr>
<tr>
<td>Clause Sp-25</td>
<td>Additional Specifications For Site Office</td>
</tr>
<tr>
<td>Clause Sp-26</td>
<td>Additional Specifications for Blasting</td>
</tr>
<tr>
<td>Clause Sp-27</td>
<td>Additional Technical Specifications For Road Signs</td>
</tr>
<tr>
<td>Clause Sp-28</td>
<td>Additional Specifications For Landscaping &amp; Horticulture</td>
</tr>
</tbody>
</table>
In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest codes and specifications of IRC, BIS, BS, ASTM, AASHTO and CAN/CSA in that order. Where even these are silent, the construction and completion of the works shall conform to sound engineering practice as approved by the Engineer and in case of any dispute arising out the interpretation of the above, the decision of the Engineer shall be final and binding on the Contractor.

### Part-B: Amendments/Modifications/Additions to Existing Clauses of General Technical Specifications.

The Supplementary Technical Specifications shall comprise of various Amendments/Modifications/Additions to the “SPECIFICATIONS FOR ROAD AND BRIDGE WORKS” referred to in Part-C below and Additional Specifications for particular item of works not already covered in Part-C.

#### 2.2.1

A particular Clause or a part thereof in “SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (Fourth Revision, August 2001)”, as corrected in the original referred in Part-C, where Amended/Modified/Added upon, and incorporated in Part-B, referred to above, such Amendment/Modification/Addition supersedes the relevant Clause or part of the Clause.

#### 2.2.2

The Additional Specifications shall comprise of specifications for particular items of works not already covered in Part-C.

#### 2.2.3

When an Amended/Modified/Added Clause supersedes a Clause or part thereof in the said Specifications, then any reference to the superseded Clause shall be deemed to refer to the Amended/Modified/Added Clause or part thereof.

#### 2.2.4

In so far as Amended/Modified/Added Clause may come in conflict or be inconsistent with any of the provisions of the said M/O RT&H Specifications under reference, the Amended/Modified/Added Clause shall always prevail.

#### 2.2.5

The following Clauses in the “SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (April Revision, April 2001)” have been amended/modified/added upon:

<table>
<thead>
<tr>
<th>Clause Numbers</th>
</tr>
</thead>
</table>

### Part-C: General Technical Specifications

The General Technical Specifications shall be the “SPECIFICATIONS FOR ROAD AND BRIDGE WORKS” (Fourth Revision, August 2001) issued by the Ministry of Road Transport and Highways (formerly the Ministry of Surface Transport) Government of India,
and published by the Indian Roads Congress. This specification shall be applicable to all items of construction and maintenance work under this project.

| 2.4 | Where reference is made in the Contract to specific standards codes to be met by the materials, plant, and other supplies to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards before 30 days from the date of submission of bid shall apply, unless otherwise expressly stated in the contract. Where such standards and codes are national, or relate to a particular country or region, other internationally recognized standards which ensure a substantially equal or higher performance than the standards and codes specified will be accepted subject to the Independent Engineer’s prior review and written approval. Further as the Contract period is substantially long period new technologies, material available in the market shall be used by the contractor for operation and maintenance as per latest relevant IRC / MOSRT & H/ IS standards at no extra cost to MSRDC as directed I.E. from time to time. Difference between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer’s approval. In the event the Independent Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the documents. |
PART A-ADDITIONAL TECHNICAL SPECIFICATIONS

Note: Relevant clauses for Operation and Maintenance shall be applicable.

CLAUSE SP-1  FIXING DOWEL BARS IN CONCRETE

-----deleted-----

CLAUSE SP-2  PLANT AND EQUIPMENT FOR AGGREGATES AND CONCRETE

-----deleted-----

CLAUSE SP-3 CURING USING LIQUID MEMBRANE FORMING COMPOUND

-----deleted-----

CLAUSE SP-4  ADDITIONAL SPECIFICATIONS FOR USE OF ROCKFILL IN EMBANKMENT & BEHIND STRUCTURES

-----deleted-----

CLAUSE SP-5  SPECIFICATIONS FOR GROUND IMPROVEMENT SYSTEM

-----deleted-----

CLAUSE SP-6  ADDITIONAL SPECIFICATIONS FOR TRAFFIC MANAGEMENT AND DIVERSION

The contractor shall prepare and submit to Engineer within one month of the date of commencement of work, a detail traffic diversion plan as per the requirement of traffic authorities. The contractor shall have to carry out the modifications in the traffic diversion plan at various stages of work as required. The contractor shall maintain liaison with the traffic police / authorities so as to ensure smooth flow of traffic at all stages of the work without causing inconvenience to the traffic.

1  Traffic Rotary

The contractor shall provide traffic rotary showing traffic direction made up of four blinkers mounted on M.S. Frame of 5x50x6mm size 250 Hz frequency electrically operated at both ends of the cordoned area for help and guidance of road users. Necessary arrangements for supply of electricity shall be made by the contractor.

2  Road Delineators

Road delineators/spring delineators as per IRC-79 and as per relevant drawings and as directed by Engineer shall be fixed at suitable intervals to have a suitable guidance to the road users at the night time for smooth flow of traffic. Delineators shall be fixed firmly in the ground. Also red flags, cat eye reflectors/Tiger eye reflectors shall be fixed on the barricades. Alternative arrangements shall also be kept ready in case of failure of electricity.

3  Signs, lights, barriers and other traffic control devices shall be provided and maintained in a satisfactory condition till such time they are required as directed by the Engineer, so as to ensure smooth and safe traffic on the road throughout the length. Guidelines given in IRC-SP-55 “Safety in Road Construction Zone” should be followed. All above items of work are included in the lumpsum price of the item. The contractor will also provide police warden and walkie-talkie sets as required by the Engineer (who will consult Police Authorities in this respect).
CLAUSE SP-7 REPAIR OF CRACKS OF WIDTH MORE THAN 0.3MM WITH SOUND CONCRETE SURFACE

Repair of cracks of width more than 0.3mm shall be done by injecting epoxy or cementations grout in relatively sound concrete.

1. Materials (For epoxy grout materials)

Epoxy resin like SIKADUR 53 of M/S Sika Qualcrete or Resicrete 21 of M/S Structural Water Proofing Co. or any approved equivalent shall be used for repair to PSC/RCC Bridge. Epoxy resins shall generally conform to the manufacturers’ specifications. Only such resins having a low shrinkage coefficient, high adhesion strength, water impermeability, high abrasion resistance, and good bonding characteristics even in presence of moisture shall be used. (Phenolics, polyesters, acrylics etc. do not generally satisfy well the above mentioned requirements and shall not be used). The proposed epoxy resin system shall conform to ASTM-881-87 and shall conform to the following requirements:

- **Density**: 1.11 kg/litre
- **Viscosity at 30°C**: 500 ± 50 centipoises
- **Pot life at 30°C**: 30 minutes minimum
- **Compressive strength under water (for 14 days) of a 5 cm cube**: 90-100 N/mm²
- **Bond strength (14 days)**: Concrete failure
- **Approx. injection pressure**: 2 kg/cm²
- **Shrinkage**: Conforming to ASTM C 883

2. Equipment (Epoxy grout materials)

Injection equipment which should possess the following characteristics:

i) Ease of handling, simple function
ii) Low failure rate
iii) Cater for varying viscosity and pot life suited for the job
iv) Capable of injecting into cracks of width >=0.3mm
v) Simple cleaning and maintenance routines
vi) Provision of an arrangement for controlling and stopping the injection before the gun is withdrawn
vii) Fitted with pressure gauge to indicate grouting pressure.

Materials, equipment and procedure for injection for cementations grout shall be same as for polymer modified cementations (PMC)/ grout as indicated in specification for improving concrete quality.

3. Procedure

3.1 Surface Preparation: The visible cracks and other outlet points nearby shall have to be sealed by adopting the given procedure. First of all, the area shall be cleaned thoroughly and all visible outlets shall be sealed. For sealing the cracks, V-notch (20mm wide x 10mm deep) shall be cut along the cracks. This shall be cleaned off all loose particles, dust etc. by compressed air. A layer of epoxy bounding agent/ PMC slurry be applied over the freshly cut surface. Epoxy repair mortar shall be used to fill the groove while the slurry coating is still wet but after a lapse of 30 minutes of the slurry coat. Entry ports for pressure injection shall then be made by pneumatic percussion/rotary drills. In each hole a plastic
The mixing of various components of epoxy system shall be carried out by mechanical means to ensure thorough and uniform mixing.

The injection shall be carried out from the lowermost elevation to the highest elevation to ensure that air or moisture is completely displaced from the cracks and grout materials fills the cracks completely. This is indicated by the flow of grout material noticed at the higher elevation. The rate of grout material injection shall be adjusted so as to fill up all the voids. All inlet points shall be closed by suitable means to ensure that there is no flow back of grout material after the injection has been completed. In case there is no flow from other nipple, the injection should be stopped after it has attained a steady pressure of 2 kg/cm² for about 5-10 minutes. 

"Payment shall be made per LM of the crack prepared for pressure grouting and will include the cost of all labour, materials, equipment, scaffolding etc. for executing the item as described in the technical specifications".

CLAUSE SP-8 REPAIR OF HONEYCOMBS AND SPALLING

The repair of spalled, honeycombed concrete shall be done by low permeability polymer modified cementations repair mortar (PMC).

1 Materials
High early strength Portland cement conforming to IS: 8112 shall be used for production of polymer modified cement repair mortar and polymer modified cementations slurry, which is to be used as a bonding medium with concrete substrate.

"The polymer latex which is to be used should consist of water based acrylic polymer and copolymer dispersion and special purpose chemicals. The polymer solid contents shall be 29 to 31 percent. The particles shall be nearly spherical shape with a diameter of 0.30 to 0.40 micrometer. The manufacturer shall certify to the above requirements about solid content and grain size. In order to keep control over the quality, the manufacturer shall provide infrared absorption spectrum analysis for the materials (polymer latex) to be supplied by them. The same material shall also be used for various purposes such as in a slurry form with cement to form a bonding or priming medium, with sand and cement in proportions recommended by manufacturer to form the repair mortar.

No additional water shall be used to prepare the PMC slurry or repair mortar as the water present in the latex is sufficient for cement hydration. The cement/latex ratio shall remain constant for various uses. The sand to be used for constituting the PMC repair mortar shall be silica sand.
The grading of the sand shall follow the limits provided as below:

<table>
<thead>
<tr>
<th>IS Sieve No.</th>
<th>Percentage Passing by weight</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coarse</td>
<td>Fine</td>
</tr>
<tr>
<td>10mm</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>4.75mm</td>
<td>95-100</td>
<td>100</td>
</tr>
<tr>
<td>2.36mm</td>
<td>90-100</td>
<td>100</td>
</tr>
<tr>
<td>1.18mm</td>
<td>40-60</td>
<td>100</td>
</tr>
<tr>
<td>600 micron</td>
<td>0-19</td>
<td>90-100</td>
</tr>
<tr>
<td>300 micron</td>
<td>0-4</td>
<td>40-60</td>
</tr>
<tr>
<td>150 micron</td>
<td>0-3</td>
<td>0-10</td>
</tr>
<tr>
<td>75 micron</td>
<td>3 max</td>
<td>0-3</td>
</tr>
</tbody>
</table>

2 Repairing Procedure

2.1 Preparation of Concrete substrata: All defective areas shall be delineated and marked out on site in conformity with the supervising officer.

Concrete on the damaged, loose or honeycombed areas shall be chipped out up to the reinforcement level or up to the level of good parent concrete or up to the point on the reinforcement where the reinforcement is free from corrosion. The chipping of concrete shall continue to expose the full circumference of the steel and to a further depth of 10mm as directed by the supervising officer.

The chipped surface of concrete shall be thoroughly cleaned by wire brush and compressed air to remove all dust and loose materials. The exposed reinforcement shall be mechanically cleaned of all rust and mill scale.

2.2 Priming of Concrete Surface and Reinforcement: Before commencing the application of concrete repair mortar, the prepared concrete substrate shall be thoroughly soaked with water and the free surface water shall be removed before priming.

The well mixed polymer cement slurry (Polymer to cement ratio 1:2) shall be applied over the well soaked but surface dry concrete and steel bar for adhesion of fresh cement and sand mortar as per specification and as directed by the Engineer.

2.3 Cementitious Repair Mortar: The repair mortar of 1 cement: 3 smooth silica sand shall be applied on the polymer cement slurry in layers of maximum 10mm thickness each and up to a total thickness of 8-10mm short of outer surface. The outer surface shall be scarified for good bonding with the next layer.

The polymer modified cement sand mortar in the proportion of 1 polymer: 2 cement: 6 sand shall be applied over the scarified cement sand mortar in maximum 10mm thickness and finishing smooth up to the existing surface of concrete as per specification and as directed by the Engineer.

Curing of the repaired areas with PMC mortar shall be done in accordance with acceptable good practice. However, no curing compound or curing membrane shall be used and curing shall only be done by spraying of water or by using wet Hessian cloth.
CLAUSE SP-9  

GEOTECHNICAL INVESTIGATIONS (EXPLORATORY)

----deleted----

CLAUSE SP-10  

SPECIFICATIONS FOR INTER-LOCKING CONCRETE PAVING BLOCK

----deleted----

CLAUSE SP-11  

EXTERNAL LIGHTING INSTALLATION

SUPPLY

The lighting package shall include the following major supply items:

i) Street lighting feeder pillar.

ii) Hot dip galvanized octagonal pole.

iii) Raising / lowering high mast.

iv) Lighting luminaries and lamps.

v) L.T. Armoured Cable.

vi) Earthing system.

STREET LIGHTING FEEDER PILLAR (SLFP)

SLFP shall be suitable for 415 V, 3 phase, 4 wire, and 50 Hz supply and shall be outdoor type with canopy and shall be free standing floor type.

SLFP shall be provided with incoming & outgoing MCCB / MCB of appropriate rating and in desired quantity depending on total no. of circuits in use. Outgoing shall have at least one spare circuit all the time. Major switchgears shall have potential free terminals for communication with RTU.

SLFP shall be made up of CRCA sheet steel and shall be dust and vermin proof providing a degree of protection of IP 55. The thickness of sheet steel enclosures shall be 2 mm minimum for load bearing and 1.6 mm for other members.

Busbars will be made up of aluminum, colour coded for easy identification and of appropriate size.

Doors shall be provided with all round neoprene gaskets. The incomer switchgear shall have interlocking mechanism so as to prevent opening of the door when the switch is ON and to prevent closing of the switch when the door is not fully closed. However, a device for bypassing the door interlock shall be provided to enable the operation of the switch with the door open, when necessary, for examination / maintenance.

All accessible live connection/metals shall be shrouded and it shall be possible to change individual fuses, switches, from the front of the boards/panels without any danger of contact with live parts.

Adequate interior cabling space and suitable removable cable gland plate (min. 3 mm thickness) plates shall be provided for bottom entry of cables through glands. Necessary number of glands to suit the required cable sizes shall be provided. Cable glands shall be double compression type made of chrome-plated brass.

Every SLFP will have LED type ‘SUPPLY ON” indicating lamps. Indicating lamps shall be of the clustered LED type and low watt consumption. Lamps shall be provided with series resistors.
Earth bus of 50x6 GI flat with zinc plated bolts and nuts shall be provided in the bottom of the panel.

The SLFP shall be provided with individual labels with equipment designation / rating. Also the boards shall be provided on the front with a label engraved with the designation of the SLFP. Labels shall be made of non-rusting metal or 3 ply lamicoid or engraved PVC.

Internal wiring of the panel shall be done using flexible copper cables of appropriate sizes. All the wires shall be numbered and ferrules shall be provided for easy identification.

Proper clip-on stud type terminals of appropriate rating shall be provided for termination of incoming as well as outgoing cable inside the SLFP.

Inside the door of lighting panels a single line circuit diagram / description shall be fixed for ready reference.

All sheets steel enclosures of panels will be chemically cleaned rinsed, phosphated & dried. After the treatment steel surfaces will be given two coats of primer & finished grey enamel paint or powder coating of shade 631 of IS - 5. Coating thickness shall be minimum 50 microns.

**HOT DIP GALVANIZED OCTAGONAL POLE**

The Octagonal Poles shall be designed to withstand the maximum wind speed as per IS 875. The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS: 5649 Part VI 1982. The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding. The welding of pole shaft shall be done by Submerged Arc Welding (SAW) process.

All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing 4 foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside. The welding shall be done as per qualified MMAW process approved by Third Party Inspection agency.

The octagonal poles shall have door of approximate 500 mm length at the elevation of 2000 mm from the base plate. The door shall be vandal resistant and shall be weather proof to ensure safety of inside connections. The door shall be flush with the exterior surface and shall have suitable locking arrangement. There shall also be suitable arrangement for the purpose of earthing. The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.

Material:

- a) Octagonal Poles
  - HT Steel Conforming to grade S355JO.
- b) Base Plate
  - Fe 410 conforming to IS 226 / IS 2062
- c) Foundation Bolts
  - EN.8 grade

The welding shall be carried out confirming to approve procedures duly qualified by third party inspection agency. The welders shall also be qualified for welding the octagonal shafts.

The Octagonal Poles shall be in single section (upto 11 mtr). There shall not be any circumferential weld joint.
The poles shall be hot dip galvanized as per BSEN ISO 1461 standards with average coating thickness of 70 micron. The galvanizing shall be done in single dipping.

The Octagonal Poles shall be bolted on a pre-cast RCC foundation with a set of four foundation bolts for greater rigidity.

The galvanized mounting decorative bracket shall be supplied along with the Octagonal Poles for installation of the lighting luminaries.

The pole / bracket manufacturing & galvanizing unit shall be ISO 9001: 2000 & ISO 14001 certified to ensure consistent quality & environmental protection.

**STREET LIGHTING LUMINARIES**

Street light luminaries shall be outdoor weatherproof integral type suitable for dusty and high traffic density roads.

The luminaries shall be epoxy powder coated made up of single piece die-cast aluminum housing for lamp, control gear accessories.

The luminaries shall have electrochemically brightened, polished finish computer aided pot optic aluminum reflector suitable for tubular lamp.

The luminaries shall have heat resistant toughened clear glass, rubber gasket with SS toggles & SS hardware.

The luminaries shall have easy access to control gear by top opening for maintenance purpose.

Degree of protection: Lamp housing compartment – IP 66; Control gear accessories housing compartment – IP 54

The control gear compartment of the luminaries shall house open construction type low watt loss copper wound ballast, power factor improving capacitor, electronic igniter and terminal block.

Ballasts shall be copper wound, open type construction, vacuum impregnated low loss design. Ballasts shall be mounted using self locking, anti-vibration fixings and shall be easy to remove without demounting the fittings. Ballasts shall be provided with suitable taps to set the voltage range. End connections and taps shall be brought out to a suitable terminal block rigidly fixed to the ballast enclosure. Ballasts shall be free from hum and such of those which produce hum shall be replaced by contractor free of cost.

Capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits. The capacitors shall be suitable for operation at supply voltage and shall have a value of capacitance so as to correct the power factor of its corresponding lamp circuit to the extent of 0.85 lag or better. The capacitors shall be hermetically sealed.

Lamps: 150/250 Watts SON-T plus lamps having higher lumens delivery. The lamps shall be capable of withstanding regular vibrations and the connections at lead in wires and filaments / electrodes shall not break under such circumstances. Lamps shall conform to relevant Indian Standards. Average life of the lamp shall be more than 20,000 burning hours.
FLOOD LIGHTING LUMINARIES

These floodlights shall be primarily used on high masts. Accessories like ballasts, capacitors, igniters & lamps etc. shall conform to the corresponding ARE & general specifications. Distinct features of the floodlights are given below.

Luminaries housing shall be epoxy powder coated having die-cast aluminum housing with heat dissipating fins.

The luminaries shall have electrochemically brightened, polished finish computer aided aluminum reflector suitable for tubular lamp.

Glass: Heat resistant, clear, toughened glass fixed to the housing with SS toggles and silicon rubber gasket.

Lamp holder: GES lamp holder for tubular HID lamp, pre-wired up to the terminal block.

Mounting arrangement: MS hot dip galvanized and stove enameled mounting bracket.

Degree of protection: IP 55

Control gear box housing: Epoxy grey powder coated die-cast aluminum and hinged cover with rubber gasket.

Control gear box will house ballast, capacitor, igniter, fuse, earth terminal and suitable connectors. These will be suitable for loop-in-loop-out.

WIRING OF THE LUMINARIES

The wires for connection from terminal plate of the pole / high mast to the fixtures shall be 1100 V, minimum 3Cx2.5 sq mm PVC insulated, unarmoured having flexible copper conductors. The wires shall conform to the applicable IS.

L.T. ARMOURLED CABLE

The cable shall be of 1.1 KV grade.

The material of the conductor shall be aluminum and conductor shall be sector shaped.

The material of insulation shall be XLPE as per IS 7098 (Part 1).

The material of inner sheath shall be extruded PVC type ST2 as per IS 5831.

The armoring shall be made up of G.S. strip.

The individual cores of the cable shall be red, yellow, blue and black.

The cable shall be supplied in drum lengths.

The cable should conform to all provision of type tests, acceptance tests and routine tests as per relevant IS. Contractors shall submit the TCs.

The cable shall be terminated with crimping tool using aluminum / copper lugs and double compression glands.
EARTHING SYSTEM

All equipment of the lighting system shall be earthed as per relevant Indian Standards. General specifications of earthing for pole, high mast & SLFP are given below.

Each pole shall be earthed using 1 no. 20mm dia, 1.5 m long MS rod. The connections between the earthing stud inside pole and the electrode shall be done with 8 SWG GI wire.

High masts and SLFPs each shall be earthed with 2 nos. - 40mm dia., 2.5 m long GI pipe. The connections between the earthing stud and the electrode shall be done with 25X3 GI strips.

INSTALLATION

The installation work shall include electrical equipments, viz., street lighting feeder pillar (SLFP), octagonal poles, raising / lowering high masts, lighting luminaries and lamps, L.T. armoured cable, its earthing system, wiring, termination, testing and commissioning.

The installation work shall confirm to the latest applicable electricity rules, all currently applicable standards, and codes of practice, regulations and safety codes of the locality where the installation is to be carried out. Nothing in this specification shall be construed to relieve the Contractor of this responsibility.

All codes and standards shall be understood to be the latest version on the date of offer made by the bidder unless otherwise indicated.

The Contractor shall make his own arrangements for moving / lifting all the equipments / items to the respective erection sites.

The equipments /items shall be installed in a neat work manner so that it is leveled, plumbed, squared and properly aligned & oriented.

The Contractor shall furnish all supervision, labour, tools, equipments, rigging material, incidental items such as bolts, wedges, anchors / angles, frames, studs, rawl plug, concrete etc. to complete the installation.

Manufacturer’s drawings, instructions and recommendations shall be correctly followed in handling, installing, testing and commissioning of all items / equipments.

The Contractor shall carry out civil works, welding, bolting, drilling, grouting, chipping, sealing, making opening, finishing etc. as required for satisfactory execution of the work.

All care should be taken to avoid damage to galvanized / painted surfaces during installation. Damages, if any, shall be properly repaired using cold spray zinc solution / paint as the case may be.

All nuts, bolts and washers required for complete installation shall be zinc plated / hot dip galvanized.

POLES & MASTS

Installation of poles and masts shall include construction of required foundation. Bidder must submit the proposed civil foundation drawings & its calculations.
Excavation in all types of soil, casting of civil foundation & grouting of foundation bolts, its curing, back filling & making the surface good and cleaning etc. are included in the scope of civil work related to poles & masts.

Grade of the concrete used shall be minimum M20.

PVC pipe of suitable diameter shall be provided in the pole / mast foundation for underground cable entry / exit.

For poles, one MCB corresponding to each fixture shall be provided in the in-built junction box. Terminal shall be stud type and suitable for termination loop-in-loop-out armored cable.

Individual fixtures on the poles shall be connected with minimum 3Cx2.5 sq.mm. flexible copper wires.

All hardware used for mounting the fixtures, JBs, other accessories on poles / high mast shall be either SS / galvanized / zinc plated.

All poles and high masts shall be properly earthed.

High mast shall be installed with the help of a crane of suitable capacity.

Pole, masts and its brackets shall be properly leveled & aligned after installation.

**LIGHTING LUMINAIRES AND LAMPS**

Lighting luminaries along with its control gear & lamps shall be assembled and tested before installation.

Luminaries & lamps shall be alignment properly in order to ensure desired light distribution and to avoid glare.

Fixing arrangement of the luminaries shall be such that even during stormy weather conditions, the fixtures shall not get misaligned.

**LT ARMoured CABLE**

The trenches excavation will include removal of all materials including the haul of excess material to disposal area. Soil conditions inclusive of rock may be encountered.

After laying of cables, trenches shall be filled with soil and leveled with ground after proper compaction. Extra soil from the site shall be removed promptly.

At road crossings and junctions, the cables shall be laid in the already existing RCC hume / GI pipes provided by client.

Before laying, the insulation and conductor continuity shall be checked with megger.

While laying cables, care shall be taken that kinks, twists or mechanical damage do not occur to the cable.

All bends in cables will be made with the due consideration to the minimum permissible bending radius of the cables.
On being pulled, the cable will not be allowed to drag drawing along ground or over a second cable already laid. Special care will be taken while pulling through an opening where other cables have already been laid.

Extra cable loop of at least 1m shall be provided on either end.

Cables as far as possible shall be laid in complete, uncut lengths from one pole to the other.

All power cables shall be terminated using crimping type aluminum lugs.

Double compression type brass cable glands shall be used to terminate cable.

Wherever more than one cable are laid in the same trench, minimum gap of 150mm need to be maintained between the cables.

For all cables laid in trenches, cable markers shall be provided at every 50m distance and at every turn.

**EARTHING SYSTEM**

Entire system will be earthed in accordance with the provisions of the relevant IS and Indian Electricity Rules.

All major electrical equipment, not intended to be live, will have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules. However poles & equipment rated for 240V may have single earth connection.

All earthing terminations will ensure a permanent low resistance contact. Where combinations of GI and aluminum conductors are to be used, connection between them will have bimetallic connectors and other necessary provisions to ensure low contact resistance at all conditions.

In general, earthing shall conform to provisions of IS 3073.

**TESTING AND COMMISSIONING**

Before a completed installation or an extension to an existing installation is put into service, tests stipulated in applicable standards / Codes of Practices / FQP shall be carried out by the Contractor in presence of the Engineer or his representative.

The Contractor shall obtain the necessary License/Authorization from the Licensing Board of the locality/state for carrying out the installation work.

The measurement & recording of lux level for all type of installations in presence of the Engineer shall be in the scope of the bidder. Methodology for measurement of lux level shall be explained in detail by the bidders in their bid.

The bidder shall ensure that instruments and gauges to be used for testing and inspection of critical parameters as identified in the specification have valid calibration certificate.

**QUALITY ASSURANCE PROGRAM**

The bidder shall furnish detailed Quality Assurance Programme and Quality Plan (MQP as well as FQP) for all the major supply items to be supplied and installed under the scope of the work.
The Contractor must be an ISO-9001 certified Company. Current certificate of the same must be submitted along with the bid.

All the major equipment & its accessories shall be subject to routine tests and acceptance tests as per relevant IS / QP.

The Engineer or his authorized representative may witness / review / verify the above tests. All testing charges shall be deemed to be included in the bid price. No extra amount shall be payable on account of the above.

The Contractor shall submit type test certificate of the major equipments for the Engineer’s approval before commencement of manufacturing process.

CODES AND STANDARDS

All standards, specifications, and codes of practice referred to herein shall be the latest edition including all applicable official amendments and revisions one month prior to receipt of completed bids. In case of conflict between specifications given in tender and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards & codes.

LIST OF CODES AND STANDARDS

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<td>Colour for ready mixed paints &amp; enamels</td>
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<tr>
<td>IS : 226</td>
<td>Structural steel (standard quality)</td>
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<td>Mild steel wires for electrical wiring installation</td>
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<td>PVC insulated cables upto 1100 V</td>
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<td>IS : 732</td>
<td>Code of practice for electric wiring installation upto 650V</td>
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<td>IS : 800</td>
<td>Code of practice for general construction in steel</td>
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<tr>
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<tr>
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<td>Code of practice for installation and maintenance of electric cables</td>
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<td>IS : 2208</td>
<td>HRC cartridge fuse links upto 650V</td>
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<td>Danger notice plates</td>
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<td>IS : 2629</td>
<td>Recommended practice for hot-dip galvanizing of steel</td>
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<td>IS : 2959</td>
<td>Contactors for voltage not exceeding 1000 V AC</td>
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<td>IS : 3043</td>
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<td>IS : 3202</td>
<td>Climate proofing of electrical equipments</td>
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<td>IS : 3961</td>
<td>Recommended current ratings for PVC insulated cables</td>
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<tr>
<td>IS : 4012</td>
<td>Dust proof electrical lighting fittings</td>
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<td>IS : 4013</td>
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<td>IS : 4064</td>
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<td>BS: 5649</td>
<td>Lighting Columns</td>
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</table>
IS : 5831  PVC insulation and sheath of electric cables
IS : 6616  Ballasts for high-pressure mercury vapour lamps
IS : 6665  Code of practice for industrial lighting
IS : 6875  Specification of control switches for voltage not exceeding 1000 V AC
IS : 7098  1.1 KV grade XLPE Cables
IS : 8130  Conductors for insulated electric cables
IS : 8623  Factory built assemblies of switchgear upto 1000 V AC
IS : 8828  MCBs for AC circuits not exceeding 1000 V AC
IS : 9224  Low voltage fuses
IS : 9974  High pressure sodium vapour lamps
IS : 10118 Code of practice for selection of switchgear and control gear
IS : 10322 Luminaries
IS : 10810 Methods of tests for cables
TR-7 of ILE  High mast & octagonal pole shafts
National Electrical Code
Indian Electricity Rules
Indian Electricity Act

CLAUSE SP-12  MAINTENANCE OF WORK ORDER BOOK

A work order book shall be maintained on the site and it shall be the property of Employer and the Contractor or his authorized representative shall promptly sign orders given therein by the Engineer or his authorized representative and comply with them. The compliance shall be reported by Contractor to the Engineer in sufficient time so that it can be checked. The blank work order book with machine numbered pages in triplicate with perforated sheet for two copies to be detached shall be provided by the Engineer for this purpose. The Contractor shall be supplied the first and carbon copy.

The contractor shall depute his representative not below the rank of Project Manager to attend periodic review meetings notified by the Engineer. The Engineer shall record the business of meeting and is to provide copies of his record to those attending meeting and to the Employer.

CLAUSE SP-13  WORKING METHODS AND PROGRESS SCHEDULE

1. A quality assurance procedure covering all aspects of the work shall be adopted for this work to ensure the desired quality. Details of the procedure shall be decided by mutual consultation between the Engineer and the Contractor at the start of the Works.

2. The Contractor shall submit within the time stipulated by the Engineer in writing, the details of actual methods that would be adopted by the Contractor for the execution of any item as required by the Engineer at each of the locations, supported by necessary detailed drawings and sketches including those of the equipment and machinery that would be used, their locations, arrangements for conveying and handling materials etc. and obtain prior approval of Engineer well in advance of starting of such item of work.

3. The Engineer reserves the right to suggest modifications or make complete changes in the methods proposed by the Contractor, whether accepted previously or not, at any stage of work, to obtain the desired accuracy, quality, safety, and progress of work which shall be binding on the Contractor and no claim on account of such change in method of execution will be entertained by the Employer, so long as Specifications of the items remains unaltered.

4. The Contractor shall furnish sufficient plant, equipment and labour as may be necessary to maintain the progress schedule. The working and shift hours for operations to be
done under the Employer supervision shall be such as may be approved by the Engineer. They shall not be varied without the prior approval of the Engineer. The Contractor shall provide necessary lighting arrangements etc., for night work, as directed by the Engineer without extra cost.

5. The Contractor shall submit the progress of work in prescribed forms and statements at periodical intervals in the form of progress charts, forms, statements and/or reports as may be approved by the Engineer.

6. The Contractor shall maintain Performa, charts, details regarding machinery, equipment, labour, materials, and periodical returns thereof as may be specified by the Engineer.

CLAUSE SP-14 ADDITIONAL SPECIFICATIONS FOR MAINTENANCE OF RIGHT OF WAY

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CLAUSE SP-15 SPECIFICATION FOR DYNAMIC PILE TESTING

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CLAUSE SP-16 SPECIFICATION FOR CONTROLLED LOW STRENGTH MATERIAL

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CLAUSE SP-17 COAL TAR ANTI CARBONATION PAINT/EPOXY PAINT

This paint shall be applied to concrete surfaces in contact with soil. The paint shall provide protection to concrete surface against corrosion from aggressive environments. It shall also be long term chemical resistant.

Application:

Coal Tar anti carbonation paint/ epoxy paint shall be applied on dust free surface, free from laitance, loose material and grease etc. The surface should be roughly cleaned before the application. The paint shall not be applied on wet or uncured surface. The manufacture of the paint and primer shall be one of the followings or equivalent:

FAIR MATE, FOSROC, SUNANDA CHEMICALS, MC BOUCHEME, etc.

The paint shall be applied by brush or spray to achieve uniform finish. The paint shall be stored, mixed and applied as per manufacture’s specifications. The painting shall be done such a way that it covers concrete surface not more than manufacture’s specified area.

A minimum of 2 coats shall be applied on the fully prepared surface. Primer coat shall be applied as directed by Engineer. A minimum dry film thickness of 100 microns shall be achieved.
CLAUSE SP-18  ANTI CARBONATION PAINT (ACRYLIC PAINT)

The item is for providing and applying anti-carbonate acrylic based paint to exposed concrete surface. The material for paint shall be from approved company only.

It shall be either or of equivalent specifications:

- Bentonflair –W : Mc-Baucheme
- Sunnex – 8 : Sunanda Chemicals
- Dekguard S : FOSROC
- Sikagard 550 W Elastic : Sika

The paint shall be approved from the Engineer-in-charge. The specifications given by the company shall be followed strictly which shall generally be as under:

**Preparation of Surface:**

- Clean the surface to remove dirt, loose particles, laitance, flaking and rub down to original hard surface. If necessary and as directed by Engineer the surface shall be cleaned by air blow.
- Examine the surface. Any surface irregularities and blowhole defects should be rectified with the material prescribed by the company.
- Primer shall be applied before application of first coat of the paint. It shall be applied with brush / rollers or spray as per manufacturers directions.
- Second coat of paint shall be applied after 8 hours or as specified by manufacturers.
- Approximate total dry thickness of film shall be not less than 190 micron.

**Testing:** Testing of paint shall be done as per manufacturers direction.

CLAUSE SP-19  REINFORCED SOIL WALL

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CLAUSE SP – 20  ADDITIONAL CONDITIONS / DIRECTIONS FOR READY MIX CONCRETE (RMC)

1.0 All special conditions for cement concrete work, aggregates shall also be applicable.

1.1 The contractor shall procure RMC from the captive plant installed by the contractor.

The design mix for RMC must be in consideration with IS 10262, SP 23 got approved from MSRDC’s engineer.

Ready mix concrete prepared and transported shall be as per IS 4926:1976 Reaffirmed in 1999 or the latest IS code as directed by Engineer.

Ordinary Portland cement (OPC 53) to be used for RMC shall conform to IS 12269:1987 Reaffirmed in 1999. RMC will be brought to site from RMC plant only by transit mixers (agitators).
No dry mix shall be brought on site and water added there at.

Contractor must ensure the Grade of concrete, Specified workability - slump, minimum cement content, Flyash content, water content, type of admixture, quantity of admixture, time of loading of RMC i.e., initial & final setting time and other features of concrete as per IS, MoRTH specifications and as directed by Engineer.

When transit mixer arrives at site, the drum should always be speeded to about 10 to 15 rev/min, for at least 3 minutes, to make sure that the concrete is thoroughly mixed and uniform, before discharge as directed by Engineer.

The contractor has to maintain and keep record updated of every RMC batch, testing of samples, cube’s test records and other reports throughout the period of construction and present it for inspection / checking as and when directed by Engineer. The contractor has to bear all the charges of testing and no extra claim shall be entertained.

The admixtures used shall conform to IS 9103:1979 reaffirmed in 1980 or ASTM C-494 of 92 and must be compatible with the cement used for manufacturing concrete. Calcium chloride shall not be used as an admixture in reinforced or pre-stressed concrete work. Super plasticizers containing chlorides shall not be used in reinforced or prestressed concrete work. No extra payment will be made for the use of admixtures and use of potable quality water for mixing of cements.

All taxes / duties / royalties will be borne by the contractor and not by MSRDC and no extra claim will be paid in this regard.

The contractor shall make all necessary arrangements and provide uninterrupted supply of RMC as and when required and as directed by Engineer, failed to which strict action will be taken by MSRDC against contractor for intentionally delaying and stopping the work.

The contractor shall make free of cost all necessary arrangements and provide uninterrupted access, sitting arrangement for Engineer / MSRDC’s staff at RMC plant as and when directed, however necessary arrangement shall be made for keeping records for entire construction period.

2.0 Testing of Ready Mixed Concrete

The sampling and testing requirements for ready mixed concrete (RMC) are the same as those for site mixed concrete. As regards testing of workability following procedure is followed.

i) After making sure that the concrete has been uniformly mixed, take a sample from the first 0.5 Cum. of concrete discharge, and does a slump (or compacting factor) test on the sample. If the result complies with the specified requirements, then the load should be accepted. If the results are beyond limits, a further sample should be taken from the second 0.5 Cum of the discharge, and if this is satisfactory, the load should be accepted, if not, the concrete load shall be rejected, as the same is not as per the specification and as per mix design. (Refer IS 4926-1976)

ii) Twelve cubes shall be cast at the Batching / RMC plant as well as at the site for every day’s work where the concrete is placed for 7 days and 28 days strength of concrete.
iii) Contractor must establish a full-fledged laboratory within 20 days from the notice given by the MSRDC official’s with all accessories as per Indian Standards / Indian Road Congress standards each at Batching / RMC plant for testing various samples, cubes and at site also.

iv) The contractor shall employ minimum one Civil Engineer on batching plant per shift. They will additionally employ adequate number of trained supervisors, one full time mechanic and skilled laborers. The contractor’s engineers should be experienced and well conversant with the functioning of Batching/ RMC plant, concrete mix design procedure etc. The Contractor not employing such qualified Engineers shall not be allowed to commence with the work. The qualified Engineer shall be available on plant throughout the period of execution of the work.

v) It is the responsibility of the contractor to establish a full-fledged laboratory at site as well as at the Batching / RMC plant site approved from MSRDC. If failed it will be the sole right of the MSRDC to allow or disallow the use of his laboratory for testing of the samples, specimens and cubes or to be done at any other approved laboratory by MSRDC. In such case contractor has to be bear the cost of transportation and testing charges of samples, cubes, specimens, generation of report and all other taxes & duties levied upon by the approved laboratory.

vi) The aggregates, sand, cement shall be as per additional specification SP-2.

vii) The rate proposed in this tender for all concrete and allied works are inclusive of water charges. The batching plant owners shall have to make their own arrangement at their cost for bringing adequate water of potable quality for mixing concrete. Any suitable measures shall be employed by the plant owner to maintain the desired temperature of concrete as per I.S. specifications at the batching plant itself and for this no extra payment will be made. Water used for mixing of concrete shall be clean and free from oil, salt, acid, vegetable matter and other injurious substances harmful to the concrete; it shall meet the requirements stipulated in latest I.S. Code – 456. The water brought for concreting and curing etc. shall be got tested from MSRDC approved laboratory to verify whether it is suitable for above purposes, whenever directed. This testing will be done at the contractor’s cost.

viii) The sand shall be of approved quality with fineness modulus between 2.4 to 3.5. The sand will have to be screened to remove the over sized particles at quarry itself and washed at plant before its use, in no case shall fine aggregate be accepted containing more than two percent by dry weight, not more than three and half percent, by dry volumes, not more than five, by wet volume of clay loam, silt. The fine aggregates shall be only river sand. The fine aggregates will be tested and retested as directed by the Engineer till they satisfy the required norms as per IS and as specified above.

ix) The mix design shall be carried out as per IS 10262 and IS: SP 23. All the mixed design shall be got approved from MSRDC 30 days prior to the date of execution. No other method will be accepted.

x) For minimum test frequency and test report procedures refer MSRDC’s Manual for Quality Control & Quality Assurance for Road and Bridge works and related IS publication.
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<tr>
<th>Clause-SP 27</th>
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</tr>
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1.1 General

The Colour, configuration

The Colour, size and location of all traffic signs shall be as specified in the drawings and in the absence of any details or any missing details, the signs shall be provided as directed by the Engineer.

The sign shall be reflectorised as shown on the drawings or as directed by the Engineer. The signs shall be of retro reflective type and made of prismatic reflected sheeting as per Cl. 101.3 fixed over aluminium sheeting as per these specifications.

The cautionary and mandatory signs shall be fabricated through process of screen-printing. In regard to informative signs with inscriptions, the message shall be of cut out letters made in the transparent overlay film pasted over the base sheeting with pressure sensitive adhesive or as instructed by the base sheeting with pressure sensitive adhesive or as instructed by the manufacturers or as directed by the Engineer.
1.2 Material

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.2.1 Concrete: - Concrete shall be of the grade shown on the contract drawings or otherwise as directed by the Engineer.

1.2.2 Reinforcing Steel: - Reinforcing steel shall confirm to the requirement of IS: 1786 unless otherwise shown on drawing.

1.2.3 Bolts, nuts, washers: - High strength bolts shall conform to IS: 1367 whereas precision bolts, nuts etc. shall conform to IS : 1364. The bolts and nuts shall be galvanized (zinc coated, 0.55 kg/sqm minimum single spot) and galvanizing shall conform to relevant IS specifications.

1.2.4 Plates and supports: Plates and support sections for the signposts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications. The plates and supports shall be galvanized (zinc coated, 0.55 Kg per Sqm. minimum single spot.) and galvanizing shall conform to relevant IS specifications.

1.2.5 Aluminium - Aluminium sheets used for signboards shall be of smooth, hard and corrosion resistant aluminum alloy conforming to IS: 736 – Material designation 24345 or 1900. The back of the sheet will be painted with two coats of Anti Carbonation Paint/Epoxy paint.

1.2.6 The thickness of sheet shall be 3 mm for all types of signs.

1.3 Structural Details

The structural details for supports shall be as per the contract drawings and or as directed by the Engineer.

1.4 Retro-reflective sheeting

1.4.1 General requirements

The retro-reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface, which has the property of retro-reflective over its entire surface. It shall be unused, shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling, and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure facing the sun for two years and its having passed these tests shall be obtained from a reputed laboratory, by the manufacture of the sheeting, for each lot separately. The reflective sheeting shall be of prismatic lens type.

1.4.2 The retro-reflective sheeting shall be of Prismatic lens type, consisting of cube corner lenses and pressure sensitive adhesive and should be applied to the sign substrate at room temp. 18 deg. C, transparent, waterproof plastic having smooth surface. The coeff. of retro reflective as determined in accordance with ASTM standard E- 810 shall give the minimum values as indicated in table given below.
TABLE SP-16

Minimum Coefficient of Retro-reflection for retro-reflective sheeting
Prismatic lens type (lux / sqm)

<table>
<thead>
<tr>
<th>Obser. Angle</th>
<th>Ent. Angle in Degree</th>
<th>White</th>
<th>Yellow</th>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
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<tbody>
<tr>
<td>0.2</td>
<td>- 4</td>
<td>700</td>
<td>470</td>
<td>215</td>
<td>43</td>
<td>80</td>
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<tr>
<td>0.2</td>
<td>+ 30</td>
<td>400</td>
<td>270</td>
<td>100</td>
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<td>0.5</td>
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<tr>
<td>0.5</td>
<td>+ 30</td>
<td>75</td>
<td>51</td>
<td>26</td>
<td>5.0</td>
<td>10</td>
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</tbody>
</table>

When totally wet, the sheeting shall not show less than 90% of the values of retro reflectance indicated in Table. At the end of 7 years, the sheeting shall retain at least 75% of its original retro reflectance.

1.5 Messages / Borders

The messages (legends, letters, numerals etc.) and borders of Cautionary / Regulatory sign boards shall be screen printed. Screen printing shall be processed and finished with materials in a manner specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. The messages (legends, letters, numerals etc.) and borders of information signs shall be of cut letters made in transparent overlay film pasted over the base sheeting with pressure sensitive adhesive or as instructed by the manufacturers or as directed by the Engineer.

1.5.1 For screen printed transparent coloured areas on white sheeting, the coefficient of retro-reflection shall not be less than the values of corresponding colour in Tables Sp-5.

1.5.2 Cutout messages and borders, wherever used, shall be made in transparent film applied on base sheeting with pressure sensitive adhesive with the coefficient of retro reflection shall not be less than the values of corresponding colour in Tables Sp-5. For the background colour of the sign the coeff of retro reflection shall not be less than that specified in Table Sp-5 for the respective colours.

1.6 Colour

Unless otherwise specified, the general colour scheme shall be as stipulated in IS: 5 “Colour for Ready Mixed Paints” Viz

<table>
<thead>
<tr>
<th>Colour</th>
<th>IS Colour</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>IS Colour</td>
<td>166</td>
</tr>
<tr>
<td>Red</td>
<td>IS Colour</td>
<td>537</td>
</tr>
<tr>
<td>Green</td>
<td>IS Colour</td>
<td>284</td>
</tr>
<tr>
<td>Orange</td>
<td>IS Colour</td>
<td>591</td>
</tr>
<tr>
<td>Fluroscent green</td>
<td>IS Colour</td>
<td></td>
</tr>
</tbody>
</table>

The colours shall be durable and uniform in acceptable hue when viewed in daylight or under normal headlights at night.

1.7 Adhesives

The sheeting / film shall have a pressure sensitive adhesive of the aggressive tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean
surface. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type material of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate. In case of pressure sensitive adhesive sheeting, the sheeting shall be applied in accordance with the manufacturer’s specifications.

1.8 Fabrication

1.8.1 Surface to be reflectorised shall be effectively prepared to receive the retro reflective sheeting. The aluminum shall be de-greased either by acid or hot alkaline etching and all scale / dust removed to obtain a smooth plain surface before the application of retro reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting / primer. There shall be no opportunity for metal to come in contact with grease oil or other contaminate prior to the application of retro reflective sheeting.

1.8.2 Complete sheets of the material shall be used on the signs except where it is unavoidable; at splices, sheeting with pressure sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. The transparent overlay film in which cutout messages have been made shall be bonded with sheeting in the matter specified by the manufacturer.

1.9 Warranty and Durability

The contractor shall obtain from the manufacturer a seven year warranty for satisfactory field performance including stipulated retro reflectance of the retro reflective sheeting of Prismatic lens type and that of transparent film and submit the same to the Engineer. In addition, a seven year warranty for satisfactory in field performance of the finished signs with retro reflective sheeting of Prismatic lens type, inclusive of the screen printed or cutout letters / legends, transparent film and their bonding to the retro reflective sheeting shall be obtained from the contractor / Supplier and passed on to the Engineer. The contractor / Supplier shall also furnish a certification that the signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty.

Warranties should be given in original and should have legal jurisdiction in India. Warranties given by power of attorney holders will not be acceptable.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and following cleaning, shall show no appreciable discoloration, cracking, blistering or dimensional change and shall not have less than 50 % of the specified minimum reflective intensity values (Tables 100 –1) when subjected to accelerated weathering for 1000 hours, using type E or EH weather meter (AASHTO Designation M-268).
1.10 Installation

1.10.1 Sign posts, their foundation and sign mountings shall be so constructed as to hold these in a proper and permanent position. Sign supports shall be of Galvanized structural steel and shall be firmly fixed to the ground by means of properly designed foundation or as shown in the contract drawings. The work of foundation shall conform to clause 801.4.4.

1.10.2 All components of signs and supports, excluding the back side of aluminium sheet and the reflective portion shall be thoroughly descaled, cleaned and galvanized (zinc coated, 0.55 Kg/Sqm. minimum single spot.) and shall conform to relevant IS Specifications.

1.10.3 The signs shall be fixed to the posts by welding and/or bolts and washers as shown in the drawing. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.11 Foundation for Support

1.11.1 Foundation for supports of sign boards with single support shall be by making excavation in all type of strata to the sizes and level as shown in relevant drawings and fixed with M-20 grade cement concrete during installation.

1.11.2 Foundation for supports of sign boards with two or more supports shall be made by boring holes in all types of strata to the sizes levels as shown in relevant drawings and fixed with M-20 grade cement concrete during and installation. All concrete works will be carried out as per relevant MORT&H Specification.

CLAUSE SP-28 ADDITIONAL SPECIFICATIONS FOR LANDSCAPING & HORTICULTURE

1.1 BASE PREPARATION

Base preparation (up to 150 mm thick from the existing ground level) shall be carried out in any type of soil, murum (soft or hard), soft rock, boulders, old foundations, concrete, asphalt or stone paved surface, old masonry, or concrete all type or debris, all type of weeds. The contractor shall do the removal of all unwanted material including the surplus material and disposal of the same.

1.2 DIGGING OF PITS

Tree pits shall be dug a minimum of three weeks prior to back filing. The pits shall be 900x900x900mm. While digging the pits the topsoil up to the depth of 300mm may be kept aside if found good (depending upon site condition), and mixed with the rest of the soil. If the terrain is rocky, it shall be considered while digging pits and appropriate arrangement shall be made.

If the soil below is not good for plantation, it shall be replaced with the soil mixture as specified further herein. If the soil is suitable for plantation, it shall be mixed with manure; river sand shall be added to the soil if it is heavy. The bottom of the pits shall be forked to break up the subsoil.
1.3 BACKFILLING

The soil is back filled, watered thorough and gently pressed down, a day previous to planting to make sure that it may not further settle down after planting. The soil shall be pressed down firmly by treading it down, leaving a shallow depression all round for watering.

1.4 PLANTING

No tree pits shall be dug until final tree positions have been pegged out for approval. Care shall be taken that the sapling when planted is not buried deeper than in the nursery or in the pot. Planting should be carried out in well-watered soil. It is most important to plant trees at the original soil depth; the soil mark on the stem is an indication of this and it should be maintained on the finished level allowing for setting of the soil after planting. All plastic and other imperishable containers should be removed before planting. Any broken or damaged roots should be cut back to sound growth. The bottom of planting pit should be covered with 50mm and 75mm of soil. Bare roots should be spread evenly in the planting pit, a small mound in the center of the pit on which the roots are placed will aid an even spread. Soil should be placed around the roots, gently snaking the tree to allow the soil particles to shift into the root system to ensure close contact with all roots and to prevent air pockets. Backfill soil should be firmed as filling proceeds layer-by-layer, care being taken to avoid damaging the roots. Organic material should be applied, according to soil requirements.

1.5 STACKING

Newly planted trees must be held firmly although not rigidly by stacking to prevent a pocket forming around the stem and newly formed fibrous roots being broken by mechanical pulling as the tree rocks.

Methods

The main methods of stacking shall be:

A. Single verticals stake 900 mm longer than the clear stem of the tree, driven 600 mm to 800 mm into the soil.

B. Two stake as above driven firmly on either side of the tree with a crossbar to which the stem is attached. Suitable for bore rooted or balled material.

C. A single stake driven in at an angle of 45 degrees and leaning towards the prevailing wind, the stem just below the lowest branch being attached to the stake. Suitable for small bare rooted or balled material.

D. For plant material 3 m to 4.5 m high with a single stem a three-wire adjustable guy system may be used in exposed situations.

The end of stake should be pointed and the lower 1 m to 1.20 m should be coated with a non-injurious wood preservative allowing at least 150 mm above ground level.

1.6 TYING

Each tree should be firmly secured to the stake so as to prevent excessive movement. Abrasion must be avoided by using a buffer, rubber or Hessian, between the tree and stake. The tree should be secured at a point just below its lowest
branch, and also just above ground level; normally two ties should be used for each tree. These should be adjusted or replaced to allow for growth.

1.7 WATERING

The contractor shall allow for the adequate watering in all newly planted trees and shrubs immediately after planting and be shall during the following growing season, keep the plant material well watered. All shrubs, which are supplied pot grown, shall be well soaked prior to planting. Watering in and subsequent watering of summer planted container grown plants is essential.

1.8 SHRUBS PLANTING IN PLANTERS AND BEDS

All areas to be planted with shrubs shall be trenched to a depth of 450 mm. Tall shrubs may need staking, which shall be provided if approved by the Landscape Architect, depending upon the conditions of individual plant specimen shrubs and ground cover shrubs in beds and planters. Positions of shrubs to be planted shall be marked out in accordance with the Planting Plan. Shrubs are set out; precautions should be taken to prevent roots drying. Planting holes 40 cm dia and 40 cm deep should be excavated for longer shrubs. Polythene and other non-perishable containers should be removed and any badly damaged roots carefully pruned. The shrubs should then be set in holes so that the soil level, after settlement, will be at the original soil mark on the stem of the shrub. The hole should be backfilled to half its depth and firmed by treading. The remainder of the soil cans then the returned and again filled by treading.

1.9 MAINTENANCE

1.9.1 The landscape contractor shall maintain all planted areas within the landscape contract boundaries until the period of three months after the Contract. Maintenance shall include replacement of dead plants, WATERING, seeding, cultivating, control of insects, fungicide and other diseases by means of spraying with an approved insecticide or fungicide, pruning and other horticultural operations necessary for the proper growth of the plants and for keeping the landscape sub-contract area neat in appearance.

Watering shall be done daily. Manuring shall be done four times a year with organic manure like cow dung and once in a year by spreading chemical fertilizers. Weeding shall be done regularly.

1.9.2 Pruning & Repairs: Upon completion of planting work on the landscape sub-contract all trees should be pruned and all injuries repaired where necessary. The amount of pruning shall be limited to the minimum necessary to removal dead or injured twigs and branches and to compensate for the loss of roots and the results of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or special shape of the trees.

1.9.3 The proper stocking of manure at site on a dry space with proper care till the application shall be in the contractor’s scope.

1.9.4 Root System: The root system shall be conducive to successful transplantation. Where necessary, the root ball shall be preserved by support within Hessian or other suitable material. On soils where retention of good ball is not possible, the roots should be suitably
protected in some other way, which should not cause any damage to roots.

1.9.5 Condition: Trees and shrubs shall be substantially free from pests and diseases, shall be materially undamaged. Torn or lacerated roots shall be pruned before dispatch. No roots shall be subjected to adverse conditions, such as prolonged exposure to drying winds or subjections to water logging, between lifting and delivery.

1.9.6 Supply & Substitution: Upon submission of evidence that certain materials including plant materials are not available at time of contract, the contractor shall be permitted to substitute other material and plants. All substitutions shall be of the nearest equivalent species and verity to the original specified and shall be subject to the approval of the Landscape Architect.

1.9.7 Packaging: Packaging shall be adequate for the protection of the plants and such as to avoid heating and drying out.

1.9.8 Marking: Such specimen of tree and shrub or each bundle shall be legibly labeled with the following particulars:
- Its name
- The name of the supplier, unless otherwise agreed
- The date of dispatch from the nursery

1.9.9 Protective Fencing: According to local environment shrubs may have to be protected adequately from vandalism until established.

1.9.10 Completion
- On completion the ground should be formed over and left tidy.
- Completion period four months from the date of issue of LOI / Work Order. As per built, drawings should be submitted.

1.10 TREE PLANTING & GENERAL SHRUB PLANTING

1.10.1 Trees should be supplied with adequate protection as approved after delivery. If planting is not to be carried out immediately, balled plants should be placed check to check and the ball covered with sand to prevent drying out. Bare rooted plants can be healed in by placing the roots in a prepared trench and covering them with earth, which should be watered in to avoid air pockets around the roots.

1.11 TREE GUARDS

1.11.1 Where tree guards are necessary, care should be taken to ensure that they do not impede movement or restrict growth of trees.

1.12 STOCK

1.12.1 Nursery Stock:
- Planting should be carried out as soon as plants reach the site. Where planting is delayed, care should be taken to protect the plants from pilfering or damage from people or animals. Plants with bare roots should be healed in as soon as received or otherwise protected from drying out, and others set closely together and protected from the wind. If planting should be unpacked, the bundles opened up and each group of plants
healed in separately and clearly labeled. If for any reason the surface of the roots becomes dry, the roots should be thoroughly soaked before planting.

1.12.2 Plant Materials

Plant materials shall be well formed and shaped true to type and free from disease, insect and defect such as knots, windburn, sun-cold, injuries, abrasion or disfigurement.

All plant materials shall be healthy, sound, vigorous and free from plant diseases, insect pests, or their eggs and shall have healthy well-developed root systems. All plants shall be hardy under climatic conditions similar to those in the locality of the project. Plants supplied shall be conforming to the names listed on both the plan and the plant list. No plant materials will be accepted if branches are damaged or broken. All material must be protected from the sun and weather until planted.

All nursery stock shall have to inspected and approved by the Landscape Architect before planting.

All plants shall be conforming to these requirements specified in the plant list. Except that the plants larger than specified may be used if approved, but use of such plants shall not increase the contract price. If the use of larger plant is approved the spread or roots or ball or earth shall be increased in proportion to the size of the plant.
3. PART B

AMENDMENTS/MODIFICATIONS/ADDITIONS TO EXISTING CLAUSES OF GENERAL TECHNICAL SPECIFICATIONS

SECTION 100 GENERAL

CLAUSE 101 (Modification)

Replace the last sentence and read as under:

The latest edition of all specifications/standards till 3 months before the final date of submission of the tender shall be adopted.

CLAUSE 102 (Addition) DEFINITIONS

The following abbreviations shall be added in this Clause:

"MORT&H" : Ministry of Road Transport and Highways
"MMRDA" : Mumbai Metropolitan Region Development Authority
"MSRDC" : Maharashtra State Road Development

CLAUSE 107 CONTRACT DRAWINGS

Clause 107.1 (Modification)

"The Contract Drawings provided for bidding purpose shall be as contained in Volume of the Bidding Documents and shall be used as reference only. The shapes, dimensions of substructure and superstructure of flyovers including height of RE walls are mandatory."

CLAUSE 108 SITE INFORMATION

Clause 108.4 (Substitution)

"Identification of quarry sites and borrow areas shall be the responsibility of the Contractor. Materials procured from quarry sites and borrow areas identified by Contractor and to be used in Works must comply with the requirements of quality as stipulated in the Technical Specification for particular items of work. Aggregates available from Turbhe Quarry are not suitable."

CLAUSE 110 PUBLIC UTILITIES

--- deleted ---

CLAUSE 112 ARRANGEMENTS FOR TRAFFIC DURING CONSTRUCTION

Clause 112.2 (Addition)

Where the Project road under construction crosses existing cross roads, or an established road, the road shall be kept open at all the times for which no extra payment shall be made. In case the Engineer specifically orders to
construct and maintain diversion, the same will be paid for if specifically provided for in the BOQ. Otherwise, it is deemed to be included in the rates quoted for items of project work. Temporary diversions for diverting the traffic from existing carriageway to new carriageway or vice-a-versa will have to be constructed by the contractor at his cost and this work is treated as incidental to the work execution.

**Clause 112.4 (Modification/Addition)**

**Traffic Safety and Control**

Last line of Para 5 shall be read as under:

“The sign shall be of approved designs and of reflectory type.”

Add the following paragraph at the end of the clause:

“Before commencement of any construction, the Contractor shall prepare and submit details of the arrangements he proposes to make for passing traffic during construction, design of barricades, signs, markings, lights, flags etc. and get the same approved by the Engineer.”

“Delete para 2 of Clause 112.4”

**CLAUSE 120**

**SITE OFFICE FOR ENGINEER AND OTHER SUPERVISORY STAFF**

--- deleted ---
4. SPECIFICATIONS AND STANDARDS FOR OPERATION AND MAINTENANCE WORKS

1. PREAMBLE

The Technical Specifications contained herein shall be read in conjunction with the other Bid documents as specified and "specification for road and bridge works", issued by Ministry of Surface Transport (Road Wings), Govt. of India and published by the Indian Roads Congress, hereinafter referred as "MORT&H Specifications" and IS and BS specifications for electrical and mechanical items.

2. OPERATING ENVIRONMENT

The information regarding the operating environment provided elsewhere is given in good faith by the Employer, but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the employer is erroneous or insufficient. Collection of accurate site information required for Bid and project implementation is the responsibility of the Bidder.

3. SCOPE OF WORK

The purpose of the contract is to provide operation and maintenance for Collection of toll at Rajiv Gandhi Sea Link including maintenance of the Structure, approaches, connectors, Toll plaza building and road furniture as given in the bid document and all related assets including connectors at specified service level during the Contract period. This involves round the clock vigil of the Project and to provide services as per laid down technical specifications, in order to carry out all necessary operations and maintenance activities to keep all assets in functional state.

4. GENERAL REQUIREMENT OF SPECIFICATIONS

The technical specification in accordance with which the entire work described hereinafter shall be executed and completed by the Contractor shall comprise of the following:

4.1 Part – I – General Technical Specifications

The General Technical Specifications shall be the "SPECIFICATION FOR ROAD AND BRIDGE WORKS" (FOURTH REVISION, August 2001 reprinted in September 2002) issued by Ministry of Road Transport and Highways, Govt. of India and published by the Indian Roads Congress, hereinafter referred as "MORT&H Specification". For Electrical and Mechanical works relevant IS Specifications will apply?

4.2 Part II – Supplementary Technical Specifications

The Supplementary Technical Specifications shall comprise of :-

- Amendments / Modifications / Additions to the "Specifications for Road and Bridge Works" referred to in Part I.

- Additional Specifications for particular item of works not already covered in Part I.

- When a reference is made to a clause, and Amended / Modified / Added Clause supersedes a Clause or part thereof in the said Specifications.
- In so far as Amended / Modified / Added Clause may come in conflict or be inconsistent with any of the provisions of the MORT&H Specifications under reference, the Amended / Modified / Added Clause and the additional specifications shall prevail.

4.3 The following Clause in the "Specification For Road and Bridges Work" (Fourth Revision August 2001, reprinted in September 2002) has been Amended / Modified / Added upon.
102, 110.1, 111.1, 111.9, 111.13, 111.14, 111.15, 112.1, 112.8, 113.2, 114.2(xvii), 301.3.12, 305.2.1.4, 305.2.2.2, 3.9.4, 309.5, 501.1, 5.1.2.2, 601.3.4, 602.2.2, 602.2.3, 602.2.4.1, 602.2.8, 602.3.3.1, 901.10, 3004.1.3, 3004.1.4, 3005.3 to 3005.6, 3006 to 3012.

4.4 In the absence of any definite provisions on any particular issues in the aforesaid specification reference may be made to the latest codes and specifications of IRC and BIS in that order. Where even these are silent, the construction and completion of the work shall conform to sound engineering practice as approved by the Engineer and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer shall be final and binding on the Contractor.

4.5 In respect of project road and Connectors there are some items of works which are common in nature. Where the specifications / requirement are spelt out separately, the better specifications / prescriptions among the Project Highway would be applicable.
5. AMENDED / MODIFIED / ADDITION TO EXISTING CLAUSES OF GENERAL TECHNICAL SPECIFICATIONS

GENERAL

Clause 102  Definition
The following abbreviation shall be added to this clause:
MOST  – Ministry of Surface Transport, Govt. of India.
MSRDC – Maharashtra State Road Development Corporation, Ltd., Mumbai.
MORT&H – Ministry of Road Transport and Highways

Clause 110.1: Delete the existing Clause and substitute the clause as under:-
Existing services like water pipes, sewers, oil pipelines, cables, gas ducts etc., owned by the various authorities including Public Undertaking and Local Authorities shall be checked and at most care shall be taken by the Contractor during execution of work. Damages if any, shall be the responsibility of contractor.

Clause 110.1: General
Add the following after the first paragraph:
The Contractor shall preserve trees, plants and other vegetation that remain within or adjacent to the works and shall use every precaution necessary to prevent damage or injury thereto.

On completion of the works, all areas distributed by the construction activities shall be restored to their original condition, or as may be acceptable to the engineer. The cost of the same shall be deemed included in the rates.

Clause 111.9: Add the following sentences at the end of the para
Vehicles delivering materials to the site shall be covered to avoid spillage of materials.

Clause 111.13: Add new sub-clause:
"The Discharge Standards promulgated under the Environment Protection Act 1986 shall be adhered to strictly. All waste arising from the maintenance executed services is to be disposed off in a manner which is acceptable to the State Pollution Control Board and the Engineer.

All Vehicles and machinery employed in the execution of the works shall be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of the current pollution control legislation. Notwithstanding this requirement noise levels from any item of plant must comply with the relevant legislation for levels of sound emission. Vehicle maintenance and refueling shall be carried out in such a fashion that the spillage of fuel and lubricants do not contaminate the ground or near by watercourse. An "Oil collector" shall be provided for wash down and refueling areas. Fuel storage shall be in proper bounded areas. In all vehicles, the hazard lights should be in working condition and should be used while plying on the Highway. During poor light conditions or at night, a traffic Controller with illuminating red want, flickering light etc. should direct the traffic around the plant".
Clause 111.14:  Add following new sub-clause

All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed of in a hygienic manner.
Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.

Clause 111.15:  Add the following New Sub-Clause:

All works are to be carried out in such a fashion that the damage or disruption to the flora and fauna is reduced to a minimum wherever possible. Trees or shrubs will only be felled or removed that impinge directly on traffic safety or on necessary temporary works, after seeking approval of the Engineer.

Clause 112.8:  Plant and Equipment

Add new sub Clause:

"During the day, plant and equipment working in a position adjacent to traffic and having a projection beyond the normal width of the item, such as, grade blade, shall have a fluorescent red marker attached to the outer end of the projection. During poor light conditions or at night, an additional traffic controller with an illuminated red and flickering light etc shall direct traffic around such plant and equipment. At night, all plant and machinery and any obstructions shall be removed from the Project road

Clause 114.2  (xvii)

Add to Clause "Cost of all provisions for executing the work safety including all traffic safety and regulatory arrangement provided in clause 112 and all protective clothing, barriers, earplugs etc."

SECTION 300  EARTHWORK EROSION CONTROL AND DRAINAGE

Clause 301.3.12:  Back – filling

After the last sentence, add the following:
"Density requirements for back filling shall be in accordance with Table 300-1 and compaction requirements shall be in accordance with Table 300-2” of MORT&H.

Clause 305.2.1.4  Borrow Materials

Paragraph 1 of this clause shall read as under:

“No borrow area shall be made available. The arrangement for the source of supply of the material for embankment and sub grade as well as compliance to the different environmental requirements in respect of excavation and borrow areas as stipulated, from time to time, by the
Ministry of Environment and Forest, Government of India and local bodies, as applicable shall be the sole responsibility of the Contractor”.

SECTION 500: BASE AND SURFACE COURSES (BITUMINOUS)

Clause 501: Preparation of Surface

Clause 501.1: Scope

Amend this clause as under:
Replace the works "as shown in the applicable drawings", in line 4, by words "as directed by the Engineer"

Clause 501.2: For Patching Potholes and Sealing Cracks

Amend this clause as under:
"The material for deep patching/deep potholes (depth more 75mm) shall be :
- Aggregates (50 mm)
- Prime – Coat
- Cold or Hot Bituminous mixtures (50 mm)

The shallow potholes and depressions less than 75 mm in depth shall be filled up with Cold or Hot Bituminous Mixture. For sealing narrow cracks the specifications appended in this section are to be adopted, which may be suitable modified based on the site requirements.

SECTION 600: CONCRETE PAVEMENT

Clause 601.3.4: Add the following sentence at the end of para.

The strength of concrete should be 10 Mpa at 28 days when tested in accordance with IS. 456.

Clause 602.2.2: Delete the existing para and substitute with

Ordinary Portland Cement, 43 Grade (IS 8112) shall be used at the option of the engineer.

Clause 602.2.3: Add at the end of Clause

"Admixtures containing Calcium Chloride shall not be used".

Clause 602.2.4.1: In line 3, for 35% read 25%

Clause 602.3.3: Delete part of last sentence from "and ........ shall be 0.50" and add. “

The pavement concrete shall be a class M40 concrete with a minimum 28 day compressive characteristic strength of 4 MPa. The Maximum free water cement ratio shall be 0.45.”
SECTION 800 TRAFFIC SIGNS, MARKINGS AND OTHER ROAD APPURTENANCES

Clause 801 Traffic Signs:

Delete existing entries in this clause and replace them by entries given in succeeding paragraphs.

Clause 801.1 General

Clause 801.1.1 The colour and configuration:

The colour, size and configuration of all traffic signs for the Expressway shall be as per existing drawing and specifications and in the absence of any details, the sign shall be provided as directed by the Engineer.

Clause 801.1.2 The signs shall be reflectorised as shown on the drawing or as directed by the Engineer. The signs shall be retro reflective type and made of prismatic reflective sheeting with pressure sensitive adhesive or as instructed by the manufacturers or as directed by the Engineer.

Clause 801.2 Material

The various material and fabrication of the traffic signs shall conform to the following requirement:-

All traffic signs shall be of diamond grade type IX only.

Clause 801.2.1 Concrete:

Concrete shall be of M20 grade or otherwise as directed by the Engineer.

Clause 801.3.9.7 Reinforcing steel:

Reinforcing steel shall be conform to the requirement of IS : 1786 unless otherwise shown on drawing.

Clause 801.3.9.8 Bolts, Nuts, Washers:

High strength bolt shall conform to IS: 1367 whereas precision bolt, nuts etc. shall conform to IS: 1364. The bolt and nuts shall be galvanized (zinc coated, 0.55 kgs. per sqm. minimum single spot) and galvanizing shall conform to relevant IS specifications.

Clause 801.2.5 Aluminum:

Aluminum sheet used for signboards shall be smooth, hard and corrosion resistant aluminum alloy conforming to IS: 736 – Material designation 24345 or 1900. The back of the sheet will be painted with two coats of Anti Carbonation Paint/Epoxy paint.

Clause 801.2.6 The thickness of the sheet shall be 3mm for all types of signs.

Clause 801.2.7 The structural details of the sheet shall be as per the existing drawing or as directed by the Engineer.
Clause 801.3 Retro-reflective sheeting.

Clause 801.3.1 General Requirement:

The retro reflective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and possess fast colour. It shall be new and unused and show no evidence of cracking, scaling, pitting, blistering, edge lifting or cutting and shall have negligible shrinkage or expansion. A certificate of having tested the sheeting for these properties in an unprotected outdoor exposure having the sun for two years and its having passes these test shall be obtained from a reputed laboratory, by the manufacturer of the sheeting, for each lot separately. The reflective sheeting shall be of Prismatic lens type.

Clause 801.3.2

The retro reflective sheeting shall be Prismatic lens type consisting of cube corner lenses and pressure sensitive adhesive and should be applied to the sign at room temperature 18 degree centigrade, transparent, waterproof plastic having smooth surface. The coefficient of retro reflective as determined in accordance with ASTM standard E-810 shall give the minimum values as indicated in the table given below:

<table>
<thead>
<tr>
<th>Obser. Angle</th>
<th>Ent. Angle</th>
<th>White</th>
<th>Yellow</th>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>- 4</td>
<td>700</td>
<td>470</td>
<td>215</td>
<td>43</td>
<td>80</td>
</tr>
<tr>
<td>0.2</td>
<td>+ 30</td>
<td>400</td>
<td>270</td>
<td>100</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>0.5</td>
<td>- 4</td>
<td>160</td>
<td>110</td>
<td>45</td>
<td>9.8</td>
<td>20</td>
</tr>
<tr>
<td>0.5</td>
<td>+ 30</td>
<td>75</td>
<td>51</td>
<td>26</td>
<td>5.0</td>
<td>10</td>
</tr>
</tbody>
</table>

Clause 801.3.3

When totally wet, the sheeting shall not show less than 90% of the values of retro reflectance indicated in the above Table. At the end of 7 years, the sheeting shall retain at least 75% of its original of retro reflectance.

Clause 801.3.4 Messages / Border:

The messages (legends, letter, numeral etc) and borders of Cautionary / Regulatory signboards shall be screen painted. Screen-Printing shall be processed and finished with material and in a manner sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. The messages (legend, letters, numerals etc) and borders of information signs shall be of cut letters made in transparent overlay film pasted over the based sheeting with pressure sensitive adhesive or as instructed by the manufacturers of as directed by the Engineer.

Clause 801.3.5

The screen printed transparent coloured areas on white sheeting, the coefficient of retro reflection shall not be less than the values of corresponding colour in Table given in Clause 801.3.2

Clause 801.3.6

Cutout messages and borders, whenever used, shall be made in transparent film applied on base sheeting with pressure sensitive adhesive.
with coefficient of retro reflection shall not be less than the values of corresponding colour in Table given in Clause 801.3.2 For the back ground colour of the signs, Coefficient of retro reflection shall not be less that that specified in Table given in Clause 801.3.2 for the respective colours.

Clause 801.3.7 Colour:

Unless otherwise specified the general colour scheme shall be as stipulated in IS: 5. "Colour for Ready Mixed Paints", viz:

Red - IS Colour No. 537 : Single Red  
Green - IS Colour No. 284 : Indian Green  
Orange- IS Colour No. 591 : Deep Orange

The colours shall be durable and uniform in acceptable hue when viewed in daylight or normal headlights at night.

Clause 801.3.8 Adhesives:

The sheeting / Film shall have a pressure sensitive adhesive of the aggressive tack type requiring no heat, solvent or other preparation of adhesion to a smooth clean surface. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water and other solvents) and shall be suitable for type material of the base plate such that it shall not be possible to remove the sheeting from the sign based in one piece by use of sharp instrument. The adhesive shall from durable surfaces of the plate. In case of pressure – sensitive sheeting, the sheeting shall be applied in accordance with the manufacturer’s specification.

Clause 801.3.9 Fabrication

Clause 801.3.9.1 Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminum shall be de-greased either by acid or by hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro reflective sheeting.

Clause 801.3.9.2 Complete sheet of the metal shall be used on the signs except where it is unavoidable; at splices, sheeting with pressure sensitive adhesives shall be overlapping not less that 5 mm. Where screen printing with transparent colour is possible, only butt jointing shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. The transparent overlay film in which cutout messages have been made must be bonded with sheeting in the manner specified by the manufacturer.
Clause 801.3.10 Warranty and Durability

The Contractor shall obtain from the manufacturer a seven year warranty for satisfactory field performance including stipulated retro-reflection of the retro-reflective sheeting of the Prismatic lens type and that of the transparent film and submit the same to the Engineer. In addition, a seven year warranty for satisfactory in filed performance of the finished signs and retro-reflecting sheets of Prismatic type, inclusive of the screen printing and the cutout letters/legends, transparent film and their bonding to the retro-reflective sheeting shall be obtained from the Contractor and passed on to the Engineer. The Contractor / supplier shall also materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty.

Warranties should be given in original and should have legal jurisdiction in India. Warranties given by the power of attorney holders will not be acceptable.

Processed and applied in accordance with the recommendation procedures, the reflective material shall be weather resistant and following cleaning, shall show no appreciable discoloration, cracking, blistering or dimensional change and shall not have less than 50 per cent of the specified reflective intensity value (given at Table in Clause 801.3.2) when subject to accelerated weathering for 1000 hours, using type E and EH weather meter (AASHTO Designation M 268)

Clause 801.4 Installation

Clause 801.4.1 Sign posts, their foundations and sign mountings shall be so constructed so as to hold these in a proper and permanent position. Sign support shall be of galvanized structural steel and shall be firmly fixed to the ground by means of properly designed foundation or as shown in the existing drawings.

Clause 801.4.2 All components of signs and supports, excluding the back side of aluminum sheet and the reflective portion shall be thorough descaled, cleaned and galvanized (zinc coated, 0.55 kgs per sq m, minimum single spot) and conform to relevant IS specifications.

Clause 801.4.3 The signs shall be fixed to the posts by welding and / or bolts and washers as show in existing specifications / drawings. After the nuts have been tightened, the tails of the boards shall be turned over with a hammer to prevent removal.

Clause 801.5 Foundation for supports

Clause 801.5.1 Foundation for supports of sign boards with single support shall be by making excavation in all type of strata to the sizes and levels as shown in relevant existing drawings and fixed with M 20 grade cement concrete during installation.

Clause 801.5.2 Foundation for supports of sign boards with two or more supports shall be by made by boring holes in all type of strata to the sizes and levels as shown in relevant existing drawings and fixed with M 20 grade cement concrete during installation.
SECTION 900 QUALITY CONTROL FOR ROAD WORKS

Clause 901.10

For bitumen emulsion, mild steel, cement and other similar material where essential tests are to be carried out sampling, testing and furnishing of the test certificates shall be done by means of a sub contract. The frequency of test regarding bitumen, cutback and emulsion in respect of its quality shall be as per the Table 900-4 of MORT&H Specifications unless modified and included in the bid document elsewhere.

SECTION 3000 MAINTENANCE OF ROAD

Clause 3004.1.3

And 3004.1.4 - Delete existing clause and add:-

The areas to be patched shall be identified. They shall be cut / trimmed either with jack hammer or hand tools like chisels pick-axes etc. such that the areas are in the shape of rectangles or squares. The edge lines of the pavement area to be patched shall be cut with a pavements-sawing machine. The edges shall be cut vertically up to the level where the lower layer is suitable without any loose material. The areas shall be thoroughly cleaned with compressed air or any appropriate method approved by the Engineer to remove all dust and loose particles.

For Shallow Potholes (depth less than 75 mm) Excavation shall then be filled with material as per Clause No. 501.2.2 after painting the sides with a thin layer of a prime coat. Each layer shall be compacted with approved small vibratory roller and the top layer shall be made with a cold or hot bituminous mixture. All loose and / or major surplus material on the surface shall be removed.

For Deep Potholes (depth more than 75 mm) he excavation shall be filled up the BUSG (Built Up Spray Grout) as per MORT&H Clause 506 in layers each not exceeding 75mm in thickness duly compacted up to 50 mm below existing road surface. The top 50 mm shall be filled with Hot Bituminous mixture material using aggregates as mentioned in Clause 504.2.3, duly compacted. However, in rainy season cold emulsion may be used.

Clause 3005.2.2 - Add the following at the end of the clause :-

"Compression seals shall be pre-compressed neoprene impregnated expanding foam sealing strip having a current BBA certificate or rubber seals made of polychloroprene elastomers complying with BS 2752 and conforming with the requirements of ASTM Standard D2628-81. Seals of butadiene-acrylonitrile or other synthetic rubbers may be used if certificates are produced to show that they conform to the performance requirements of ASTM Standards D2628-81 for oven ageing, oil ozone resistance, low temperature stiffening and recovery. Seals made of ethylene vinyl acetate in micro cellular form and other synthetic materials may be used in longitudinal joints and in structures with the approval of the Engineer if test certificates are produced to show adequate resistance to fuels and heat ageing when tested in accordance with BS 4443: Part 4, Method 10 and Method 12 respectively. The compression set of any seal shall not be greater than 15% when the specimen is subjected to a 25% compression in accordance with BS: 4443 Part 1, Method 6. When immersed in standard oils for 48 hours at 25°C in accordance with BS 903: Part A16 the volume change shall not be greater than 5%.”
Clause 3005.2.3 - Add the following at the end of the clause:

Compression Seals shall be shaped so that they will remain compressed at all times and shall have a minimum 20mm contact face with the sides of the sealing groove. If lubricant – adhesive is used, it shall be compatible with the seal and the concrete and shall be resistant to abrasion, oxidation, and fuels and salt.

When compression seals are used, the widths of the seals shall be selected in relation to the width of the sealing groove, the bay lengths and manufacturer's recommendations so that the estimated maximum width of the joint opening shall be not more than 70% of the original width of the seal, the estimated maximum width being calculated on the basis of a movement of 4mm per 10 m run of slab. The maximum calculated width of sealing groove shall be such that the contact face of the seal with the sides of the groove shall be not less than 20mm and that the top of the seal shall a minimum of 3mm below the surface of the concrete.

The type of sealant to be used shall be the same type as being replaced.

Clause 3005.3 - Treatment and Repair of Cracks

Scope
Development of cracks can be for a variety of reasons and all attempts should be made to ascertain the cause of the cracks. Each type of crack may require different treatment.

Transverse Cracks
Cause: Excessive Sub-grade restrain or joint locking Method: The slab has to be broken and rebuilt. The dowel bars should be realigned and then the slab is cast.

Longitudinal Cracks
Cause:
Too great a slab width or uneven slab support or development of tensile stresses due to compression along the pavement length.

Method:
The cracks are to be stitched which means installation of the bars to prevent the opening of cracks. The bars are introduced through slot cut across the cracks. The slots, 25 to 30mm wide and 470 mm long, are cut at 600 mm c/c along the length of the crack and at approximately 90 degrees to it. The depth of the slot should be about half the slab depth. The next stage is to drill vertical holes, 50 mm deep, at the end of each slot. The debris is then removed, by blowing with oil free compressed air. The holes, and the base of the slots, are then primed with resin and covered with epoxy resin mortar, in to which hooked, 16 mm dia, high yield deformed bars are pushed, until covered with mortar. Finally the slot is refilled to the road surface with either fine concrete or more resin mortar, which is then cured. The stitching should be continued in line with, and up to 1 meter beyond the end of the visible crack. Once stitching has been completed, a sealing groove is chased or sawn, whichever is the most appropriate, along the line of the crack, which is finally sealed with epoxy resin.

Miscellaneous Cracks
These are normally corner cracks or wandering cracks.

Cause:
These arise because of poor detailing, absence of dowel bars, or gross under estimating or traffic.
Method:
If the cracks are minor, the stitching can be resorted to as described earlier on the direction of the Engineer. However if the cracks are major (more than 1.5 mm and for the entire depth) then the rebuilding of the entire slab should be resorted to.

Clause 3005.4 - Treatment for poor Skid Resistance

Scope
The transverse grooves formed in the concrete surface by using a grooving machine provide good skid resistance. However, some time polishing of surface takes place which reduces the skid resistance and needs to be treated.

Cause:
The loss of skid resistance can take place because of worn away micro texture due to very heavy traffic. The second cause could be the use of sand for making the concrete containing a high proportion of acid soluble material, which causes the road surface to polish rapidly, even under light traffic.

Method:
In the first case, use of grooving machine to provide the transverse grooves may eradicate the problem. However, in the second case the fault can only be resolved by slab replacement or by using bonded concrete overlay.

Clause 3005.5 Treatment for Spalling and Scaling

(a) Spalling

Scope
Joint areas can spall for different reasons and to different depths. Spalling could be of two types’ i.e. shallow spalls that are close to the surface and deep spalls that go well below the normal depth of sealing groove, even below the dowel bars.

Method
Shallow spalls can often be removed, while at the same time creating a groove of uniform width, by sawing along a line outside the limit of the spall as shown below and filled with epoxy resin. However, in case of deep spalling, it should be rectified by full depth reconstruction.

(b) Scaling
Surface texture failure occurs due to excessive wear, Scaling may occur due to air entrainment, inadequate curing, improper finishing or the wrong concrete mixture.

Method:
Clean and scrub the area to remove any loose particles. Small area should be repaired with epoxy compound as per manufacturer’s instructions and as per directions of the Engineer.

Clause 3005.6 - Treatment of Slab Rocking and Settlement:

Scope
Uneven settlement beneath the slabs can cause this problem. This problem should be tackled at the earliest since any delay could result in cracking of the slab.

Method
These faults can be rectified by pressure or vacuum grouting to fill voids and there by provide more uniform support.
Clause 3006 - Spot Reconditioning and Reconstruction of Shoulders

Scope
The work shall consist of restoring eroded areas on cuts and fills and to repair washouts in order to keep the roadside safe.

Methods, Tools and Equipment

i) Safety devices and signs shall be placed as per MORT&H clause no. 112

ii) Fill material, confirming the specification shall be brought to site from approved quarry spreading of material shall be carried out as per procedures laid down under MORT&H clause no. 305.3.5

iii) The shoulders shall be compacted using plate compactors and slopes shall be compacted with suitable hand rammers.

The scope includes:-

a) Setting out and providing safety devices and signs placed in work area. As per MORT&H Clause No. 112

b) Furnishing all material to be incorporated in the work including all royalties, fees, rents where necessary and all lead/ lifts.

c) All labour, materials, tools, equipment, safety to measures, testing and incidentals necessary to complete the work to specifications.

Clause 3007 - Cleaning, Clearing and Repairing Drains.

Scope
The work shall consist of removing material from the roadside drain inside and outside inclusive of their covers if there, to bring them to original drainage capacity.

Disposal of sediments, extraneous debris or vegetation growth, blocking flow. The work includes the opening and replacing the covers of drains required for cleaning and disposal of material, if any.

Methods, Tools and Equipment

i) Safety devices and signs shall be placed as per MORT&H clause no. 112.

ii) The debris, sediments, vegetation growth and excess material shall be excavated. The excavated material shall be disposed of as directed by Engineer-in-charge with all leads and lifts.

iii) The drain slopes and sides shall be dressed up to original flow line and cross section.

Clause 3008 - Deepening and Reshaping of Roadside Drains.

Scope
The work shall consist of deepening and reshaping of roadside drains and making shallow lateral drains on shoulder to drain out the rain water / surface water effectively from concrete or bituminous surface as well as from roadside beams.
Method, Tools and Equipment

i) Safety devices and signs shall be placed in accordance with MORT&H clause no. 112.

ii) The drains should be cleaned and cleared off the deposition of sediments, extraneous debris or vegetation blocking free flow in the drain before repairing.

iii) In case of any erosion is noticed then these drains should be deepened / widened in proper slope as directed by the Engineer-in-charge.

iv) For draining out the standing water from road edges and paved shoulders, the shallow lateral drains at regular intervals shall be made manually as and when required.

v) The drain slope and sides are neatly dressed up to required flow line and cross section.

vi) The excess excavated material should be well area or transported away from the site with all leads and lifts, as directed by the Engineer-in-charge.

The scope of work includes:-

a) Setting out the providing safety devices and signs placed in work area. As per MORT&H clause no. 112

b) Furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads/lifts.

c) Transporting the excavated / recovered material and disposing of the same with all leads and lifts as directed by the Engineer-in-charge.

d) All labour, material, tools, equipment, safety measures, testing and incidentals necessary to complete the work to specifications.

Clause 3009 -- Routine Maintenance for Road Signs and Delineators.

Scope

The work shall consist of the washing of signs delineators, removal of posters etc. on a regular maintenance cycle to supporting structures with repairing, if necessary.

Methods, Tools, and Equipment

i) The road signs and delineators should be thoroughly washed using a detergent solution followed by a clean rinse and whole face of the sign shall be dried.

ii) Defects in supporting structures like bullet holes, surface marks or bent posts shall be repaired with appropriate tools.

iii) Damaged area shall be cleaned and loose / flaking paint shall be removed. Bullet holes shall be filled with filler and supporting structures shall be painted with first quality enamel paint in two or more coats.
Clause 3010 : Replacing Road Signs and Delineators

Scope

The work shall consist of replacement of damaged signboards / delineators due to accident, or worn out due to age and weathering.

Replacement of missing signboards and major repairs especially to sign faces.

Methods, Tools, and Equipment

i) New signboards/delineators in lieu of badly damaged/missing ones shall be provided conforming to MORT&H specification clause 801 to perform the function and convey message that was originally required.

ii) For major repairs following sequence shall be carried out.

a) Beat any holes and indentations flat with a hammer and dolly.

b) Clean the damaged area and remove any loose or flaking sheeting, paint or other surface material.

c) Fill the holes and indentations with polyester body filler and excess material shall be strike off to flush with sign face/ 

d) Patch the whole of the affected area with existing surface material as required viz. Pressure sensitive reflective sheeting, paint etc.

e) Restore the legend by black screening or reflective sheeting of correct class, cut to shape.

The scope of work includes:- 

a) Furnishing all the material to be incorporated in the work including all royalties, fees, taxes, rents and transporting them to work site.

b) All labors, material, tools, equipment, safety measures, testing and incidentals necessary to complete the work to specifications.

Clause 3011 Painting of Road Markings

Scope

The work shall consists of painting of road marking as desired by the Engineer.

Method

Where required by the Engineer, 3mm thick thermo-plastic road marking compound of white / yellow (approved colour) colour and shade will be applied to the road surface with automatic/semi automatic machine as per detailed drawing and design. Cleaning of the surface of all earlier dirt or dust and other foreign matter, and management of traffic control will be done before painting undertaken. Following marking will be done:

1. Lane Marking
2. Edge Marking
3. Chevron Marking
4. Any other type of marking like directional arrows, lettering, etc.
Clause 3012  Quality Assurance

3012.1.1  The Concept

The achievement of quality through compliance with requirements of codes and tender specifications implicitly depends upon the 'human skills' for the successful and reliable application.

Quality Assurance (QA) is essentially the system of Planning, organizing and controlling the 'human skills' to assure this compliance.

QA activity is an integral part of every work function and to this extent is the responsibility of the Contractor/supplier. The owner, consultant and approving authority also assume responsibility by the way of part supervision and technical auditing which ascertains the compliance independently. The total system of internal and external control, testing and quality control, acceptance criteria and documentation is covered in the 'Quality Assurance System''

3012.2  Organization of QA System

Main Contractor and Sub-Contractors, Material Supplier, Manufacturer, Specialist Agency/Contractor Consultant and Owner/Utility are the parties involved in QA system.

Some or all parties mentioned above are involved and have various degree or responsibility in any specific item of work in the project. The scope and interrelation between various parties form the organization of QA system. This Organization may be a single level, two level or multi-level controlling/auditing system, so defined by the number of independent parties involved in checks / controls.

3012.3  Quality Assurance Manual

3012.3.1  General

A Quality Assurance Manual constituting a base document outlining policy, procedures, responsibilities, compliance, acceptance criteria and documentation etc. shall be prepared by the Contractor and submitted to the Engineer for approval. The document shall generally cover aspects listed below, but is not limited to the same.

- Identification of all parties involved in QA and their inter-relationship.
- Internal QA system of each party.
- Levels of cross-checking / verification in case of multiple verifications/controls, including system of inspection and audit, wherever applicable.
- Organization of personnel, responsibilities and lines of reporting for QA purposes.
- Criteria for acceptance/rejection, including identification of proper authorities for such decisions.
- Inspection at the end of the defect liability period.
- Items to be covered in maintenance manual.
- All formats for documentation.
3012.3.2 Quality Related Documents

Various operations / actions which have bearing on quality are documented in the manual and the record of inspection approval/non-approval etc. recorded in the standard forms which are to be specially evolved for each activity. Broadly, they are of the following category:

3012.3.2.1 Method Statement

Includes approved methods of construction written in the form of various steps and explained by sketches if required.

3012.3.2.2 Planning Performa

This includes planning of various Quality Control Tests, their applicable procedures / codes, performing agency, QA checking agency, frequency of testing and surveillance etc.

3012.3.2.3 Inspection Performa

These are Performa for submitting data/information for seeking approval from the Engineer before commencing any operation Pour cards for concreting, approval of reinforcement, form – work etc., are some of the examples.

3012.3.2.4 Check Lists

The inspection proforma are usually accompanied by “Check Lists” which cover the important aspect of the inspected item. These are listed with space for confirming the fact of inspection and recording observations by Contractor as well as by owner's QA staff.

3012.3.2.5 Surveillance Formats

These formats record the observations of the surveillance team of the Contractor/owner which independently checks the compliance of the QA procedures at regular intervals.

3012.3.2.6 Registers and Records

These give various forms in which records of material consumption, complied test results data on calibration of equipment, works inspection notes, etc. are kept.

3012.3.2.7 Procedural Guidelines

These statement include various procedures to be followed such as 'Guidelines for dealing with non
3012.4 **Reference Documents**

3012.4.1. **ISO 9000 SERIES OF DOCUMENTS**
In general, the documents published by International Standard Organization (ISO) are to form the basis evolving the Quality System applicable for all quality related activities. More specifically ISO 9001: 1994 "Quality Systems – Model for Quality Assurance in design, development, production, installation and Servicing” is of basic nature.

3012.4.3. **Guidelines on Quality Systems for road bridges (Plain reinforced and prestressed concrete) IRC (document under publication.)**

3012.4.4. **Quality Control for Road Works: MORT&H Specification No. 900.**
5.0 **TOLL PLAZA**

5.1 Toll plazas shall be designed for projected peak hour traffic of 20 - 25 years. The total number of toll booths and lanes including ETC lanes shall be such as to ensure the service time of not more than 10 seconds per vehicle at peak flow regardless of methodology adopted for fee collection. For purpose of guidance following parameters are suggested as a capacity of individual toll lane for design purpose:

(i) Semi-automatic toll lane (Automatic vehicle identification but manual Money transaction)  
240 veh/hour

(ii) Automatic toll lanes (Automatic vehicle identification and money Transaction – smart card)  
360 veh/hour

(iii) Electronic toll collection (ETC lanes) (Toll collection through on board unit and No stoppage of vehicles)  
1200 veh/hour

However, waiting time for a vehicle in queue at toll plaza shall not be more than 4 minutes.

5.2 Two toll lanes in each direction travel shall be provided with the system of payment through smart card / Electronic Toll Collection (ETC). Not less than 2 middle toll lanes shall be capable of being used as reversible lane to meet the demand of tidal flow.

5.3 The width of each toll lane shall be 3.2 meters, expect for the lane for over dimensional vehicles, where it shall be 4.5 m.

5.4 Between each toll lane of the toll plaza, traffic islands are required to accommodate tollbooth. These islands shall be of minimum 25 m length and 1.8 m width. Protective barriers of reinforced concrete shall be placed at the front of each island to prevent out of control approaching vehicles crashing into the toll booth. They would be painted with reflective chevron markings.

5.5 Toll booth shall be placed at the centre of each traffic island with dimensions to accommodate toll collector’s desk for toll equipment such as key board and console, video screen, card reader, note and coin storage, telephone and environmental control system. The tollbooth shall have large glass window to provide the toll collector with good visibility of approaching vehicles. The bottom of the toll window should be placed at such a height (0.9 m) above ground level so as to provide convenience of operation. The Toll booths shall be ergonomically designed and vandal proof. There shall be CCTV camera installed at each booth. 
Toll booth shall be visually pleasing, structurally sound and capable to withstand extreme weather conditions of the region. It shall have clear visibility of approaching vehicles and shall be strong to withstand all forces as per relevant clauses of Section 1, Part VI of NBC. The buildings of the toll plaza complex shall conform to specifications in this volume.

5.6 The area of toll plaza covering the flared portion shall be provided with concrete pavement. All the toll lanes and tollbooths shall be covered with canopy. The canopy shall be wide enough to provide weather protection to toll operators, drivers and facilities.
The canopy shall be of aesthetically pleasing design with cylindrical support columns located at traffic island so that there is no restriction on visibility and traffic movement. The vertical clearance shall be as prescribed in this Manual or as directed by IE. The Toll Plaza complex including its canopy, having 5.5 m clear height covering all toll lanes, except one in each direction with 5.5m wide extreme lane for oversized and non-toll able vehicles. Tollgates shall be provided with check barriers, which can be electrically operated from tollbooths. High mast lighting shall be provided. Power supply will be from the public power supply system but standby diesel generating sets of adequate capacity shall be provided.

5.7 The toll plaza shall have lighting system of provide visibility to drivers for the use of facility especially to access the correct service lane and also to the toll collector – Indian Standard IS: 1944 shall be followed. The minimum requirement of illumination on the road surface of 30 lux shall be ensured. This would be done by providing high-mast lighting (minimum 25 m height), lighting at canopy, and lighting inside tollbooths. Street lighting shall also be provided on both side approaches of toll plaza for a minimum length of 500 meters on each side. Power supply shall be from public power supply system but stand by generating set of the capacity to supply the required power shall be provided at toll plaza.

5.8 The toll plaza shall be provided with surface and sub surface drainage system so that all the storm water is drained off efficiently and no ponding or stagnation of water takes place at any area of the toll plaza at any time during the year.

5.9 Toll plaza shall have fire fighting equipment including smoke detectors and auto visual alarm system as per section 4.17.1 of National Building Code so that the personnel working in the complex and the office are not subjected to hazardous situation due to fire.

5.10 The semi automatic toll collection system shall be equipped in each entry lane with a vehicle detector for counting the number of vehicles and their axle number and for identification of the category of vehicle. The system shall also have a ticket issuing machine for issue of the tickets for user fee at the press of a button on a touch panel and entry lane controller for controlling the equipment of the entry lane and for sending the data to the data processing equipment at toll plaza office. Each toll lane shall have electronically operated boom barrier along with synchronized system for traffic light.

5.11 The smart card system would comprise the system for vehicle identification, barrier and synchronize traffic light and payment through smart card. The smart card would comprise reader/writer conforming to ISO Standards: 1443-A sealed to a National Electrical Manufacturers Association (NEMA) for Ingress Protection (IP-65) having transmission frequency of 13.56 MHz.

5.12 The Electronic Toll Collection system shall consist of an on board unit fitted on a vehicle and an antenna to receive communication for identification of its code and other stored data and a system for transmitting the data from the on board unit to the reader and from reader to the customer information management system.

5.13 DELETED

5.14 Toll Plaza shall have a separate office building so as to provide comfortable office space for manager, cashier & other staff. There shall be separate rooms for T. V. monitors, meeting, toilets and for the sale of passes, smart cards, on board units and public
interaction. The building shall have a strong room for keeping the money and a garage to accommodate the security van (during operation of loading the collected revenue). There shall be parking space in the same campus for vehicles for the staff and workers and other vehicles engaged in the operation of the Project Highway.

5.15 The toll plaza shall have toll audit system and fraud protection measures. The operations for toll collection, supervision, auditing and money handing shall be done through the qualified personnel so that each operation is efficiently handled.

5.16 Operation and Maintenance Centre

Operation and maintenance centre at the toll plaza shall be maintained by the Contractor as per direction of MSRDC/ Independent Engineer. The O&M center shall be maintained by the Contractor at his cost and risk.

The Contractor shall maintain the following facilities:

(i) Main control centre and Administrative block
(ii) Equipment for operation and maintenance and storage space for them
(iii) Storage space for equipment and material for traffic signs and markings
(iv) General garage and repair shop
(v) Testing laboratory
(vi) Parking space for minimum 4 no. of large vehicles and for other expected vehicle during peak hours including those for working staff and visitors.

5.17 All building works shall be designed to meet the functional requirements and shall be compatible with regional architecture and micro climate. Locally available materials shall be given preference but not at the cost of construction quality.

5.18 The whole campus of operation and maintenance centre shall have system for security with safe entry and exit.

Specifications for atomization of Toll Plaza

The Contractor shall provide computerized automatic toll collection system at his own cost at the location specified in the bid document

The Contractor shall provide the system within 365 days from the date of award of Contract.

The system shall be in two parts:

1. Cash collection & management system for daily cash & for electronic cash for Contractors i.e. frequent travelers.

2. Toll Audit system -
   a) to facilitate Audit to the Contractor
   b) to have a data to the Corporation

Toll Audit System

To monitor the traffic count and classification information for each lane in a toll plaza shall be collected. The information thus collected shall be matched to a set time period, such as the duration of an operator’s shift. The proposed toll audit system shall have a treadle – loop – treadle configuration for accurate and efficient vehicle counting and classification.
Scope of Equipment Supply -

The Contractor shall supply the following components of the toll audit system:

i) Combination of Double Strip treadle Sensor System & Inductive loops for vehicle classification (treadle-loop-treadle configuration) for every toll lane.

ii) Traffic Data Processor Unit – Should be able to count and classify upto a minimum of 4 toll lanes.

iii) Plaza Computer.

iv) Data Collection and processing software.

The specifications and system capabilities for the toll audit system to be used shall be as follows:

Specifications of Double Strip Treadle Sensor System

The Double Strip treadle system shall consist of one inroad classifications sensor mounted in a metal frame, minimum of 2.4m long, to be employed for axle detection on a roadway regardless of vehicle speed. The mounting of the sensor in the frame shall enable fast and convenient replacement and maintenance without disturbing the lane traffic. Incase of a sensor failure, the sensor should be replaced in the treadle frame without the need to remove the frame from the pavement. The system shall incorporate the following features:

- The dimensions of the Double Strip Treadle shall be a minimum of 8 feet long, 1 inch thick and 6 inch wide.

- The axle sensor shall be an inverted “T” shape in cross-section. Machined ASTM A36/CSA C 44W Steel clamp bars shall secure each sensor in place. These removable clamp bars shall be held in place with SAE Grade & centre lock nuts on B7 studs which shall be embedded into the roadway. This method shall allow for rapid removal of the clamp bars when sensor replacement is necessary. The recessed nuts must be protected by expansion plugs.

- All axle sensors shall be weather proof and field replaceable. Each sensor shall be constructed using Force Sensing Resistive (FSR) elements and sealed in black UV-resistant polyurethane. The sensors shall be wear resistant with a minimum of Shore D hardness of 80.

- The sensor lead cable shall consist of an 18 gauge, twisted, individually shielded, stranded and tinned copper pair wire with a polyethylene jacket and a length of 30m. The connection to the sensor element shall be sealed during the moulding process.

- The Double Strip Treadle installation frame shall be mounted in existing pavements. When mounting into existing pavements, the frame shall be secured using chemical anchors. It shall be surrounded with high strength epoxy grout and supported with vertical epoxy anchors. Alternately, a shallow vault installation shall be employed which will utilize concrete to provide the necessary support around the frame.

- The treadle frame shall be constructed from ASTM A36/CSA C44W Steel, and then commercially sandblasted to SSPC-10. For corrosion protection, the frame shall be primed with zinc-rich paint and then top coated with black Anti Carbonation Paint/epoxy paint.

- The complete treadle system must be flush mounted to allow normal dust removal and road cleaning to be carried out, therefore no component of the system (i.e. frame, clamping bars, or sensor) will be elevated above the surface of the roadway.
Multiple interface cards shall be available to connect the Treadle System to a variety of electronics for different applications such as Toll Roads, Weight-In-Motion, etc.

**Specifications of Traffic Data Processor Unit**

The data processor unit shall be a portable, battery operated, multi-lane time interval recording counter and classifier, able to collect traffic data in following formats:

- Vehicle Count
- Vehicle classification
- Gap
- Headway
- Speed by axle
- Speed by length

The detailed specifications for the system shall be as follows:

- **Programming** - From counter keyboard and display
  - From IBM compatible computer (standard for tolling applications)
  - Remotely with telephone modem
  - With Take Away Memory (TAM) card.

- **Lane Test** - All lanes shall be monitored.

- **Monitoring** - Sensor activation shall be tested.
  - Configuration, spacing and ID’s shall be verified
  - All above functions shall be completed without interference with data collection & accomplished either from the display or a computer.

- **Data Collection** - Through a telephone modem.
  - With IBM compatible computer
  - With Take Away Memory (TAM) card
  - With a Datahog (Portable Data Collection Device)

- **Memory** - 68K of counter memory (standard for tolling applications)
  - UP gradable to 964K internally.
  - UP gradable to 16MB externally with TAM card.

- **FIFO Sensor Input** - A FIFO (First in, First out) buffer on all sensor inputs to eliminate sensor misses due to simultaneous activation.

- **Telemetry** - Remotely accessible with addition of external modem & phone.
  (Standard Rs.232 port with baud rates from 300 to 19,200 (standard for tolling applications)

- **Case** - Minimum of 10 gauge welded aluminium, powder coated
  - Modular plug-in CMOS electronic circuit boards
  - ANS 170 powder paint finish

- **Power** - AC power operation
  - 6 volt, 12 amp hour rechargeable battery
  - Shall have the capabilities to operate with solar power
  - Shall have the capabilities to selectable option that requires the operator to verify turn off the equipment (to prevent false shut down during lightening or accident turn-off)
- **Key board / Display**  
  - 16 key watertight keyboard  
  - Complete alphabet and number on two line, 32 characters, and liquid crystal display.  
  - Capabilities to operate with a laptop

The system shall be capable of providing data in MM/DD/YY, DD-MM-YY or YY-MM-DD formats. The system shall provide the following data collection modes:

- **Counting Modes**

  Time Interval Count Mode - Traditional method of time interval counting, which shall use the field unit to collect and sort count data by user selectable time interval traffic counts. Count method shall include direction, lane subtraction and normal.

  Time Stamped Sensor Event - The system shall be capable of collecting traffic data where the field unit shall store sensor activations with a time stamp accurate to 1/10000 of a second. This data then shall be transferable to plaza computer that will use it to produce selected reports.

- **Classification Modes**

  Binning - System shall be capable to a minimum of user defined 30 speed, 30 axle, 30 headway and 30 gap bins.

  Time Stamped Sensor Events - The system shall be capable of classifying traffic data where the field unit shall store sensor activations with a time stamp accurate to 1/10000 of a second.

  Individual Vehicle Record - The system shall be capable of storing the time of passage to 1/100 second, speed to 1/100 km/h, number of axles and spacing between axles for each vehicle.

**Performance Criteria**

The toll audit system shall be capable of following performance criteria:

- The system shall have a temperature operating range of -25°C to +70°C. The Traffic Data Processor Unit shall have a climatic operating range of 0-90% non-condensing relative humidity.
- The Sensor shall achieve an operating life of 2 millions axles or two years.
- To replace an axle Sensor in a frame, the MTTR (Mean Time To Repair) shall be ½ hour.
- The Treadle Frame shall have a MTBF of 15 years and a MTTR of 48 hours.
- The Treadle and Interface board, in a typical installation, shall have an accuracy of better than 99.9%
- The Treadle system must withstand the action of single axle loads of up to 14000 kg.
- The Traffic Data Processor Unit shall measure the speed and distance in Imperial (U.S) or metric units. It shall record interval lengths ranging from one minute to 24 hours.
- To avoid the parts of system to come to loose accidentally during its operations, the system shall have military specification connectors, all metal, rust proof and sand proof with locking bayonet connectors, with bayonet mount and threaded protective steel caps for all connection, power, sensors and programming.
- To keep out harmful dirt and moisture, the lid and seal shall be watertight.
Software & Reports

- The software to be provided for data collection and processing shall be extremely user-friendly working under windows based environment and contain industry standard classification modes.
- The software shall be configurable allowing Corporation to set many parameters including data storage mode, date format, password requirements, time adjustments, etc.
- The software shall be capable of printing the desired report to the screen, a printer or to a disk file.
- The software shall be capable of generating reports for total volume of traffic and for the binned classification for the same data set.
- The software shall be capable of displaying category of current vehicle that is passing through lane.
- System should generate following reports.
  - Booth wise & shift wise collection & traffic report.
  - Hourly category wise collection & traffic report.
  - Date wise collection & traffic report.
  - Graphical reports showing date wise and category wise comparison of collection & traffic.
  - Graphical reports showing comparison of frequent and non frequent travelers.

Technical Specifications For Cash Collection & Management System

General Requirements

The proposed Toll Collection and management system shall meet the following requirements:

a. It shall be a single system that supports both cash and Electronic Toll Collection at the toll plazas.

b. The system shall be based on state-of-the-art hardware and software. The software shall be based on state-of-the-art operating system like Linux, UNIX & windows and shall support current & well-proven concepts like Object Oriented Programming.

c. Since the system shall be in operation 24 hours a day, it is essential that the successful tenderer shall provide quick and effective repair / maintenance service from his office located in Mumbai. The tenderer shall therefore, in his bid, furnish evidence of an established office in Mumbai.

a. The Electronic toll collection shall be based on the contact less mifare smart card technology. The system shall further support both the Touch-and-Go as well as the non-stop methods of Electronic Toll Collection.

System Requirements

System Architecture

The toll collection and management system shall principally consist of two functional groups i.e. the “Front-end System” and the “Back-end-System”. The Front-end System shall include all software and hardware that is necessary to operate a single toll lane. The Back-end System shall include all software and hardware that is necessary to manage and service the tolling system. Further the Back-end System shall include a Point of Sales, which provides all customer related services (i.e. selling and re-loading.
of devices). The Front-end and Back end Systems shall be connected via Ethernet or any other communication media offering a minimum bandwidth of 10mbps.

The Lane Equipment

The lane equipment shall form part of the ‘Front-end-System’. Each lane shall have the following equipment:

a) Touch and go contact-less smart card readers with built in user display.
b) Lane PC with a suitable tollbooth operator monitor and keyboard.
c) Control Unit which acts as a lane-wise controller for all electronic transactions.
d) A receipt printer for printing out receipts against manual cash payment of toll.
e) A cash drawer to hold the toll amount collected as cash.
f) Easy up-gradability to non-stop toll system.

Backend equipment

a) A Toll Management System server. It shall serve as the core unit of the back-end system and shall collect toll collection transaction information from the Lane PCs and shall perform administration of the system database.

b) All Toll Management tasks shall be executed by workstations. Due to security reasons direct access to the TMS is not allowed. The number of workstations within a system shall be adjustable / scalable at any time. The interface between TMS shall use standard web-technologies and security mechanisms and shall be platform (OS) independent.

c) A workstation that serves as an user interface to the Toll Management system server. With the aid of the workstation it shall be possible for the system supervisor / manager to access the central database and generate necessary financial and operational reports.

d) PC shall be located at the Point of Sales and shall be used for initializing, loading and reloading Contact less Smart Cards using a suitable card-accessing device.

The Network printer shall be used automatic and manual printouts of TMS reports.

Individual Equipment Requirements

Lane Equipments

**Touch and go smart card reader**

The Touch and go smart card reader shall have the capability of accessing (Reading and writing) contact less smart cards of ISP 14443 Type A. For this purpose it shall be equipped with a suitable Radio Frequency interface. For the convenience of the road users it shall have a suitable display that will guide customers through the toll payment process. There shall also be a built in buzzer that provides acoustic indication of the transaction status. Further the smart card reader shall be suitable for outdoor installation and shall be aesthetically pleasing.

**Lane PC**

The Lane PC shall be suitable for operation in a hot and dusty environment and therefore shall be an industrial grade PC. It shall be equipped with an advanced CPU technology to guarantee maximum system performance. Further the Lane PC shall be equipped with a suitable disk storage system (RAID 1 or higher) that
ensures data security through adequate redundancy. Also in order to ensure high performance and data security the Lane PC shall be based on a suitable operating system like Linux.

**ETC Controller module**
The operating system of control unit shall be such that it guarantees maximum performance and security for Electronic Toll Collection transactions. It shall be equipped with a sufficient number of interfaces for the smart card readers and capability to communicate with Lane PC. The unit shall be rugged enough to work in a hot and dusty environment.
The control unit shall be responsible for execution and handling of Electronic toll collection transactions and thus it shall have the capability to perform the following tasks:

- Execution of cards transactions at the connected smart card readers
- Communication with the Lane PC for receiving blacklists and toll tables.
- Handling of blacklists and toll tables
- Transfer of transaction data to the Lane PC

The control unit shall be upgradeable to handling non-stop Electronic Toll Collection.

**Receipt Printer**
The receipt printer shall be of the thermal type with a sufficient speed of operation in order not to delay the toll collection operations. It shall be activated from the Lane PC. The ticket size shall be compact and yet sufficient to hold the necessary information.

**Cash Drawer**
The cash drawer shall be used for storage of the collected cash. The cash drawer shall automatically open, when a cash transaction is confirmed. It shall possess sufficient mechanical strength and ruggedness and preferably made from steel.

**Backend equipment**

**The Toll Management Server**
The Toll Management Server forms the core of the back-end system and is responsible for collecting the transaction log files from the Lane PCs, administrating the database, generation of reports and data evaluation. Thus the server shall be a machine of sufficient speed and possess adequate data storage facilities (for primary and secondary storage as well as for data archiving).

**The Workstation**
The workstation shall be equipped with a software interface to the Toll Management Server and shall be used for execution of the various tasks that are needed for a comprehensive toll management. Thus the Workstation shall be a standard office PC designed to run the Graphical User Interface software (TMS-interface) using an Internet browser.

**The Point of sales PC**
The point of Sales serves as a service point for customers. Its main functions include initialization & loading of Contact less smart cards.

For this purpose the POS shall have direct access to the Toll Management Server database via suitable interface software and therefore shall be able to register new customers at the database and install use accounts. Further it shall also serve as a service point for user inquiries and registration point in case of problems (i.e. lost or stolen devices, defective devices,)
Only authorized operators shall be allowed to access the Point of Sales PC. The POS shall have a convenient and intuitive graphical user interface, that supports the operator and clearly leads an operator through the different processes typically needed at a device issuing and service centre.

For the purpose of initialization, loading and reading of smart cards the Point of Sales PC shall be connected to a suitable smart card reader / writer.

**The Printing Facilities**
The Network shall be primarily used for printing reports of the Toll collection and management system and shall be located in the control room. The number of printers is adjustable.
SCHEDULE – D
(See Clause 4.1.3)

APPLICABLE PERMITS

(Deleted)
SCHEDULE – E
(See Clause 9.1)

PERFORMANCE SECURITY

The Chief Engineer,
MSRDC, Bandra

WHEREAS:

(A) …………….. (The “Contractor”) and the Chief Engineer, Maharashtra State Road Development Corporation (the “Authority”) have entered into a Contract Agreement dated…………. (the “Agreement”) whereby the Authority has agreed to the Contractor undertaking the Operation and Maintenance of Rajiv Gandhi Sea Link and Toll Plaza as per Tender & Collection of Toll on Upfront Basis, subject to and in accordance with the provisions of the Agreement.

(B) The Agreement requires the Contractor to furnish a Performance Security to the Authority in a sum of 10% of Estimated Realization or offer quoted by Contractor whichever is more (the “Guarantee Amount”) as security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the Contract Period (as defined in the Agreement). 5% of the performance security shall be paid in term of Demand Draft/Pay order payable at Mumbai and remaining 5% of the performance security shall be paid in the form of Bank Guarantee issued by a nationalized bank, or a Scheduled Bank in India.

(C) We, …………….. through our Branch at ………………. (the “Bank”) have agreed to furnish this Bank Guarantee by way of Performance Security.

(D) We, …………….. through our Branch at ………………. (the “Bank”) have agreed to furnish this Demand Draft/Pay order by way of Performance Security.

Form of Bank Guarantee for Performance Security

In consideration of the Maharashtra State Road Development Corporation Ltd. (hereinafter called “the Employer”) having agreed to exempt ------------------------------- ---(hereinafter called “the Contractor”) from depositing with the Maharashtra State Road Development Corporation Ltd. the sum of INR ……………………..(Rupees…………………………… only) being the amount of Performance Security payable by the Contractor to the Maharashtra State Road Development Corporation Ltd. under the terms and conditions of the contract made between the Maharashtra State Road Development Corporation Ltd. of the one part and the Contractor of the other part (hereinafter referred to as “the said Contract”) for (describe the work) as security for due observance and performance by the Contractor of the terms and conditions of the said contract on the contractor furnishing to the Maharashtra State Road Development Corporation Ltd. a Guarantee in the
prescribed form of a Scheduled Bank in India being in fact these presents in the like sum of INR
------------------(Rupees -------------------------------only).

We ---------------------------------Bank / Limited registered in India under --------
-----Act and having our Local Head Office at ------------------ in India do hereby:

1. Guarantee to the Maharashtra State Road Development Corporation Ltd:

   a) Due performance and observance by the Contractor of terms, covenants and conditions on
      the part of the Contractor in the said Contract.

   AND

   b) Due and punctual payment by the Contractor to the Maharashtra State Road Development
      Corporation Ltd. of all sums of money, losses, damages, costs, charges, penalties and
      expenses payable to the Maharashtra State Road Development Corporation Ltd. by the
      Contractor under or in respect of the said Contract.

2. Undertake to pay to the Maharashtra State Road Development Corporation Ltd. on demand
   without any demur and notwithstanding any dispute or disputes raised by the Contractor (s) in
   any suit or proceeding filed in any court or tribunal relating thereto the said sum Rs……………… (Rupees--------------------------------only) or such lesser sum as may be
   demanded by the Maharashtra State Road Development Corporation Ltd. from us our liability
   hereunder being absolute and unequivocal. Any such demand shall be conclusive as regards
   the amount due and payable by Bank under this guarantee.

3. Agree that:

   a) The guarantee herein contained shall remain in full force and effect during the subsistence
      of the said Contract and that the same will continue to be enforceable till all the dues of
      the Maharashtra State Road Development Corporation Ltd. under or by virtue of the said
      Contract have been duly paid and its claims satisfied or discharged and till the
      Maharashtra State Road Development Corporation Ltd. certifies that the terms and
      conditions of the said Contract have been fully and properly carried out by the Contractor.

   b) We shall not be discharged or released from the liability under this Guarantee by reasons
      of:

      • Any change in the constitution of the Bank or the Contractor;

      • Any agreement entered into between the Maharashtra State Road Development
        Corporation Ltd and the Contractor with or without our consent;

      • Any forbearance, act or omission on the part of the Maharashtra State Road
        Development Corporation Ltd or any indulgence shown by Maharashtra State Road
        Development Corporation Ltd to the Contractor.

      • Any variation in the terms, covenants or conditions contained in the said Contract:
• Any extension of time given to the Contractor;
• Any other conditions or circumstances under which, in law; a surety would be discharged.

c) Our liability hereunder shall be joint and several with that of the Contractor as if we were the principal debtors and not merely as surely in respect of the said sum of Rs.----------
     (Rupees ----------------------------------only).

d) We shall not revoke this guarantee during its currency except with the previous consent in writing of the MSRDC.

e) This guarantee is encashable at local office at Mumbai with a notice to guarantee issuing Bank Branch viz. ___________

4. Notwithstanding anything contained herein before our liability under this guarantee is restricted to Rs.------------------(Rupees ----------------------------only). Our guarantee shall remain in force upto---------------------- and shall be extended automatically for six months from ________ unless the guarantee is cancelled and returned by Maharashtra State Road Development Corporation Ltd to Bank.

IN WITNESS WHEREOF the Common Seal of -----------------------------has been hereunto affixed the -----------------------------day of -----------------------------20-

Witness:
1.-----------------------------

2.-----------------------------
SCHEDULE – F
(See Clause 15.2 of Volume - II)

MAINTENANCE REQUIREMENTS

1 Maintenance Requirements

1.1 The Contractor shall, at all times, operate and maintain the Project in accordance with the provisions of the Agreement, Applicable Laws and Applicable Permits. In particular, the Contractor shall, at all times during the Contract Period, conform to the maintenance requirements set forth in this Schedule-F (the “Maintenance Requirements”).

1.2 The Contractor shall repair or rectify any defect or deficiency set forth in Paragraph 2 of this Schedule-F within the time limit specified therein and any failure in this behalf shall constitute a breach of the Agreement. Upon occurrence of any breach hereunder, the Authority shall be entitled to recover Damages as set forth in Clause 15.8 of the Agreement without prejudice to the rights of the Authority under the Agreement, including Termination thereof.

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-F within the time limit set forth therein.

3 Other defects and deficiencies

3.1 In respect of any defect or deficiency not specified in Annex-I of this Schedule-F, the Contractor shall undertake repair or rectification in accordance with Good Industry Practice.

3.2 In respect of any defect or deficiency not specified in Annex-I of this Schedule-F, the Independent 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 Independent Engineer.

4 Extension of time limit

Notwithstanding anything to the contrary specified in this Schedule-F, 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 Independent 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-F, if any defect, deficiency or deterioration in the Project 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 and maintain a record thereof in a register to be kept in such form and manner as the Independent 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 Independent Engineer at any time during office hours.

7 Divestment Requirements

All defects and deficiencies specified in this Schedule-F shall be repaired and rectified by the Contractor so that the Project conforms to the Maintenance Requirements on the Transfer Date.

8 Display of Schedule-F

The Contractor shall display a copy of this Schedule-F at the Toll Plazas along with the Complaint Register stipulated in Article 38.
REPAIR/RECTIFICATION OF DEFECTS AND DEFICIENCIES

The Contractor shall repair and rectify the defects and deficiencies specified in this Annex-I of Schedule-F within the time limit set forth herein.

### Nature of defect or deficiency | Time limit for repair/rectification

#### ROADS

<table>
<thead>
<tr>
<th>Nature of defect or deficiency</th>
<th>Time limit for repair/rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) Carriageway and paved shoulders</strong></td>
<td></td>
</tr>
<tr>
<td>(i) Breach or block</td>
<td>- Temporary restoration of traffic within 24 hours; permanent restoration within 15 days</td>
</tr>
<tr>
<td>(ii) Roughness value exceeding 3,000 mm in a stretch of 1 km (as measured by a standardised roughometer/bump integrator)</td>
<td>- 180 days</td>
</tr>
<tr>
<td>(iii) Pot holes</td>
<td>- 48 hours</td>
</tr>
<tr>
<td>(iv) Cracking in more than 5% of road surface in a stretch of 1 km</td>
<td>- 30 days</td>
</tr>
<tr>
<td>(v) Rutting exceeding 10 mm in more than 2% of road surface in a stretch of 1 km (measured with 3 m straight edge)</td>
<td>- 30 days</td>
</tr>
<tr>
<td>(vi) Bleeding/skidding</td>
<td>- 7 days</td>
</tr>
<tr>
<td>(vii) Ravelling/Stripping of bitumen surface exceeding 10 sq m</td>
<td>- 15 days</td>
</tr>
<tr>
<td>(viii) Damage to pavement edges exceeding 10 cm</td>
<td>- 15 days</td>
</tr>
<tr>
<td>(ix) Removal of debris</td>
<td>- 6 hours</td>
</tr>
<tr>
<td><strong>(b) Hard/earth shoulders, side slopes, drains and culverts</strong></td>
<td></td>
</tr>
<tr>
<td>(i) Variation by more than 2% in the prescribed slope of camber/cross fall</td>
<td>- 30 days</td>
</tr>
<tr>
<td>(ii) Edge drop at shoulders exceeding 40 mm</td>
<td>- 7 days</td>
</tr>
<tr>
<td>(iii) Variation by more than 15% in the prescribed side (embankment) slopes</td>
<td>- 30 days</td>
</tr>
</tbody>
</table>
(iv) Rain cuts/gullies in slope - 7 days
(v) Damage to or silting of culverts and side drains during and immediately preceding the rainy season - 7 days
(vi) Desilting of drains in urban/semi-urban areas - 48 hour

(c) **Road side furniture including road signs and pavement marking**

(i) Damage to shape or position; poor visibility or loss of retro-reflectivity - 48 hours

(d) **Street lighting, Aviation Beacon and telecom (ATMS)**

(i) Any major failure of the system - 24 hours
(ii) Faults and minor failures - 8 hours

(e) **Trees and plantation**

(i) Obstruction in a minimum head-room of 5 m above carriageway or obstruction in visibility of road signs - 24 hours
(ii) Deterioration in health of trees and bushes - Timely watering and treatment
(iii) Replacement of trees and bushes - 90 days
(iv) Removal of vegetation affecting sight line and road structures - 15 days

(f) **Rest areas**

(i) Cleaning of toilets - Every 4 hours
(ii) Defects in electrical, water and sanitary installations - 24 hours

(g) **Toll plazas**

(i) Failure of toll collection equipment or lighting - 8 hours (with alternative arrangements for toll
(ii) Damage to toll plaza - 7 days (with alternative arrangements for toll

(h) **Other Project Facilities and Approach roads**

(i) Damage or deterioration in Approach Roads, pedestrian facilities, truck lay-bys, bus-bays, bus-shelters, cattle crossings, Traffic Aid Posts, Exhibition centre and other works - 15 days (with alternative arrangements & without interruption to traffic)

<table>
<thead>
<tr>
<th>BRIDGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) <strong>Superstructure of bridges</strong></td>
</tr>
<tr>
<td>(i) Cracks</td>
</tr>
<tr>
<td>Temporary measures - within 48 hours</td>
</tr>
<tr>
<td>(ii) Spalling/scaling - 15 days</td>
</tr>
</tbody>
</table>
### (e) Joints in bridges

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Loosening and malfunctioning of joints</td>
<td>15 days</td>
</tr>
</tbody>
</table>

### (f) Other items relating to bridges

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Gathering of dirt in bearings and joints; or clogging of spouts, weep holes and vent-holes</td>
<td>3 days</td>
</tr>
<tr>
<td>(ii)</td>
<td>Damage or deterioration in parapets and handrails</td>
<td>3 days</td>
</tr>
<tr>
<td>(iii)</td>
<td>Rain-cuts or erosion of banks of the side slopes of approaches</td>
<td>15 days</td>
</tr>
<tr>
<td>(iv)</td>
<td>Damage to wearing coat</td>
<td>15 days</td>
</tr>
<tr>
<td>(v)</td>
<td>Damage or deterioration in approach slabs, pitching, apron, toes, floor or guide bunds</td>
<td>30 days</td>
</tr>
<tr>
<td>(vi)</td>
<td>Growth of vegetation affecting the structure or obstructing the waterway</td>
<td>15 days</td>
</tr>
</tbody>
</table>
1. OPERATION AND MAINTENANCE OF THE PROJECT FACILITY

The Contractor shall maintain the Project Facility for entire Contract period. The maintenance shall be as per the guidelines for maintenance activities as detailed in the Bid Document.

1.1 Operation and Maintenance during operation period (from COD upto end of Contract period).

Operation and Maintenance from COD upto end of Contract period shall consist of maintenance of entire Project Facility to keep it in operational condition as per standards and specifications set out in the Bid Document. Further the Contractor at all time during this period shall ensure the preservation of the asset and the convenience and safety of traffic.

The maintenance of the Project Facility developed can be classified as:

(i) Routine Maintenance.
(ii) Periodic Maintenance.

(i) Routine Maintenance activities for various components of the Project Facility shall be as below:

(a) **Rigid Pavement**
   - Road cleaning once in a week.
   - Joint seals replacement as and when required.
   - Crack sealing.
   - Concrete spall / Edge repair with epoxy material
   - Mechanized texturing (to improve skid resistance) if required.
   - Replacement of cracked pavement panels.

(b) **Flexible Pavement**:
   - Repairing of Pavement Distress.
     Maintenance procedure for correcting distress in pavements shall include patching, crack sealing, surface treatment and pot hole filling.
   - Repairing of Rutting and Raveling.
   - Corrugations and shoving by camber correction.
   - Repairing of Settlement or Grade Depressions.
   - Preventing Skid Hazards during Monsoon.
   - Preventing bleeding by flushing aggregates.

(c) **Paver block pavement**:
   - Removing of ruts and ravel.
   - Cleaning on weekly basis.
   - Removal and resetting.
   - Replacement of damaged paver block.

(d) **Bridges**:
   - Cleaning on daily basis.
   - Maintenance and repairs of storm water pipes / drains.
- Maintenance of wearing course.
- Replacement / repairs of expansion joints / bearings.
- Renewal of wearing course.

**e) Landscaping and Beautification:**
- Maintaining of civil works.
- Watering to trees, plants and shrubs daily.
- Pruning.
- Grass cutting.
- Replacements of plants and shrubs.
- Cleaning of sit outs, lawns, pergolas and artifacts etc.

**f) Miscellaneous:**
- Cleaning of median kerbs, crash barriers, signages, etc.
- Painting touchup of structures, median kerbs, road markings, signages, etc.
- Replacement of footpath paver block, kerbs, water table, etc.
- Replacement of ROW railing and MS railing as and when required.

**ii) Periodic maintenance:**

Periodic maintenance is the maintenance to be carried out as below.
- Painting of kerbs, road markings, crash barriers – once in a year.
- Repairs to open drains before and after monsoon.
- Renewal of wearing course of flexible pavement - every 3 years or earlier as required.
- Renewal of wearing course over sealink – every 3 years.

**1.2 TOLL COLLECTION WORK:**

The Contractor shall collect the toll at prescribed toll plazas from COD prescribed in the Bid Document. The Contractor shall arrange necessary manpower, equipments, security and other infrastructure required for toll collection work at his own cost. The toll on a particular toll plaza shall be collected till end of the Contract period.

**1.3 CLIENT FACILITIES TO MSRDC:**

The Contractor shall provide the facilities to the MSRDC as described in as described in obligations of Contractor as per Clause No. 5.1.4 of Volume- II of the Bid Document.

**1.4 EXHIBITION CENTRE AND CONTROL ROOM:**

The contractor shall maintain the building facilities till the end of the Contract period as below:
- Cleaning of exhibition centre and control room on daily basis
- Painting the exhibition centre and control room once in a year.
- Providing watch and ward.
2. DETAILED SCOPE OF WORK

2.1 General

The scope of work includes Operation & maintenance of the Project Facility for the entire Contract period, in accordance with the stipulations of the Bid Document. The descriptions of the requirements for various elements of the Project Facility given here are the bare minimum requirements and the Contractor on his own needs to carry out necessary investigations and designs to check adequacy of the stipulated provisions and undertake the work accordingly. However the Contractor shall use only equal or higher specifications than specified in this Bid Document and/or drawings supplied with the bid document.

The Contractor shall understand the data/information and typical drawings attached with the bid document and shall himself carry out and be responsible for engineering surveys/investigations and detailed engineering designs and prepare the working drawings for all components relevant to the “operation and maintenance of Rajiv Gandhi Sea Link” to fulfill the scope of the project as envisaged hereunder.

The maintenance of different components of the Project Facility shall follow the minimum maintenance requirements as described in the bid document.

Variations in quantities to comply with the requirements of standards, design, and specifications shall not be treated as variation. In case of conflict of provisions in the defined scope, drawings, description and the specifications, the provision with better and latest standards shall be applicable.

The scope of work is broadly divided into three parts:

I) Operation and maintenance of Project Facility.

II) Collection of toll during Contract period.

2.2 Maintenance of Project Facility

i. Maintenance of Rajiv Gandhi Sea Link i.e. structures and approaches/embankments including Lift in Pylon.

ii. Maintenance of Toll Equipments and Toll plaza building.

iii. Exhibition Centre

iv. Control Room

2.2.1 Maintenance of existing Structure/Bridge

After handing over of the Bridges, structures on the corridor, the contractor shall carry out structural audit in consultation with the IE within 30 days of issue of Commencement order. As per outcome of this technical audit with the approval of IE / MSRDC the contractor shall carry out maintenance works with respect to the bridges, structures on the corridor within Contract period stipulated there.

Maintenance of the Structure shall include:

- Replacement / repairs to storm water drain pipes.
- Wearing course renewal
- Valley curve improvement.
• Lane marking with thermoplastic paint along with fixing cat-eyes, tiger-eyes etc.

• Repairs / replacement of median.

• Providing Bollards, curbouys, delineators, and reflectors at the end of Bridges.

• Lighting including electric bulbs, Aviation Beacon, street lights/C.C.T.V Cameras on bridge and toll plaza and payment towards all electric bills for the entire bridge.

• Maintenance of Lift in Pylon of main cable stayed bridge.

2.2.2 Maintenance of Toll Equipments and Toll plaza building

The constructed lanes shall be maintained by Contractor through out the Contract period as per provisions of this agreement & handed over to MSRDC at the end of the Contract period.

2.2.3 Landscaping:-

The landscaping and beautification is to be carried out as per direction of I.E. / MSRDC.

2.2.3 Maintenance of Control Room and Exhibition centre:-

• The Control room and exhibition centre shall be cleaned and maintained in proper way on daily basis.

• Necessary water and ward shall be provided

• Periodic painting shall be carried out
3. DETAILED SCOPE OF WORK FOR OPERATION AND MAINTENANCE

3.1 General

The Contractor shall maintain project facility and structures as per norms.

The Contractor shall from the Commencement date, take over the existing facility for maintenance. He shall maintain the project facility as per standards specified herein under and described elsewhere in the Bid Document along with development of project facility as envisaged in the Bid Document. Contractor shall operate and maintain entire Project facility till completion of the Contract period.

During this period the Contractor shall be responsible for following activities

i. Ensuring smooth and uninterrupted flow of traffic during normal operating conditions;

ii. Ensuring safety of the users of the Project Facility or part thereof, personnel deployed on Project and keep the Project Facility from undue deterioration and wear;

iii. Permit unimpaired performance of statutory duties and functions of any party in relation to the Project;

iv. Charging, collecting and appropriating toll in accordance with the contract.

v. Minimizing disruption to traffic in the event of accidents or other incidents affecting safety & use of the Project Facility by providing a rapid & effective response & for this purpose maintaining liaison with emergency services; Emergency maintenance shall be attended immediately.

vi. Undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, lane marking, lighting and signages;

vii. Undertaking maintenance works in accordance with Maintenance Manual and the Maintenance Programme;

viii. Preventing (with the assistance of concerned law enforcement agencies where necessary) any unauthorized entry to and exit from the Project corridor.

ix. Preventing any encroachment on the Project Site with the assistance of the concerned law enforcement agencies where necessary and preserving the right of way of the Project;

x. Applicable and adequate safety measures are taken;

xi. Minimum delay is caused to users of the Project Facilities;

xii. Any disturbance or damage or destruction to property of third party by operations of the Project Facilities is controlled / minimized;

xiii. The road users are provided with adequate information and forewarned of any event or any other matter affecting the Project Facilities to enable them to control/minimize any adverse consequences by such event or after;

xiv. Employ qualified personnel with requisite qualification and experience in sufficient number in consultation with the IE/MSRDC.

xv. Security and safety of bridges/ Security and safety above & below bridges/ etc;

xvi. Removal of debris, dead bodies and damaged vehicles. To assist local authorities for all legal processes;

xvii. Restoring any structural damages and other maintenance requirements, the toll contractor shall be responsible for providing the necessary labour, machinery, equipments and traffic management devices etc. So as to attain such contingency
expeditiously. The expenditure incurred shall be payable on actual cost basis as
asses by Independent Engineer.

**The operation and maintenance activity is broadly classified as below:**

Operation and maintenance during operation period (from COD upto end of Contract period).

3.2 Deleted.

3.3 **Operation and maintenance during operation period (from Commencement date upto end of Contract period.)**

3.3.1 **From the date of commencement** upto end of Contract period the Contractor shall operate and maintain the entire Project Facility as stipulated so as to ensure smooth and uninterrupted flow of traffic on Project Corridor and ensure safety of the users of Project Facility or part there of.

After work order contractor shall finalize in consultation with the Independent Engineer:

(i) Annual O & M Plan for the first year of operations. (For whole Project Facility)

(ii) Fourty five days prior to the completion of each year, the Contractor shall prepare an annual O and M Plan for the next year of operations.

3.3.2 During the operations period all the Project Corridor, pavements and structures contained in the Project Facility (including those in ancillary facilities) shall be maintained in traffic worthy condition as per intervention level 1 and 2 given in the table below:

**Table: Intervention Levels Operations Period (from COD upto end of Contract period)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Service Factor</th>
<th>Level 1 (Desirable)</th>
<th>Level 2 (Acceptable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Roughness by Bump Integrator (max. permissibility)</td>
<td>2500 mm/Km (Allowable Tolerance: +5%)</td>
<td>3000 mm/Km</td>
</tr>
<tr>
<td>2.</td>
<td>Potholes / km (max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Less than 75 mm deep</td>
<td>Nil</td>
<td>2 nos. of size less than 5 sq.m</td>
<td></td>
</tr>
<tr>
<td>ii) More than 75 mm deep</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Percent Cracking</td>
<td>Nil</td>
<td>No unsealed cracks more than 6mm wide on 95% Project Highway.</td>
</tr>
<tr>
<td>4.</td>
<td>Rut Depth not exceeding 10mm</td>
<td>Length not more than 5% of Project Highway</td>
<td>Up to 10% of length of Project Highway</td>
</tr>
<tr>
<td>5.</td>
<td>User Information</td>
<td>All road signs, Km post and road marking in good condition</td>
<td>All road signs, Km post and road marking in good condition</td>
</tr>
</tbody>
</table>
### Service Factor

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Service Factor</th>
<th>Level 1 (Desirable)</th>
<th>Level 2 (Acceptable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Percentage Defective bridge Deck area and bump at approach</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>7.</td>
<td>Camber</td>
<td>(+ or -) 0.05% variation from the Camber as per Design Requirements</td>
<td>(+ or -) 0.15% variation from the Camber as per Design Requirements</td>
</tr>
<tr>
<td></td>
<td>i) Main carriageway</td>
<td>(+ or -) 0.10% variation from the Camber as per Design Requirements</td>
<td>(+ or -) 0.20% variation from the Camber as per Design Requirements</td>
</tr>
<tr>
<td></td>
<td>(shoulder)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Drainage (including shoulders)</td>
<td>No visible water pool within the Project Highway</td>
<td>No visible water pool within the Project Highway</td>
</tr>
<tr>
<td>9.</td>
<td>Characteristic Deflection as per IRC: 81-1997</td>
<td>Up to 0.50 mm</td>
<td>Up to 0.80 mm</td>
</tr>
</tbody>
</table>

a) The road roughness value shall be measured at least twice in a year by a properly calibrated Bump Integrator device before the monsoon and soon after the monsoon. It shall be measured longitudinally as well as transversely along the line picking up worst surface characteristics, which include the rut areas and depressions etc. The Contractor shall ensure that at no point during the Operations Period the roughness in the road surface shall fall below than the prescribed acceptable roughness values stipulated above.

b) In case of cement concrete pavement, joints shall be thoroughly inspected every year and the loss of sealing compounds made good. The structural condition of approach ramps shall be assessed every year by taking Benkelman Beam Deflections and working out characteristic deflections of homogeneous sections of the Project Highway as per IRC-81-1997.

c) Bridges and Other Structures: The Contractor shall maintain and carry out required repairs of the various elements of the structures in accordance with IRC-SP-35: 1990.

d) The disposal of dismantled material of the Project Road works shall be responsibility of the Contractor. The Contractor shall dispose off the dismantled material as per the instructions of Independent Engineer. The electric poles and other fixtures shall be handed over to the concerned local authorities as per the instruction of Independent Engineer.

### Maintenance Activities

The maintenance activity involves keeping the Project Facility in a clean, tidy and orderly condition free of litter and debris and taking all practical measures to prevent damage to the Project Facilities or any other property on or near the...
Project Site. Removing and disposing of in accordance with all Applicable Laws and Applicable Permits, all rubbish, debris, damaged vehicles and dead bodies etc. including any and all equipments, supplies, materials and wastes brought or produced by other Contractor / Contractors on the Project Corridor.

For maintenance works, the Contractor shall generally follow the operational and performance criteria specified in the latest revision (during Contract period) of respective IRC/MORT&H standards and specifications for each of the performance indicators covered under pavement condition survey, roughness and BBD deflections. Where such criteria are not specified in the standards, the Contractor, for the purpose of routine maintenance shall set forth such criteria as to conform to relevant IRC guidelines/ MOSRT & H standards/ I.S. codes/ International codes/ Sound engineering Practices in consultation with the Independent Engineer. All the maintenance shall be with material of same standard and specifications as original or of superior specifications to be used in consultation with Independent Engineer. Further, as the Contract period is substantially long period, new technologies, material available in the market, shall be used by the contractor for operation and maintenance as per latest relevant IRC / MORT&H / IS standards at no extra cost to MSRDC, as directed by IE from time to time .

The maintenance activities may be broadly classified as:

a. Routine maintenance

Routine maintenance is a group of recurrent activities and which are related to the repair of faults and attention to the road, structure and facilities to ensure the preservation of the asset and convenience and safety of traffic, e.g. - Repairing potholes, surface patching, Road/Drain cleaning, etc.

b. Periodic Maintenance

Periodic maintenance is a group of activities which can normally be predicted and planned for by nature, location and extent and are carried out periodically, e.g.- Bituminous surface renewal, Lane marking etc.

All safety, traffic management, routine maintenance, periodic maintenance etc. shall be deemed to be part of bid.

3.3.4 The scope of maintenance activities for various components of the Project Facility shall be but not limited to as given below:

i) Pavement

a. Rigid Pavement

Routine maintenance

- Cleaning of the roads once in a week.
- Deteriorated joint seals shall be replaced as and when required.
- Minor cracks shall be sealed with epoxy material as and when required.
- Concrete spall and edge breaking shall be repaired with epoxy material as and when required.

Periodic maintenance

- Road markings and other road side features shall be maintained to meet the relevant standards to the satisfaction of the Independent Engineer.
- The periodic maintenance activities shall also include (i) removal of surface defects such as polishing of stones, loss of coarse aggregates potholes, scaling, raveling etc.
by using Portland-cement mixes, bituminous mixes or resin mixes etc., (ii) removal of cracks and (iii) removal of deficiencies in joints

b. **Flexible Pavement**

**Routine maintenance**

- Cleaning of the roads once in a week.
- Repairing of pavement distress (including pavement ruts, pot holes) to be attended as and when required.
- Corrugations and shoving to be removed by camber correction as and when required.
- Repairing of settlement and grade depressions by providing DBM, BC layers as and when required.
- During monsoon skidy surfaces shall be flushed by fine aggregates to increase skid resistance. Similarly in the summer whenever bleeding is observed fine aggregates shall be flushed to avoid skidding as and when required.
- Resurfacing hungry area by means of MSS as and when required.

**Periodic maintenance**

- The following renewal treatment to bituminous surfaces including thermoplastic painting and other road markings will be provided by the Contractor when the Roughness index is more than 2000 mm / Km or after every three years whichever occurs earlier.

For the flexible pavements wearing course shall be renewed by bituminous concrete (BC) every third year including camber and grade correction by DBM course. Polymer Modified bitumen (55 Grade) shall be used for Bituminous concrete.

- The periodic renewal shall result in improvement of the riding quality, satisfying road roughness value.
- The rip-rap (stone pitching) shall be repaired wherever required.

c. **Paver block pavement**

**Routine maintenance**

- Cleaning the pavement surface once in a week.
- Removing of rut and ravels by removing the paver blocks, correcting the surface including compaction and rearranging the paver blocks as and when required.
- Whenever paver blocks are observed to be damaged or missing they shall be replaced with new ones.

**Periodic Maintenance**

- Removing and resettling of paver blocks every three years.

ii) **Structures/ Bridges**

**Routine maintenance**

- Cleaning the carriageway daily.
- Pot holes, surface irregularities shall be repaired as and when required.
- Repairs to the painting with paint of same standard as and when required.

**Periodic maintenance**

- Cleaning and washing parapet wall / railing every month.
- Oil Painting of railings, crash barriers once in a year.
- Oil painting of kerbs, median verge twice in a year.
- Cleaning of water spouts & down take pipes.
- Repairs / replacement of drainage above & below the bridge as and when required.

Wearing course renewal with milling, DBM leveling course and BC / mastic asphalt overlay every 3rd year. Polymer Modified bitumen (55 Grade) shall be used for Bituminous concrete.

- Repairs / replacement of street lighting as and when required.

In case of the existing bridges, all maintenance activities shall be carried out as stipulated above except structural repairs approved by MSRDC / IE.

**iii) Bridges**

**Routine maintenance**
- Cleaning the carriageway once a week.
- Pot holes, surface irregularities shall be repaired as and when required.
- Repairs to the painting with paint of same standard as and when required.

**Periodic maintenance**
- Cleaning and washing parapet wall / railing every month.
- Oil Painting of railings, crash barriers once in a year.
- Oil painting of kerbs, median verge twice in a year.
- Painting of substructure, super structure every three years.
- Paint to structures for durability purpose: Anti carbonation or equivalent paint as approved by I.E. / MSRDC shall be applied during first year of contract and onwards once in three years.
- Cleaning of water spouts & down take pipes.
- Repairs / replacement of drainage above & below the bridge as and when required.

Wearing course renewal with milling, DBM leveling course and BC / mastic asphalt overlay every 3rd year. Polymer Modified bitumen (55 Grade) shall be used for Bituminous concrete.

- Repairs / replacement of street lighting as and when required.

**x) Longitudinal covered drains / Open drains / Median drains**

**Routine maintenance**
- Cleaning before and after monsoon and whenever required.
- Repairs required to be carried out to the open drains as and when required.

**xi) Landscaping**
- Maintenance of highway landscape shall include attending to repairs to elements of the landscape connected services as and when necessary, and replacement of irreparable items of work.
- Trees shall be maintained as per guidelines in SP:21-1979 and no indiscriminate felling of trees shall be resorted. The felling of trees shall be undertaken in consultation with the Independent Engineer and after obtaining permission of local authority, as applicable.
• While borrowing earth from roadside land for maintenance it shall be ensured that no earth is removed from around roots of trees. All borrowing operations shall be as per IRC: 10-1961.

• Maintenance operations include numbering and maintaining a register of all roadside trees within the ROW.

• The routine maintenance such as trimming and shaping shall also cover those hedges and trees within the ROW.

• Cutting or clearance to safeguard visibility at intersections, road bends, accesses and signs shall be carried out in such a way as to avoid permanent damage to hedges and trees. Hedges and trees overhanging carriageways shall be trimmed to provide minimum headroom of 5.5 meters at all times.

• Turfing within the ROW shall be mowed as to achieve a visual pattern in harmony with adjacent areas. Mowing shall be done when the height of cut reaches 150 mm.

• The O&M shall include a maintenance and management plan for trees, shrubs, turfing and hedges to sustain their development in a manner pleasing in appearance. It will also include the lawn, turfing, icons on the road / Toll Plaza developed by the MSRDC.

**Routine maintenance**

• Watering to trees, plants and shrubs on daily basis.

• If the median plantation and Bridge gardens, watering drip irrigation system fails, the contractor shall carry out watering by other means.

• Cleaning seat outs, lawns, pergolas, artifacts, bus stops shall be carried out on daily basis.

• Maintenance of civil works such as repairing to tiling, roofing, seat outs, drip irrigation system, railings shall be carried out as and when required.

• Grass cutting and pruning of shrubs and trees shall be done once in a month.

• Lights provided for garden areas near bridge / road side gardens have to be maintained.

**Periodic maintenance**

• Applying manure, pesticide and sweet soil once in every three months and whenever required.

• Replacement of ground cover, lawn once in a year.

• Replacement of plants and shrubs as and when required.

**xii) Toll Plaza Complex**

**Routine Maintenance**

• Cleaning of toll plaza premises and administrative building on daily basis.

• Maintenance of electrical and toll plaza system equipments as and when required.

• Replacement of damaged boom barriers.

• Cleaning of sign boards on daily basis.

• Cleaning and maintenance of drainage system of toll plaza complex, administrative building and pavement once in a month.
• Maintenance and repairs of damaged barriers, kerbs and their painting as and when required.
• Maintenance of upkeep of furniture in toll booths & administrative building.
• Security – watch and ward round the clock.

Periodic Maintenance
• Painting of toll booths, canopy, administrative building and other structures of toll plaza complex - every 3 years.
• Upkeep and replacement of road furniture.

xiii) Control / Exhibition Room
Routine Maintenance
• Cleaning of Building on daily basis.
• Maintenance of electrical and equipments as and when required.
• Maintenance of upkeep of furniture in administrative building.
• Security – watch and ward round the clock.

Periodic Maintenance
• Painting of building - every 3 years.
• Upkeep and replacement of furniture.

xiv) Embankment slope / ROW retaining wall and ROW railing
Routine Maintenance
• Side slopes shall be repaired as and when required
• Rain cuts shall be repaired as and when required
• ROW railing precast panels if damaged or missing shall be replaced as and when required.

Periodic maintenance
• For retaining wall and ROW railing exposed faces to be painted with anti-carbonation paint once in every three years.

xv) Footpath
Routine Maintenance
• Cleaning of footpath on weekly basis
• Replacement of footpath kerbs, water table, and lacquered finish paver blocks as and when required.
• Cleaning / washing of kerb stones once in a month.
• Periodic Maintenance
• Painting of kerbs with enamel paint twice in a year

xvi) Median and Newjersy barrier
Routine Maintenance
• Cleaning/ washing of Kerbs and Newjersy barriers on once in a month.
- Replacement of kerbs and Newjersy barriers as and when required.
- Periodic Maintenance
- Painting of Median and Newjersy barrier with enamel paint twice in a year

**xvii Road Furniture**

Road furniture shall consist of road markings, overhead signs, gantry signs, bus stops along with bays and pedestrian guard rails/safety barriers etc.

- All traffic signs and markings shall always be kept clean, visible and in correct alignment and position.
- Any damage to traffic signs which reduces or threatens to reduce full and clear visibility shall be rectified within twenty four (24) hours of its occurrence. If they are used as base for posters, the posters shall be removed and the signs shall be cleaned within 24 hours. Signs shall be washed using detergent solution followed by clean water, to maintain their visibility and reflectivity unimpaired due to dust etc.
- Any part of traffic signs damaged due to weathering, corrosion, vandalism or any other cause shall be replaced by the Contractor within seven days.
- Any mandatory sign including those for traffic safety, damaged beyond repair shall be replaced within 2 days and all other signs replaced within 3 days.
- Appropriate devices for measuring the luminosity and reflectivity shall be used to check visibility and reflectivity of signs, delineators and markings. These shall be replaced by similar material if the reduction in the level of these two requirements falls below 50% of the original level.
- Lane marking with thermo-plastic paint shall be carried out soon after any overlay/renewal coat is provided.
- Safety Barriers and Pedestrian Guard Rail

  The Crash Barrier (W Type) / M S railing replacement/ repairs incase of damage due to impact/thief etc. Metallic painting as and when required.

  Concrete Posts and Steel Beam Guardrails will require repairs or replacement from impact damage caused by vehicles. Periodic cement/oil painting once every year.

**xviii Street lighting, Aviation Beacon and electric fittings / fixtures of Bridge, Landscaping etc. wherever applicable.**

Routine maintenance

- Cleaning of street light poles, light fixtures / fittings once in a month.
- Replacement of consumables such as bulbs, tube lights etc as when required.
- Repairs to fixtures / fittings as and when required.
- Repairs to painting of electric poles, other fixtures / fittings etc. as and when required.

Periodic maintenance

- Replacement / repairs of electric cable, ducting, wiring as and when required.
- Painting to electric poles, other fixtures / fittings every three years.
- Timely payment towards the electricity bill for entire bridge, toll station, control room and exhibition centre, etc.
xix) Road markings

Routine maintenance

- Cleaning of thermo plastic marking, patch painting of other markings as and when required.

Periodic maintenance

- Replacement of thermo plastic lane marking every year.
- Replacement of other road markings twice a year.
- Replacement of fixtures such as cat eyes, tiger eyes, corbouys, bollards as and when required.

3.3.5 Detailed Maintenance

3.3.5.1 Expansion Joints

a) Introduction

Starting with the day of installation, the expansions joint components are continually exposed to natural elements, e.g.: temperature changes, rain, snow moisture, ozone, carbon dioxide and ultraviolet rays and elements that are introduced by humans, e.g.: traffic impact, chemical influences, e.g. de-icing salts and industrial pollutants.

The combined effect of these elements on the joint components is a steady and unavoidable deterioration process. Regular inspection and maintenance are vital measures for a long lifespan of the expansion joint.

b) Inspection types

(i) Annual inspection

The regular inspection shall be carried out every year service but latest 1 year after the installation and comprises of:

1. Condition of the elastomeric profiles
2. Condition of the sliding surfaces where accessible
3. Condition of gap width (in the first 10 years only)
4. Evidence of noise
5. Condition of the corrosion protection (paint)
6. Water damages on the concrete structure below the joint
7. Condition of the cover plates (footpath, fascia)
8. Condition of the adjacent pavement (nosing)
9. Adjacent Bridge Structures

The results of this annual inspection shall be recorded on the inspection report sheet enclosed

(ii) General Inspection

The general inspection shall be carried out every 3 years and comprises of:

Item (1) to (9) of the Annual Inspection
10. Condition of the welding
11. Determination of the opening and closing capacity
12. Condition of the bolts
13. Condition of sliding bearings, sliding springs and control springs (if accessible)
14. Noising
The results of this general inspection shall be recorded on the inspection report sheet enclosed.

c) **RESULTS AND ACTIONS TO BE TAKEN.**

N  No actions needed
Further measurements and long-term observations are required, e.g. at extreme temperature, unequal load distribution. The results and actions taken shall be recorded
C  Minor repair works as cleaning, paint repair required

**ASSESSMENT CRITERION AND REPAIRS**

(i) **Elastomeric Profiles (1)**

**Condition:**
- Extracted, loose
- Torned
- Rough, brittle
- Cut by sharp materials

**Action:**
N  No irregularities noted, no repair or cleaning required
R  Cleaning by hand brushing or pressurised air
- Water jet cleaning max. 100 bar, 25 °C

(ii) **Sliding Surfaces (2)**

Sliding surfaces (stainless steel) are located on top and underside of the joists. Checking is done from the underneath, inside the joist boxes, checking is done by the help of mirror and torch based on experiences over many years, damages are very unlikely to be expected.

**Condition:**
- Irregularities
- Cracks, fissures
- Spots with dirt, cement slurry V
- Spots with rust

**Action:**
N  No irregularities noted, no repair or cleaning required.
R  Spots from dirt and rust shall be removed softly

A thin silicon film shall be applied on the cleaned surfaces.

(iii) **Gap Width (3)**

Reasons for unequal gap widths:
- Damaged sliding surfaces of the joists due to cement slurry from installation.
- Expansion joints installed with a longitudinal skew of more then 2% are subject to the influence of uneven accelerating and braking forces by the traffic. It could be therefore possible that the gaps on the lower end are smaller than those at the upper side. This is harmless if no other evidence of blocking, e.g. mechanical obstruction of a joist, can be found.

**Condition:**
- All gaps are of equal width
- Unequal gap width
- Gaps not parallel

**Action:**
N  No irregularities noted
R  Foreign particles must be removed.
- Clean dirty sliding surfaces
(iv) Alignment of Joint (4)

The alignment of the joint is a helpful indicator for the general behavior of the super- and substructure concerning movements as tilting, rotation etc. In general the deviation of the alignment can cause a reduction of the driving comfort or can have a negative influence on the joint system as a whole.

Especially two points shall be clarified with care:

- The alignment in transverse direction (referring the joint)
- The steps between each individual gap

The alignment in transverse direction shall be measured with the 4m straight edge. The deviation between joint and straight edge should not overrun 5mm.

Individual steps, either between road surface and edge profile, edge profile and lamella or between lamellas shall not be bigger than 3mm.

Accept criteria: Above tolerances are met
When to take action: Above tolerances are not met
Remedial action: Further clarifications to find the origin of the exceeded tolerances are necessary

The alignment of the joint is a helpful indicator for the general behavior of the super- and substructure concerning movements as tilting, rotation etc.

In general the deviation of the alignment can cause a reduction of the driving comfort of the vehicles or can have a negative influence on the joint system as a whole.

Especially two points shall be clarified with care:

- The alignment in transverse direction (referring the joint)
- The steps (in vertical direction) between each individual gap

The alignment in transverse direction shall be measured with a 4m straight edge. The deviation between the joint and straight edge should not overpass 5 mm. Individual steps, either between road surface and edge profile, edge profile and lamella or between lamellas itself shall not be larger than 3mm.

Condition: 
- Above tolerances are met
- Above tolerances are slightly not met
- Above tolerances are not met

Action: 
N - No irregularities noted, no action required.
C - Further measurements and observations required. Long-term observation required.

The results and actions taken shall be recorded.

(v) Noise (5)

Noise generated by the expansion joint under traffic load, can be regarded as an indicator for the condition of the joint itself and also for the adjacent bridge structure.

Reasons: 
- Loosened sliding plates
- Damaged sliding bearings
- Loosened bolts
- Damaged or deformed steel parts

Condition: 
Abnormal roll-over noise as:
- High pitching sound
(vi) Corrosion Protection (Paint) (6)

The condition of the corrosion protection shall be checked carefully. Early detected and repaired damages will certainly avoid expensive repairs on a later date. On the top surface the corrosion protection will be wearied off by the tyres within a short period, but this has no influence to the joint. Parts and elements not covered by concrete are corrosion protected in accordance with design drawing

Condition:  
- Superficial paint damages as:
- Flaking off of paint
- Fissures
- Stains on steel parts

<table>
<thead>
<tr>
<th>Action</th>
<th>Action</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
<td>R</td>
</tr>
<tr>
<td>N</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

- No irregularities noted, no repair required
- Loose bolts must re-tighten or replaced.
  Torque moment (M12=90Nm, M16= 150Nm)

(vi) Evidence of Water Leakage (7)

Modular expansion joints are watertight. Thus this water tightness considerably extending the lifespan of the bridge structures below. Leakage of water together with temperature and chemical reaction might be a reason for following damages: (beside an unpleasant appearance)

Condition:  
- Destruction of the bridge structure, broken concrete
- Corroded steel parts, e.g., reinforcement, drainage pipe.
- Rust staining, dirt staining
- Ice coating and icicles and water puddles

<table>
<thead>
<tr>
<th>Action</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

- No irregularities noted, no repair required

(viii) Cover Plates (8)

Cover plates are covering the gaps at fascia and the lamellas in the footpath area (user’s comfort)

Condition:  
- Loose fixing bolts
- Corrosion protection damaged
- Noise emitting from vibrations of steel parts

<table>
<thead>
<tr>
<th>Action</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

- No irregularities noted, no repair required
- Repair of paint damages

(ix) Adjacent Bridge Structures (9)

The inspection of the joint must also include the adjacent bridge structure. If damages are detected they must be repaired as soon as possible to avoid further sources of damages.
Condition: - Broken concrete
- Broken corners and edges
- Fissures and gaps in the concrete
- Rust staining
- Freely visible, laid open reinforcement bars

Action: N - No irregularities noted, no repair required
C - Further actions according the instructions of the Authorities or bridge engineer in charge.

(x) Condition of the Welding (10)

All load carrying elements of the expansion joint are bolted. The remaining welding has no load carrying function. A visual check for fissure and cracks is therefore sufficient.

Condition: - Rupture
- Fissures

Action: N - No irregularities noted, no repair required
C - Shall be co-ordinated with welding experts

(xi) Opening and Closing Capacity of the Expansion Joint (11) Refer to chapter Gap Width

(xii) Condition of Bolts (12)

All important connections of the expansion joint are bolted (prestressed). Only in few rare cases are bolts loosened. A check of the bolts is also done with the checking for noise (4.5). Only a random check for a firm seating (e.g. 2 bolts per joist and per control unit) is recommended.

Condition: - Loose
- Broken

Action: N - No irregularities noted, no repair required
R - Tighten with a torque wrench
- Torque moment (M12 90 Nm, M16 = 150 Nm)
R - Broken bolts to be replaced.

(xiii) Sliding Bearings, Sliding Springs and Control Springs (13)

Sliding springs and sliding bearings have to be checked if they are still under pretension. This checking can be done by hand. If it is possible to move and rotate an element, the element is no longer prestressed and an unwanted deformation of the expansion joint could have taken place.

Verify that the rubber of the sliding springs and control springs have not pealed off

Condition: - Pealed rubber

Action: N - No irregularities noted, no repair required
C - Further measurements and observations required

(xiv) Nosing (14)

The asphalt adjacent to expansion joint must be free of damages in order to ensure a smooth over rolling of the joint, without heavy shocks. This increases the lifespan of the expansion joint considerably.

Verify that the rubber of the sliding springs and control springs have not pealed off

Condition: - Deformation of the edge profile
- Height difference between the edges
- Condition of the nosing material between the edges and asphalt surface
- Damages on the asphalt surface
- Tracking grooves

Action:  
N - No irregularities noted, no repair required
C - Repair of minor damages

e) Maintenance

(i) General Information

There are no defined wearing parts, which are intended to be replaced during a defined time period. However unexpected damages are possible
— sliding spring
— sliding bearing
— rubber elements

(ii) Repair work on joint

Small repair work can be done by skilled workers which are familiar with expansion joints.

Note: Any repair work having an influence on the function of the joints must be made or supervised by joint experts.

(iii) Repair of paint damages

Superficial paint damages:
- Grinding of the defective area with a fine grinding paper
- Remove dust with a clean cloth
- Apply 1 coat of chlorinated rubber by brush painting

Repair down to metal surface:
- Grinding of the defective area down to metal surface, old paint layers must be completely removed
- Apply 1 coat of primer (epoxy-resin basis) by brush painting
- As soon as the primer becomes dry, apply 2 coats of chlorinated rubber. Each coat shall have a dry film thickness of approx. 40-50 μm.

Annex: Inspection Report Sheet

<table>
<thead>
<tr>
<th>Client:</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.:</td>
<td>Controller (Name)</td>
</tr>
<tr>
<td>Drawing No.:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Inspection - 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element of Inspection</strong></td>
</tr>
<tr>
<td>1. Condition of the Elastomeric Profiles</td>
</tr>
<tr>
<td>2. Condition of the Sliding Surfaces</td>
</tr>
</tbody>
</table>
### Annual Inspection - 1

<table>
<thead>
<tr>
<th>Element of Inspection</th>
<th>Action</th>
<th>Results / Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Gap Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Alignment of the Joint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Noise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Condition of Corrosion Protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Water Damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Cover Plates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Adjacent Bridge Structures</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### General Inspection - 2

<table>
<thead>
<tr>
<th>Element of Inspection</th>
<th>Action</th>
<th>Results / Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Condition of Welding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Gap Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Condition of Bolts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sliding bearings, Sliding springs, Control springs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Road Surface</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Issued: ________________

Place ______ Date __________

________________________

Signature

Issued: ________________

Place ______ Date __________

________________________

Signature

3.3.5.1 Disc Bearing

(a) Introduction:

The described measures and actions shall ensure that the functions of the bearings are maintained at the highest possible level of its life span.

(b) Inspection:

Suitable easy access to the bearing have been provided and maintained. Provision to be kept in the substructure & superstructure for jacking it up in case the bearings get damaged beyond repair and is required to be replaced.

i) Frequency of Inspection:

Inspection of the bearings at site is required from time to time to ascertain the performance of the same. Periodic normal maintenance of the bearings like keeping the surrounding area clean and dry, repainting of exposed metallic parts as specified in clause (Element of Inspection) should be carried out in order to ensure better performance and longer life of the bearings. The bearings are required to be inspected at an interval of one year for the first six years and the bearings should be
examined carefully after unusual occurrence like unusual heavy traffic, earthquake, cyclone, flood, etc. Necessary records of inspection should be maintained.

ii) Result and Actions:

The results of every inspection have to be recorded in the inspection report and shall be classified in each case into the following types of action. A typical format of inspection report is enclosed.

X No action.

XX Further measurements/long term monitoring or design analysis needed (e.g. Considering extreme temperature/exposures, variation of load etc.). Actions should be outlined in a report.

XXX Minor maintenance work e.g. cleaning, painting etc.

In case of defects where the cause of necessary actions cannot be determined by the inspecting person or the responsible bridge engineer, the manufacturer shall be consulted.

iii) Cleaning:

The inspection should be preceded thorough and careful cleaning of the bearings depending on the actual condition surrounding the bearing e.g. deposit of salt, debris, dust or any other foreign material.

iv) Elements of Inspection:

The following are recommended inspection elements and actions, which are required to be considered to monitor and maintain the bearing.

(1) Functions checks:

During inspection at site, it should be checked whether all components of the bearings are functioning satisfactorily. This check is more essential than measurement and requires an experienced eye. However, the overall malfunctioning may be easily detected by any unusual characteristics or physical property of the bearing such as excessive movement, damage of Disc, excessive rotation and excessive compression of Disc etc.

(2) Measurement of movements:

During inspection at site measurements are required to be taken and documented to compute its movement and rotation values w.r.t. their design value to ascertain whether the performance of the bearings is satisfactory. To ascertain maximum movement, measurement should be taken once during peak winter (early morning) and once during peak summer (afternoon) and corresponding atmospheric temperature should be recorded. The recorded value of movement shall be compared with the design value.

(3) Measurement of dimensions:

Overall dimensions of the bearings are required to be measured and compared with the actual dimensions to ascertain any excessive stress or strain on the bearing.
(4) **Evidence of locked-on condition:**

If any movable or rotating part of a bearing is found to be in locked-in/jammed condition necessary remedial measures should be taken immediately.

(5) **Anchor bolts :**

The anchor bolts should be checked to ensure that the same are secured in position. In case of any necessary remedial measures viz. tightness, changing the bolts etc. are required that should be done immediately.

(6) **Evidence of corrosion :**

If corrosion of any of exterior exposed steel surface of the bearing is detected the following measures may be taken. The root cause of defects should be found out and proper rectification should be done to avoid recurrence of the same problem.

- Detect the affected part.
- The affected area should be thoroughly cleaned manually by proper hand tools like light wire brush or buffing etc. It should be ensured that the surface does not loose its roughness and does not have any loose rust.
- Apply two coats of Interseal-670 HS (data sheet attached by brush @ 100 microns/coat. The time interval between two coats should be minimum of 5/6 years.
- Over coat with the finish coat of Polyurethanar Interthane-990 (Alimunium) should start after 16 hours from the coat of Interseal-670 HS (Akzonobel).
- The coats of Polyurethane of 50 microns/coat should be applied after a time gap of 2/3 hours from the first coat of Polyurethane. The brush application DFT should not be 40/50 microns/coat
- A total time of 12 hour should be left for proper curing of the coats.

(7) **Condition of adjacent bridge structure :**

The adjacent structure of the bearings are also required to be inspected for any damage and if found necessary actions to repair the same should be taken immediately.

(c) **Maintenance :**

(i) Disc Bearings are maintenance free due to its unique features and supporting quality assurance system and thereby eliminate considerable effects caused by extreme atmospheric or adverse environment condition and/or unforeseen events/

(ii) The surrounding area of the bearings should be kept cleaned and dried to damage to the bearings.

(iii) The bearings should be thoroughly and carefully cleaned at least once in every year to ensure that there is no deposition of salt and debris, dust or any other foreign material on or adjacent to the bearing.
(iv) The exposed nonworking metallic surfaces of the bearing shall be painted once in every three years as per the following:

- Clean manually the surfaces and remove grease, oil, salt and other contaminants.
- Apply a coat of AKZONOBEL Interseal-670 HS by brush as per paint manufacturer’s instruction (data sheet for Intersseal-670 HS enclosed for ready reference.)
## Format for Periodic Inspection Report of Bearings

Name of the Bridge: 
Owner of the Bridge: 
Date and time of inspection: 
Last inspection carried out on: 
Pier/Abutment marked: 
Bearing Location: 
Type/Name of Bearing: 
Atmospheric Temperature:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Elements of Inspection</th>
<th>observation</th>
<th>Remarks (x,xx,etc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Functioning properly Yes/No, if No explain in detail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>Measurement of movement (mm) if applicable</td>
<td>Design value</td>
<td>Measured value</td>
</tr>
<tr>
<td>(C)</td>
<td>Measurement of dimension of the overall height of the bearing shall be measured at the…extreme corners of the bearing from the seating level of the base plate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d)</td>
<td>Evidence of locked-in condition if observed, explain in detail</td>
<td>Movement</td>
<td>Rotation</td>
</tr>
<tr>
<td>(e)</td>
<td>Condition of anchor bolts (specify in Yes/No)</td>
<td>Secure d in Position</td>
<td>Damage</td>
</tr>
<tr>
<td>(f)</td>
<td>Evidence of corrosion in case any corrosion of exposed steel surface is observed. Specify suitable recommendation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(g)</td>
<td>Condition of the adjacent structure in case any damage to the structure is observed. Specify suitable recommendation for repair</td>
<td>Superstructure</td>
<td>Substructure</td>
</tr>
</tbody>
</table>

Name of the Inspector: 
Signature: 
Designation of the Inspector: 
Date: 

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Request For Proposal – Bid Document
Volume III : Schedules

Contractor: MSRDC
3.3.6 Following are the main features of Maintenance activities and their periodicity. The contractor shall carry out maintenance work within that periodicity.

Frequencies for maintenance heads given are indicative and minimum required. However contractor shall be responsible for upkeep of structures and project facilities as per clause 3.1 and 3.3.3, without any additional cost to MSRDC.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Maintenance Head</th>
<th>Frequency</th>
<th>Cure Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(a) Rigid Pavement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Road cleaning.</td>
<td>Once in week</td>
<td>48 hrs</td>
</tr>
<tr>
<td></td>
<td>• Joint seals replacement.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Crack sealing.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Concrete spall / Edge break repair with epoxy material</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Mechanized texturing (to improve skid resistance).</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Replacement of pavement panel</td>
<td>As and when required</td>
<td>60 days</td>
</tr>
<tr>
<td>2</td>
<td>(b) Flexible Pavement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Road cleaning</td>
<td>Once in week</td>
<td>48 hrs</td>
</tr>
<tr>
<td></td>
<td>• Repairing of Pavement Distress.</td>
<td>As and when required</td>
<td>24 hrs</td>
</tr>
<tr>
<td></td>
<td>Maintenance procedure for correcting distress in pavements shall include patching, crack sealing, surface treatment and pot hole filling.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Repairing of Rutting and Raveling.</td>
<td>As and when required</td>
<td>3 days</td>
</tr>
<tr>
<td></td>
<td>• Corrugations and shoving by camber correction.</td>
<td>As and when required</td>
<td>3 days</td>
</tr>
<tr>
<td></td>
<td>• Repairing of Settlement or Grade Depressions.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Providing anti-skid Hazards.</td>
<td>During mansoon</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Preventing bleeding by flushing aggregates.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Wearing course renewal</td>
<td>Once in every three year</td>
<td>60 days</td>
</tr>
<tr>
<td>3</td>
<td>(c) Paver Block Pavement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cleaning.</td>
<td>Once in week</td>
<td>24 hrs</td>
</tr>
<tr>
<td></td>
<td>• Removing of ruts and ravels.</td>
<td>As and when required</td>
<td>48 hrs</td>
</tr>
<tr>
<td></td>
<td>• Replacement of Paver Block</td>
<td>As and when required</td>
<td>7 hrs</td>
</tr>
<tr>
<td>4</td>
<td>(d) Bridges</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cleaning.</td>
<td>Daily</td>
<td>24 hrs</td>
</tr>
<tr>
<td></td>
<td>• Maintenance of wearing course. (Patching, Crack sealing, Pot hole filling, Surface patching, etc)</td>
<td>As and when required</td>
<td>24 hrs</td>
</tr>
<tr>
<td></td>
<td>• Cleaning / washing railings, crash barriers, parapets etc.</td>
<td>Twice in a year</td>
<td>15 days</td>
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<tr>
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</tr>
<tr>
<td></td>
<td>• Oil painting railings, crash barriers, parapets etc.</td>
<td>Once in a year</td>
<td>30 days</td>
</tr>
<tr>
<td></td>
<td>• Wearing course renewal as stipulated</td>
<td>Once in every three years</td>
<td>60 days</td>
</tr>
<tr>
<td></td>
<td>• Cleaning expansion joints</td>
<td>As and when required</td>
<td>15 days</td>
</tr>
<tr>
<td></td>
<td>• Repairs / replacement of water spouts, down take pipes</td>
<td>As and when required</td>
<td>15 days</td>
</tr>
<tr>
<td>5</td>
<td>(e) Landscaping and Beautification:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Maintaining of civil works.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Watering to trees, plants and shrubs.</td>
<td>Daily</td>
<td>24 hrs</td>
</tr>
<tr>
<td></td>
<td>• Pruning.</td>
<td>Monthly</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Grass cutting.</td>
<td>Monthly</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Replacements of plants and shrubs.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Applying manure, pesticide, sweet soil.</td>
<td>Every three months and whenever required.</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Cleaning of sit outs, lawns, pergolas and artifacts etc.</td>
<td>Daily</td>
<td>24 hrs</td>
</tr>
<tr>
<td>6</td>
<td>(f) Miscellaneous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cleaning/washing of median kerbs, railings, crash barriers, signages, etc.</td>
<td>Monthly</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Painting touchup of structures, median kerbs, road markings, signages, etc.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Replacement of footpath paver block, kerbs, water table, etc.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>• Replacement/repairs of ROW railing and MS railing.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td>7</td>
<td>• Painting of footpath kerbs, median kerbs, and concrete crash barriers.</td>
<td>Once in a year</td>
<td>30 days</td>
</tr>
<tr>
<td></td>
<td>• Painting of traffic islands, landscaping civil works etc.</td>
<td>Every 3 year</td>
<td>30 days</td>
</tr>
<tr>
<td></td>
<td>• Painting of ROW railing and MS railing.</td>
<td>Every 3 year</td>
<td>60 days</td>
</tr>
<tr>
<td>8</td>
<td>• Renewal of wearing course on structures by mastic asphalts</td>
<td>Every 3 year</td>
<td>60 days</td>
</tr>
<tr>
<td></td>
<td>• Repairs to wearing course on structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>• Replacement of road signages</td>
<td>After Inspection as required</td>
<td>30 days</td>
</tr>
<tr>
<td>10</td>
<td>• Prevention and removal of unauthorized entry, encroachment etc.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td>11</td>
<td>• Maintenance of OFC duct pipes 0f 350mm dia in median along with chambers.</td>
<td>As and when required</td>
<td>7 days</td>
</tr>
<tr>
<td>12</td>
<td>• Cleaning of street light poles, light fixtures and fittings</td>
<td>Once in a month</td>
<td>7 days</td>
</tr>
<tr>
<td>Item</td>
<td>Frequency</td>
<td>Duration</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>--------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Replacement of street light poles, light fixtures and fittings.</td>
<td>As and when</td>
<td>48 hrs</td>
<td></td>
</tr>
<tr>
<td>Cleaning of thermo plastic marking, patch painting of other markings.</td>
<td>As and when</td>
<td>One Month</td>
<td></td>
</tr>
<tr>
<td>Replacement of thermo plastic lane marking.</td>
<td>Once in a year</td>
<td>One Month</td>
<td></td>
</tr>
<tr>
<td>Replacement of other road markings.</td>
<td>Twice every year</td>
<td>15 days</td>
<td></td>
</tr>
<tr>
<td>Replacement of fixtures such as cat eyes, tiger eyes, corbouys, bollards.</td>
<td>As and when</td>
<td>15 days</td>
<td></td>
</tr>
<tr>
<td>Additional road marking with thermo plastic paint / oil paint and / or signages as per requirement of Traffic Police or as directed by MSRDC.</td>
<td>As and when</td>
<td>15 days</td>
<td></td>
</tr>
<tr>
<td>Building/ Exhibition centre/ Control Room/ Traffic Aid Post</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning building premises daily</td>
<td>Daily</td>
<td>24 hrs</td>
<td></td>
</tr>
<tr>
<td>Floor washing and cleaning</td>
<td>Daily</td>
<td>24 hrs</td>
<td></td>
</tr>
<tr>
<td>Painting –</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterproof Cement Paint (for Outer portion of building)</td>
<td>Once in a year</td>
<td>1 Month</td>
<td></td>
</tr>
<tr>
<td>Oil bound distemper</td>
<td>1st year and at the contract period</td>
<td>1 month</td>
<td></td>
</tr>
<tr>
<td>Minor repair Works</td>
<td>As and when</td>
<td>15 days</td>
<td></td>
</tr>
</tbody>
</table>

3.4 Safety and Traffic Management Operations

During entire O & M activities from date of Commencement till the end of Contract period the contractor shall carry out safety and traffic management operations for all corridors as below -

3.4.1 Safety

The Contractor shall implement a Safety Management Programme in line with relevant MORT&H and IRC guidelines. This shall form a part of the O&M Manual.

The Contractor shall nominate a traffic safety and control officer (Traffic Safety Officer) who shall be responsible for all arrangements necessary for traffic safety and control including the provision and operation of recovery vehicles for breakdown. The Traffic Safety Officer shall be available on call on a 24 hours’ basis.

In case of Emergency, the Contractor shall take prompt and effective steps to minimize the adverse effects to road users and shall act as requested or as directed by the Police and take all such safety precautions and measures to minimize the risk of personal injury.

3.4.2 Traffic Management

Traffic Management shall be undertaken during scheduled and unscheduled construction work and maintenance activities and also during any Emergency. Traffic Management during Emergency shall be undertaken in consultation with the Independent Engineer / traffic police. The extent of the traffic management shall be assessed as per the site conditions.
a) Traffic Management Plan

Before the commencement of construction activity, an overall traffic management plan and Programme for a planned scheduled construction and/or operations and maintenance activity of the existing highway shall be prepared in consultation with the Independent Engineer. This plan should get approved from traffic police & local authority if required and shall be included in O and M manual.

i. At major intersections all traffic turning movements will be allowed at all times;

ii. At all times at least three lanes in each direction shall be available for traffic throughout the Project Corridor.

iii. Lane closure adopted for diverting the main traffic during Maintenance Works shall be governed by the approved Programme of maintenance.

iv. The activity of renewal or strengthening shall not be carried out in a continuous length of more than 2 km at a time.

v. Lane closure in short lengths less than or equal to 500 meters for carrying out maintenance activities shall not be more than for a continuous period of 12 hours unless otherwise permitted by traffic police and Independent Engineer.

vi. Traffic speed through the construction zone shall be reduced to 40 km/hr by placing appropriate/adequate warning signs.

b) For the safety of construction workers as well as the traffic, a physical separation of 1.5 m between work area and the highway traffic shall be maintained by installing orange coloured drums; & traffic, safety ribbons between. (Painted rocks/stones are not permitted). Zones of deep cuts, bridges, ROB, retaining walls etc, continuous barricading 1.5 m high using plain M.S. sheets mounted on iron frame shall be provided.

c) During all constructions the traffic shall enter and exit the construction site at designated and manually controlled entrances.

d) Adequate advance warning and information signs shall be incorporated in the traffic management plan in accordance with IRC/MORT&H standards and specifications.

e) The Contractor shall provide, erect, maintain, reposition, cover, uncover and remove traffic signs as required in respect of works on the Project Site (including without limitation any diversions). Adequate safety during night time shall be ensured by providing mobile emergency lighting units with illuminated warning signs at important locations finalized in consultation with the Independent Engineer.

f) Traffic may be regulated in one corridor in case of emergency for traffic regulation during such contingency, as the total volume would remain unaffected. No compensation towards loss of toll revenue, if any, shall be payable to the Contractor by MSRDC.
3.4.3 HIGHWAY TRAFFIC MANAGEMENT SYSTEM

(a) Preventive Maintenance for HTMS Equipments
Preventive maintenance helps to reduce the possibility of occurrence if accidental situations. For this, timely maintenance of field and control room is necessary for uninterrupted operation of the system.

i. Field Equipments
This activity includes cleaning and maintenance of equipments installed in field i.e. CCTV cameras, Emergency Telephone (ET), VMS Board, RWS sensor, Optical Transmitters and Data logger for RWS.

1) CCTV Cameras
- Clean camera dome. Check that the camera pole is still secure on the foundation.
- Check all electrical connectors and cables are tightened firmly, Realign the cameras if required.
- Check the camera view on the monitor.
- Check the camera as below:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>No Video</td>
<td>• Check that the Green LED on the Auto Dome CPU board is on. This LED indicates video from the camera.</td>
</tr>
</tbody>
</table>

If the Green LED is off, then:
• Check that the Red LED on the Auto Dome CPU board is slowly blinking. This LED indicates power to the Auto Dome power supply board and to the CPU Module.

Red LED on Auto Dome CPU Module
Flash Sequence Indicates:
• 5 sec. on / 0.5 sec off: Normal operation
• Steady on: CPU is locked

If the Red LED is on steady, then:
• Try cycling the Auto Dome power off and or

If the Red LED Is off, then:
If using a Bosch Pendant Power Supply Box:
• Check that Green LED in Power Supply Box is on. This LED indicates mains power through the transformer.

If the Green LED Is off, then:
• Turn off the Power.
• Check the FXI 01 fuse for mains power to the Power Supply Box.
If O.K., then:
• Check the FXI 02 fuse for 24 V power to the Auto Dome Pendant
If O.K., then:
<table>
<thead>
<tr>
<th>2. No Camera Control</th>
<th>Ensure that the keyboard and monitor are set to the correct (same) camera number.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>If O.K., then: Check that the camera address is properly set. Enter ON-997-ENTER to display the camera address.</td>
</tr>
<tr>
<td></td>
<td>If address is not set or is incorrect, then:</td>
</tr>
<tr>
<td></td>
<td>- Set the camera address using Fast Address (ON-998-ENTER). If O.K., then:</td>
</tr>
<tr>
<td></td>
<td>- Check that the Amber LED on the Auto Dome CPU turns on when receiving pan/tilt commands from the controller keyboard. The Amber LED indicates Control is being received.</td>
</tr>
<tr>
<td></td>
<td><strong>Amber LED on Auto Dome CPU Module</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Flash Sequence</strong></td>
</tr>
<tr>
<td></td>
<td>- Off</td>
</tr>
<tr>
<td></td>
<td>No incoming communications or no power</td>
</tr>
<tr>
<td></td>
<td>- Solid for 2 seconds</td>
</tr>
<tr>
<td></td>
<td>Receiving good data</td>
</tr>
<tr>
<td></td>
<td>- Fast blinking Lost packet(s)</td>
</tr>
<tr>
<td></td>
<td>If amber LED does not light when given PTZ commands, then:</td>
</tr>
<tr>
<td></td>
<td>- Check if other cameras on the system can be controlled. If not, check the controller and wiring connections.</td>
</tr>
<tr>
<td></td>
<td>If O.K., then:</td>
</tr>
<tr>
<td></td>
<td>If using a non-Bosch power supply:</td>
</tr>
<tr>
<td></td>
<td>- Check that the mains power to the power supply box is on.</td>
</tr>
<tr>
<td></td>
<td>if O.K., then:</td>
</tr>
<tr>
<td></td>
<td>- Check that there is 24 V output from the transformer.</td>
</tr>
<tr>
<td></td>
<td>- Check the connector on top of the Auto Dome housing for bent pins.</td>
</tr>
<tr>
<td></td>
<td>If O.K., then:</td>
</tr>
<tr>
<td></td>
<td>- Check the integrity of all wires and terminal connections to the Auto Dome.</td>
</tr>
<tr>
<td></td>
<td>If O.K., then:</td>
</tr>
<tr>
<td></td>
<td>If there is power to the Auto Dome, then:</td>
</tr>
<tr>
<td></td>
<td>- Remove the camera and CPU modules from the Auto Dome housing and check that the Green LED on the housing power supply board is on.</td>
</tr>
<tr>
<td></td>
<td>If the Green LED is off, then:</td>
</tr>
<tr>
<td></td>
<td>- Check that the fuse on the housing power supply. Board is good. (Try replacing the unit, if an extra camera module is available.)</td>
</tr>
<tr>
<td></td>
<td>If there is power to the Auto Dome, then:</td>
</tr>
<tr>
<td></td>
<td>- Remove the camera and CPU modules from the Auto Dome housing and check that the Green LED on the housing power supply board is on.</td>
</tr>
<tr>
<td></td>
<td>If the Green LED is off, then:</td>
</tr>
<tr>
<td></td>
<td>- Check that the fuse on the housing power supply. Board is good. (Try replacing the unit, if an extra camera module is available.)</td>
</tr>
</tbody>
</table>
| 3. Intermittent camera control | • Check that only the last Auto Dome in a daisy chain configuration is terminated with a 110Ω Resistor across the +1-biphase terminals.  
**If O.K., then:**  
• Check that the maximum wire distance has not been exceeded for the control protocol (the maximum distance for RS-232 is 50 feet). See the Auto Dome Modular Camera System Installation Manual.  
**If O.K., then:**  
• Check that all wiring meets Bosch recommended standards and specifications, See the Auto Dome Modular Camera System Installation Manual. |
| 4. Camera moves when moving other cameras | • Check that the camera address is properly set (ON-997-ENTER). If the camera address is not set, the Auto Dome responds to control commands to any camera on the system.  
**If camera address is not set, then:**  
• Invoke the Fast Address Menu to assign a camera address (ON-998-ENTER). |
| 5. Cannot access user settings | • Enter the unlock command OFF-90-ENTER. This command may require a password. (Commands automatically lock in 30 minutes.) |
| 6. Picture is dark | • Check that the Gain Control is set to AUTO (ON-43-ENTER).  
**If O.K., then:**  
• Check that the Auto Iris Level is set to the appropriate level (ON-11-ENTER).  
**If O.K., then:**  
• Check that the video coax is erminated with 75Ω Only at the head end. (Double termination causes dark video.) |
2) Emergency Telephone (ET)
   - Check whether ET enclosure is in good condition (no damage).
   - Check all electrical, fiber connectors and cables are tightened firmly.
   - Check battery voltage and efficient charging through solar panel.
   - Do the test call to control room and ensure that unit is working properly after maintenance.

3) VMS Board
   - Turn the power off.
   - Check that the VMS is properly fixed on the gantry.
   - Check all screws, bolts and nuts are tightened firmly.
   - Clean the VMS screen with a cloth & non-detergent soap.
   - Check all electrical connectors and cables are tightened firmly.
   - Turn the power on & check that VMS is still working and examine for any dead LED Bricks.

4) Remote Weather Station
   (i) RWS Logger
       - Turn the Met logger power off.
       - Check SMPS output voltage is in operating range.
       - Check all electrical, data connectors and cables are tightened firmly.
   (ii) RWS Sensors
       - Wind and Wind Direction sensor
           - The anemometer bearings and the potentiometer be inspected at least every 24 months. Only a qualified technician should perform the replacement.
           - Obtain an RMA number before returning the sensor to Vendor for service.
       - Temperature & Relative Humidity Sensor
           - In areas of high dust or contamination (i.e.: smokestacks, seawater), periodic cleaning of the RH sensor protective filter is recommended. Soaking in clean water or a mild soap solution is recommended. DO NOT USE SOLVENTS.
           - Obtain an RMA number before returning the sensor to vendor for service.
       - Surface / Sub-surface Temperature sensor
           - Remove sensor carefully and soak in clean water or a mild soap solution.
           - Check data connector and cable is tightened firmly
           - No cable damage.
       - Visibility & Precipitation sensor.
           - Turn the power off.
           - Spray the TX and RX lenses liberally with the window cleaner and wipe thoroughly with a soft. Clean cloth.
           - Clean away any old spider webs that are on the sensor cross arm, heads and enclosure.
5) Optical Transmitter
   - Turn the power off.
   - Clean the optical Transmitter with non-detergent soap.
   - Clean outer Enclosure thoroughly.
   - Check all electrical, fiber connectors and cables are tightened firmly.
   - Check SMPS output voltage is in operating range.
   - Check all the LED indicators are working properly.

6) Precaution
   - Avoid putting water inside the equipment.
   - Do not use a high-pressure cleaning device.
   - Be careful of the equipment under power.
   - Switch the power off before cleaning.
   - Keep good housekeeping in the field during and after maintenance.

7) Frequency of preventive Maintenance
   Frequency of preventive Maintenance for Field equipment shall be:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CCTV Camera</td>
<td>Monthly</td>
</tr>
<tr>
<td>2.</td>
<td>Emergency Telephone (ET)</td>
<td>Quarterly</td>
</tr>
<tr>
<td>3.</td>
<td>VMS Board</td>
<td>Quarterly</td>
</tr>
<tr>
<td>4.</td>
<td>RWS sensors/Logger</td>
<td>Quarterly</td>
</tr>
<tr>
<td>5.</td>
<td>Optical Transmitter</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>

ii. Plaza Equipment
   Equipment installed in plaza i.e. server, workstation, network switch, laser and dot matrix printer, Device server, CCTV Matrix, DVR, Audio Matrix, Optical Receiver, ET optical Receiver, ET Audio Receiver, Projector, CCTV monitor should be cleaned and maintenance should be carried out.

Server and Workstations
   - Logout from HTMS admin application software and shutdown the computer.
   - Carry out a visual check and clean Monitor and CPU with a cloth and non-detergent soap, if necessary.
   - Clean mouse and keyboard with soft hair brush and air blower.
   - Keyboard should be cleaned once a week with dry air (tilt upside down and blow out). Mouse keys should be blown out with dry air on a weekly basis also.
   - Check all electrical connectors and cables are tightened firmly.
   - Turn ON the computer. Check functionality by running the application.
Network Switch
- Clean the network switch with non-detergent soap.
- Check all electrical connectors and cables are tightened firmly.
- Check all the LED indicators are working properly.

Laser Printer and Dot Matrix Printer
- Switch off the printer.
- Open the printer and wipe the dust with a clean and soft cloth.
- Check the printer cartridge, replace if required.
- Check the power cable connectors are tightened firmly.
- Switch on the power and print the test page.
- Check the UPS is working properly on inverter and bypass mode.
- Check all electrical connectors, cables, and components.

Device Server
- Clean the Device server with non-detergent soap.
- Check all electrical, data connectors and cables are tightened firmly.
- Check all the LED indicators are working properly.

CCTV Matrix/ Keyboard
- Clean the CCTV matrix with non-detergent soap.
- Check all electrical, video connectors and cables are tightened firmly.
- Check all the LED indicators are working properly.
- Cleaning the Keyboard: The keyboard may be cleaned when necessary, by temporarily removing it from the system and wiping it with a damp cloth. If a conventional spray cleaner is required, spray the cloth first, then wipe off the surfaces. Do not use petroleum-based cleaners.

Digital Video Recorder (DVR)
- Clean the DVR with non-detergent soap.
- Check all electrical, data connectors and cables are tightened firmly.
- Check all the LED indicators are working properly.

ET Audio Matrix
- Clean the audio matrix with non-detergent soap.
- Check all electrical, data connectors and cables are tightened firmly.
- Check all the LED indicators are working properly.

ET Optical Receiver
- Clean the Optical Receiver with non-detergent soap.
- Check all electrical, fiber connectors and cables are tightened firmly.
- Check all the LED indicators are working properly.

Optical Receiver
- Clean the Optical Receiver with non-detergent soap.
- Check all electrical, fiber, video and data connectors and cables are tightened firmly.
- Check SMPS output voltage is in operating range.
• Check all the LED indicators are working properly.

**ET Operator Unit**
• Clean the Unit with a soft cloth and non-detergent soap.
• Check all electrical connectors and cables are tightened firmly.
• Do the tests call to any of the ET unit and ensure that unit is working properly after maintenance.

**Projector**
**Lens cleaning**
• Clean the lens with a commercially available blower and/or lens cleaner.
• Ti lens is easily scratched, so do not rub it with hard objects, or strike it.

**Main unit cleaning**
• Clean the main unit after unplugging the power cord. - Wipe dirt off the main unit gently with a soft cloth.
• Do not wipe the main unit with a damp cloth. Doing so may allow water to get inside, resulting in an electric shock or failure. V
• Do not use benzene, thinner and the like as they may deform or discolor the unit or damage the paint surface.
• When using a chemically treated cloth, follow the precautions included with the cloth.

**UPS**
• Disconnect UPS input power supply.
• Clean the UPS with cloth and non-detergent soap, especially the battery terminals and silicon
• Grease should be re-applied, to prevent corrosion.
• Ensure that all the lamps on the front panel of the UPS are functioning properly by depresssing the lamp test / reset pushbutton..
• Inspect and recording of all the voltage, current and frequency levels.
• Ensure the correct functionality of all the control equipment on the UPS equipment.
• Inspect all of the electrical wiring of the complete UPS system.
• Inspect the electrical reticulation (armed cabling and cabling in or on services). V
• Inspect wiring and circuit boards of electrical distribution boards. V
• Inspect socket outlets (UPS and normal).

**Battery Maintenance**
• The UPS should be charged once every 4 to 6 months if it has not been used for a long time.
• In the regions of hot climates, the battery should be charged and discharged every 2 months. The standard charging time should be at least 12 hours.
• Battery replacement should be performed by qualified personnel.
• Replace batteries with the same number and same type of batteries.
• Do not replace the battery individually. All the batteries should be replaced at the same time following the instructions of the battery supplier.
• Normally, the batteries should be charged and discharged once every 4 to 6 months. Charging should begin after the UPS shuts down automatically in the course of discharging, the standard charging time for the standard UPS should be at least 12 hours.

**Precautions**

• Ensure to switch off the power.
• Do not touch any electronic board without electrostatic discharge protection measures.
• Ensure the covers are locked after cleaning.
• After maintenance; reinstall all safety shields, guards, and labels.
• Do replacement if any safety device is worn or defective.

**Frequency of Preventive Maintenance**

Frequency of preventive maintenance for plaza area equipments shall be:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Particulars</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Server</td>
<td>Monthly</td>
</tr>
<tr>
<td>2.</td>
<td>Workstations</td>
<td>Daily</td>
</tr>
<tr>
<td>3.</td>
<td>Network switch</td>
<td>Monthly</td>
</tr>
<tr>
<td>4.</td>
<td>Laser Printer and Dot matrix Printer</td>
<td>Fortnightly</td>
</tr>
<tr>
<td>5.</td>
<td>Device Server</td>
<td>Monthly</td>
</tr>
<tr>
<td>6.</td>
<td>CCTV Matrix</td>
<td>Monthly</td>
</tr>
<tr>
<td>7.</td>
<td>DVR</td>
<td>Monthly</td>
</tr>
<tr>
<td>8.</td>
<td>Projector</td>
<td>Fortnightly</td>
</tr>
<tr>
<td>9.</td>
<td>Audio Matrix</td>
<td>Monthly</td>
</tr>
<tr>
<td>10.</td>
<td>ET Optical Receiver</td>
<td>Monthly</td>
</tr>
<tr>
<td>11.</td>
<td>Optical Receiver</td>
<td>Monthly</td>
</tr>
<tr>
<td>12.</td>
<td>UPS</td>
<td>Fortnightly</td>
</tr>
<tr>
<td>13.</td>
<td>ET Operator Unit</td>
<td>Daily</td>
</tr>
</tbody>
</table>
(b) **Toll Plaza Equipments**

The list of Toll collection equipment is as follows:

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Item Description</th>
<th>Unit</th>
<th>Installed/Commission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LANE EQUIPMENT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Toll Lane System Processor, (Incl. Operating Software)</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>AVC controller</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>3.</td>
<td>AVC Sensors (2 Fibre optic treadles)</td>
<td>Set</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Height Sensors</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>5.</td>
<td>Analyser (Classax with Loop Detector)</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>6.</td>
<td>Operator Monitor (15”TFT) &amp; Dedicated keyboard</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>7.</td>
<td>Receipt Printer</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>8.</td>
<td>Overhead Lane Signal</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>9.</td>
<td>User Fare Display-2 line</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>10.</td>
<td>High Speed Barriers MIB20 – 0.9 Sec</td>
<td>Unit</td>
<td>12</td>
</tr>
<tr>
<td>11.</td>
<td>Traffic light with pole 3m</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>12.</td>
<td>Manual Booth controller – external switches</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>13.</td>
<td>Lane Intercom Unit</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>14.</td>
<td>Siren with Amber light</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>15.</td>
<td>Bar Code Readers 6” range</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>16.</td>
<td>Panic Alarm Switch</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>17.</td>
<td>Incident Camera with ICS card</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>18.</td>
<td>Accessories and Cabling</td>
<td>Unit</td>
<td>18</td>
</tr>
<tr>
<td>19.</td>
<td>2 KVA UPS for lanes with 10 mins standby</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>20.</td>
<td>Cash drawers</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>21.</td>
<td>High Speed Barriers MIB10-0.6 sec</td>
<td>Unit</td>
<td>4</td>
</tr>
<tr>
<td><strong>Smart card system</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Outdoor Desktop smart card reader</td>
<td>Unit</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>ETC Ejection system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>High Speed Barriers MIB10 – 0.6 Sec</td>
<td>Unit</td>
<td>3</td>
</tr>
<tr>
<td>2.2</td>
<td>Transceiver</td>
<td>Unit</td>
<td>6</td>
</tr>
<tr>
<td><strong>PLAZA EQUIPMENT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Plaza Server with Rack, Window 2008 professional server &amp; Oracle database (ML350G5, RAID 5, with 15” TFT Monitor)</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Remote MIS Server with Rack</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Workstation for Incident capture System</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Workstation for Admin</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Lane Status Display Workstation</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>16 port switch</td>
<td>Unit</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Master Intercom</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Network Cables &amp; Cabling (Limited upto 100m distance between both and Plaza)</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>6 KVA UPS for plaza with 15 minute standby</td>
<td>Unit</td>
<td>1</td>
</tr>
</tbody>
</table>
### Request for Proposal – Bid Document

**Volume III : Schedules**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Item Description</th>
<th>Unit of Measurement</th>
<th>Installed/Commission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>VMS System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Field Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.1</td>
<td>VMS Boards – 3 Lines, 18 Characters</td>
<td>Unit</td>
<td>2</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Gantry per VMS board including mounting</td>
<td>Unit</td>
<td>2</td>
</tr>
<tr>
<td>1.1.3</td>
<td>Cable (of following types 1.1.3 to 1.1.3.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.3.1</td>
<td>Data Cable – Rs 485</td>
<td>Meter</td>
<td>1000</td>
</tr>
<tr>
<td>1.1.3.2</td>
<td>Power Cable</td>
<td>Meter</td>
<td>1000</td>
</tr>
<tr>
<td>1.2</td>
<td>Control Room Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2.1</td>
<td>VMS Workstation (Windows SP Licensed+VMS Application Software)</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>1.2.2</td>
<td>RS485 to RS232 Converter (2 way conversion)</td>
<td>Unit</td>
<td>2</td>
</tr>
<tr>
<td>1.2.3</td>
<td>Data Cable – RS485</td>
<td>Meter</td>
<td>1500</td>
</tr>
<tr>
<td>1.2.4</td>
<td>Data Cable – RS232</td>
<td>Meter</td>
<td>270</td>
</tr>
<tr>
<td>2.0</td>
<td>ET System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Field Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.1</td>
<td>Master ET (comprising of following items from 2.1.1.1 to 2.1.1.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.1.1</td>
<td>Fiber optic interface</td>
<td>Unit</td>
<td>4</td>
</tr>
<tr>
<td>2.1.1.2</td>
<td>Solar Panel + Voltage Regulator + Closure Contact</td>
<td>Unit</td>
<td>4</td>
</tr>
<tr>
<td>2.1.1.3</td>
<td>Optical Coupler</td>
<td>Set</td>
<td>8</td>
</tr>
<tr>
<td>2.1.1.4</td>
<td>Fiber body with other hardware</td>
<td>Unit</td>
<td>4</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Slave ET (comprising of following items from 2.1.2.1 to 2.1.3.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.2.1</td>
<td>Fiber body with other hardware</td>
<td>Unit</td>
<td>4</td>
</tr>
<tr>
<td>2.1.3</td>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.3.1</td>
<td>ET Identification Marks</td>
<td>Unit</td>
<td>8</td>
</tr>
<tr>
<td>2.1.3.2</td>
<td>Protection Barrier</td>
<td>Unit</td>
<td>8</td>
</tr>
</tbody>
</table>

**SOFTWARE**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Item Description</th>
<th>Unit of Measure</th>
<th>Installed/Commission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Lane Software</td>
<td>License</td>
<td>16</td>
</tr>
<tr>
<td>2.0</td>
<td>Toll Management System</td>
<td>License</td>
<td>1</td>
</tr>
<tr>
<td>3.0</td>
<td>ETC Software</td>
<td>License</td>
<td>3</td>
</tr>
<tr>
<td>4.0</td>
<td>Smart Card software</td>
<td>Included</td>
<td>16</td>
</tr>
</tbody>
</table>

**MISCELLANEOUS**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Item Description</th>
<th>Unit of Measure</th>
<th>Installed/Commission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>OBU</td>
<td>Unit</td>
<td>5000</td>
</tr>
<tr>
<td>2.0</td>
<td>Smart cards</td>
<td>Unit</td>
<td>5000</td>
</tr>
<tr>
<td>Sr.No.</td>
<td>Item Description</td>
<td>Unit of Measurement</td>
<td>Installed/Commission</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>2.1.3.3</td>
<td>Master to slave cable (25m length)</td>
<td>Set</td>
<td>4</td>
</tr>
<tr>
<td>2.2</td>
<td>Control Room Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.1</td>
<td>ET Audio Matrix</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>2.2.2</td>
<td>ET Workstation (Operating system XP Licensed + ET Application Software + Head set + Micro phone)</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>2.2.3</td>
<td>Fiber optic interface</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>2.2.4</td>
<td>Control centre Hard Ware</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>3.0</td>
<td>Remote Weather Station</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Field Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1.1</td>
<td>Sensors</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>3.1.1.1</td>
<td>Air Temperature Sensor</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>3.1.1.2</td>
<td>Relative Humidity Sensor – (Included above in 4.1.1.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1.1.3</td>
<td>Road Temperature Sensor</td>
<td>Unit</td>
<td></td>
</tr>
<tr>
<td>3.1.1.4</td>
<td>Sub-surface temperature probes</td>
<td>Unit</td>
<td></td>
</tr>
<tr>
<td>3.1.1.5</td>
<td>Visibility Sensor</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>3.1.1.6</td>
<td>Wind Speed Sensor</td>
<td>Unit</td>
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</tr>
<tr>
<td>3.1.1.7</td>
<td>Wind Direction Sensor – (Included above in 4.1.1.6)</td>
<td>Unit</td>
<td>1</td>
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<tr>
<td>3.1.1.8</td>
<td>Barometric Pressure Sensor</td>
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<tr>
<td>3.1.1.9</td>
<td>Precipitation Sensor</td>
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<tr>
<td>3.1.1.10</td>
<td>Dew Point Sensor</td>
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<td>1</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Radiation shield for sensors above</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>3.1.3</td>
<td>RPU Cabinet</td>
<td>Unit</td>
<td>2</td>
</tr>
<tr>
<td>3.1.4</td>
<td>Pole for sensors and RPU mounting GI pipe 50 sq mm</td>
<td>Unit</td>
<td>2</td>
</tr>
<tr>
<td>3.1.5</td>
<td>Cable (of following types 4.1.5.1 to 4.1.5.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1.5.1</td>
<td>Data Cable RS 232</td>
<td>Meter</td>
<td>60</td>
</tr>
<tr>
<td>3.1.5.2</td>
<td>Power Cable</td>
<td>Meter</td>
<td>400</td>
</tr>
<tr>
<td>3.2</td>
<td>Control Room Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2.1</td>
<td>RWS Workstation (Operating system- Windows XP Licensed +RWS Application Software)</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Cable (of following type 4.2.2.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2.2.1</td>
<td>Data Cable RS 232</td>
<td>Meter</td>
<td>60</td>
</tr>
<tr>
<td>4.0</td>
<td>Control Room Equipments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Server with Windows 2003 professional OS &amp; Oracle database ML350G5, RAID 5, with 15” Monitor &amp; Antivirus)</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>4.2</td>
<td>Admin Workstation (Operating system Windows XP Licensed + Admin Application Software)</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>4.3</td>
<td>Network Management Software</td>
<td>Set</td>
<td>1</td>
</tr>
<tr>
<td>4.4</td>
<td>Rack for mounting the Server and the DVR</td>
<td>Unit</td>
<td>1</td>
</tr>
<tr>
<td>4.5</td>
<td>Rack for mounting the Fiber optic interfaces</td>
<td>Unit</td>
<td>1</td>
</tr>
</tbody>
</table>
3.5 Surveillance

Regular 24 hours patrol/surveillance of the ROW in respect of the Project/Project Facility shall be required to monitor, report and take actions against activities, such as,
encroachments, unauthorized construction of road or entrance connections, structures, interference with drainage system etc, within ROW of the Project Corridors.

Surveillance shall also include traffic operation and management of accidents/ other incidents. The surveillance report shall be submitted daily before 11.00 am of next day and in case of accident the report shall reach within 1 hour to IE / MSRDC.

The contractor shall evolve a mechanism to initiate appropriate actions on receipt of surveillance report in consultation with IE. The surveillance Plan shall be developed in consultation with the Local Administrative Authorities and Independent Engineer and it shall form a part of the O and M Manual.

3.6 Inspections

The Contractor shall plan inspection Programme for the Project Facilities for its smooth operations as follows:

3.6.1 Visual Inspection

Visual Inspections are broad general inspections carried out frequently by highway/ bridge maintenance engineers having adequate knowledge of road structures. The purpose of visual inspection is to report the obstacles to traffic and fairly obvious deficiencies, which could lead to accidents or maintenance problems. Such inspections should be frequent. The visual inspection may be carried out by visual assessment with careful observation of the specific object/item of the Project Facilities for identification and for quantification of the deficiencies or damages of the Project Facilities.

3.6.2 Close Inspection

Close inspections may be visual and/or by standard instrumental aids for assessment of defects / deficiencies of Project with careful observation of specific element(s). The close inspection may be daily / periodic but it is more intensive and would require detailed examination of element of the Project. It should cover all the aspects of the specific element of Project Highway against a checklist. The frequency of close inspections would depend upon the nature of structure of Project Highway. This inspection is to be carried out by the Highway/Bridge Engineer having good knowledge of road structures with theoretical background to analyze the nature, and extent of defects/deficiencies, suggest suitable remedial measures to rectify/remedy them and quantify repair work.

3.6.3 Thorough Inspection

A thorough inspection is comprehensive and detailed for assessment of defects/deficiencies of the Project Highway by visual inspection or with aid of standard equipment and non-destructive testing where necessary. Such an inspection is to be carried out on the basis of comprehensive checklist of items related to the materials, condition and situation of the structure etc. The checklist is to be prepared meticulously well in advance of inspection. The thorough inspection should be undertaken during the most critical weather condition, which is generally rainy season in India. During rainy season the Road /bridge structures are under severe condition thereby the damage and deficiencies of the Project Highway are more pronounced. The inspection carried out during the said period offer the most critical evaluation of the performance of the structure. The thorough inspections would be of critical importance for bridges, culverts and drainage structures, as well as road pavements during adverse weather condition of monsoon period.
3.6.4 **Inspection with Independent Engineer**

After receiving the reports from the contractor or otherwise MSRDC / IE may decide to arrange inspection along with or without experts from third party, contractor shall also attend such inspections and take remedial measures as suggested in those inspection reports.

3.6.5 **Frequency of Inspections**

The type of inspection and related frequency of various items of Project Highway and its facilities have been indicated in the Table below. The frequency of inspection can be suitably revised in consultation with the Independent Engineer if the situation so warrants. The objective and minimum frequency of inspections under normal circumstances shall be as under. If the exigencies arise, the interval of inspection shall be reduced.

### Table - : Objective and Frequency of Inspection

<table>
<thead>
<tr>
<th>Object</th>
<th>Item</th>
<th>Daily</th>
<th>Monthly</th>
<th>Quarterly</th>
<th>Before and after rainy season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riding Surface</td>
<td>Pavement Bitumen</td>
<td>♦</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td></td>
<td>Concrete</td>
<td>♦</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td>Median</td>
<td>Kerb</td>
<td>♦</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td>Side Slopes</td>
<td>Shape</td>
<td>♦</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td></td>
<td>Turfing</td>
<td>♦</td>
<td></td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pitching and masonry</td>
<td>♦</td>
<td></td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retaining wall</td>
<td>○</td>
<td></td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td>Drainage</td>
<td>Side/Toe drain</td>
<td>☀</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td></td>
<td>Gullies and catch pits</td>
<td>☀</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td>Bridges</td>
<td>Superstructure</td>
<td></td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td></td>
<td>Substructure</td>
<td></td>
<td>○</td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Head wing walls and aprons</td>
<td></td>
<td>○</td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Painting</td>
<td></td>
<td></td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hand rail</td>
<td>○</td>
<td></td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td>Culverts/ Underpasses</td>
<td>Safety Barrier</td>
<td>♦</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td>Traffic operation</td>
<td>Signs</td>
<td>λ</td>
<td>○</td>
<td></td>
<td>λ</td>
</tr>
<tr>
<td></td>
<td>Marking</td>
<td>♦</td>
<td>○</td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delineator</td>
<td>♦</td>
<td>○</td>
<td>λ</td>
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</tr>
<tr>
<td></td>
<td>Lighting</td>
<td>♦</td>
<td>○</td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td>Other facilities</td>
<td>Vegetation / landscaping</td>
<td>♦</td>
<td>○</td>
<td>λ</td>
<td></td>
</tr>
<tr>
<td>Traffic Conditions</td>
<td></td>
<td>♦</td>
<td>λ</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Encroachments</td>
<td></td>
<td>♦</td>
<td>λ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.7 Reporting

The reporting and information that generally need to be provided by the Contractor are given below. The requirements given below are indicative of the type of information to be provided. The format of such reports, recording requirements, software standards and number of copies required would be finalized in consultation with the Independent Engineer. All reports and records shall be in the English language. For each corridor separate reports shall be submitted as below -

3.7.1 Inspection Reports and Remedial Measures

The periodicity of inspections for maintenance activities by the Contractor shall be set out in the O M & M Manual and regular reports on the same shall be sent to the Independent Engineer whenever required. The Contractor shall carry out any maintenance, repair or rehabilitation works found necessary as a result of such inspections.

3.7.2 Quarterly O M & M Report

During the Contract period, the Contractor shall provide to the Independent Engineer/MSRDC a quarterly report for each corridor separately (Quarterly O M & M Report) that shall contain the following minimum information:

- Inspections undertaken by the Contractor during the respective quarter of the year and action taken/ proposed thereafter.
- Details of all reports submitted to the Independent Engineer during the quarter of the year
- O M & M inspection compliance report.
- Maintenance activities undertaken during the quarter ended,
- Details of any Emergency and action taken.

The format of the O&M Report would be finalized in consultation with the Independent Engineer.

3.8 O M & M Manual

Copy of the present O & M manual being followed by MSRDC will be made available to the Contractor. The O&M Maintenance Manual prepared by the Contractor in consultation with the Independent Engineer shall cover the necessary requirements as per the manual made available and shall set out the operations and maintenance standards and details of the operations and maintenance activities to be undertaken during the Contract period; so that the Project Facilities shall at all times conform to the Design Requirements/ specifications.

The O M & M Manual should have separate sections for operations and maintenance.

The Manual should include but not limited to the following aspects:

- Organization structure with responsibilities of key personnel;
• Traffic Management Plan including the Corridor Control Plan;
• Maintenance Intervention Levels.
• Asset Management Project Deliverables and Tolerance Criteria;
• Environment Management Plan;
• Inspection and remedial measures;
• Maintenance Programme;
• Management information system;
• Report Formats.

3.9 Inventory

The Contractor shall maintain an inventory of all constructed, renovated, existing components of the Project Facility (the "Inventory"), separately for each corridor in a format to be developed in consultation with the Independent Engineer.

Throughout the Contract period the Contractor shall update the inventory each year before monsoon to take account of works carried out on and other changes made to the Project Facility and submit the same to MSRDC in the month of June every year for each corridor separately.

A copy of the Inventory shall be submitted by the Contractor to the Independent Engineer within thirty (30) days of receipt of a request for the same.

3.10 Abnormal Indivisible Load Routing (Oversize and Overweight)

The Contractor shall take all reasonable steps to facilitate the transit of Abnormal Indivisible Loads along the Project Facilities.

The Contractor shall develop a procedure for handling Abnormal Indivisible Loads in consultation with local authorities and the Independent Engineer.

3.11 Equipment belonging to third parties

The Contractor shall be responsible for the installation, operation, maintenance and removal of any equipment belonging to third parties.

3.12 Asset Management Deliverables And Tolerance Criteria: The Contractor shall strictly follow and adhere to the Asset Management Project Deliverables and Tolerance Criteria.

<table>
<thead>
<tr>
<th>Asset Management Project Deliverables and Tolerance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1. Pavement including Slopes</td>
</tr>
<tr>
<td>Paved Lanes</td>
</tr>
</tbody>
</table>
| Safe Adequate skid Resistance | Roughness Less than 2000 mm/km | • no ruts more than 10 mm  
• no unsealed cracks larger than 6 mm on 95% of road length  
• no potholes not more than 5.00 sq. m area and 2.5 cm deep  
• no shoving more than 7 spots per km  
• bleeding, raveling not more than 3% of total area of pavement  
• no edge deformation more than 10 mm/km  
• no shallow depressions more than 5 sqm/km  
• patching - even, and not less than 12 mm higher or lower  
• roughness not greater than 2000 mm/km  
• no false ditch (shoulder build up causes water to drain back onto the pavement) |

**Timeliness Requirement:**

- potholes causing a threat to safety will be responded to immediately, others within 2 days of notification  
- bleeding surface to be treated immediately within 1 day  
- renewals improving roughness within one months of notification

<table>
<thead>
<tr>
<th>2. Roadside Grass / Turf</th>
<th>Neat Attractive Sight distance Present</th>
<th>90</th>
</tr>
</thead>
</table>
| Tolerance/s Criteria : | • neat around crash barrier, headwalls, paved ditches  
• grass height 12” or less  
• sight distance is clear in intersections, passing zones, curves etc. |
<table>
<thead>
<tr>
<th>Component</th>
<th>Condition</th>
<th>Tolerance Criteria</th>
</tr>
</thead>
</table>
| Debris, Trees and Road kill     | Roadway free of obstruction      | **Timeliness Requirement:**
|                                 |                                  | - Respond immediately upon notification
|                                 |                                  | - road kill promptly and properly disposed off within 4 hours                        |
| Litter/Malba                    | Neat                             | **Tolerance/s Criteria:**
|                                 | Attractive                       | - Roadside appears neat and clean                                                   |
| Landscaping                     | Neat                             | **Tolerance/s Criteria:**
|                                 | Attractive                       | - overall appearance is neatly maintained                                          |
| Slopes                          | Stable                           | **Tolerance/s Criteria:**
|                                 | No erosion                       | - minimal erosion, and no erosion showing a pattern that will endanger the stability of the slope |
| Slope Pitching/PCC concrete lining | No disturbed pitching / lining | **Tolerance/s Criteria:**
|                                 |                                  | - the slope of pitching / lining surface should be as per design slope, slight variation shall be repaired within two days |
| Road blockage                   | No blockage                      | **Tolerance/s Criteria:**
|                                 |                                  | - inform traffic police and remove blockage, if required construct temporary diversion. |
| 3. Drainage                     | Pipe culverts                    | **Tolerance/s Criteria:**
<p>|                                 | Structurally sound               |                                                                                  |
|                                 |                                  |                                                                                  |</p>
<table>
<thead>
<tr>
<th>Type</th>
<th>Criteria</th>
<th>Tolerance/s Criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box Culverts/</td>
<td><strong>Open Drains</strong></td>
<td>• &lt;10% deteriorated barrel&lt;br&gt;• &gt;90% diameter open&lt;br&gt;• drains properly with no standing water&lt;br&gt;• joints intact&lt;br&gt;• no evidence of flooding&lt;br&gt;• minimal erosion at ends&lt;br&gt;• end protection intact</td>
</tr>
<tr>
<td></td>
<td>Joints intact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adequate capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No erosion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no dip in road over pipe indicating structural problems</td>
<td></td>
</tr>
<tr>
<td>Slab Culverts</td>
<td><strong>Open Drains</strong></td>
<td>• &lt;10% deteriorated barrel&lt;br&gt;• &gt;90% diameter open&lt;br&gt;• drains properly with no standing water&lt;br&gt;• joints intact&lt;br&gt;• no evidence of flooding&lt;br&gt;• minimal erosion at ends&lt;br&gt;• end protection intact</td>
</tr>
<tr>
<td></td>
<td>Joints intact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adequate capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No erosion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolerance/s Criteria:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• no undermining or undercut requiring action&lt;br&gt;• &lt;25% spilled&lt;br&gt;• no obstruction to flow of water that requires action</td>
</tr>
<tr>
<td>Ditches, Paved/</td>
<td><strong>Aligned Drains</strong></td>
<td>• no undermining or undercut requiring action&lt;br&gt;• &lt;25% spilled&lt;br&gt;• no obstruction to flow of water that requires action</td>
</tr>
<tr>
<td>Lined drains</td>
<td>Structurally sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean</td>
<td></td>
</tr>
<tr>
<td>Ditches</td>
<td><strong>Drain Functional</strong></td>
<td>• grade drains&lt;br&gt;• minimal erosion&lt;br&gt;• outfalls functional&lt;br&gt;• no obstruction to flow of water that requires action</td>
</tr>
<tr>
<td>Unpaved/Unlined Drains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm Drains Drop Inlets</td>
<td>Open</td>
<td>90</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>No flooding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No settlement</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kerb and Gutter</th>
<th>In line</th>
<th>95</th>
<th>Tolerance/s Criteria :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clean/drain</td>
<td></td>
<td>minimal obstruction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Erosion or scour in upstream or downstream</th>
<th>Sound</th>
<th>No Erosion due to scour</th>
<th>100</th>
<th>Erosion not to be allowed to continue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No undermining</td>
<td></td>
<td>no unsealed cracks &gt;6 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no spalling &gt; 1/4&quot; deep</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt;25% of surface spalled</td>
<td></td>
</tr>
</tbody>
</table>

**Timelines Requirement:**
For all the above cases repair or reconstruction shall be attended and completed within a week or as instructed by Independent Engineer

### 4. Bridges

<table>
<thead>
<tr>
<th>Overall Bridge</th>
<th>Smooth ride</th>
<th>% scour critical – 0</th>
<th>Tolerance/s Criteria :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong</td>
<td>% posted – 0</td>
<td>no graffiti on structures</td>
</tr>
<tr>
<td></td>
<td>Aesthetic</td>
<td></td>
<td>Timeliness Required :</td>
</tr>
<tr>
<td></td>
<td>Wide enough</td>
<td></td>
<td>structurally critical conditions must be notified immediately and repaired within a time frame as decided by Independent Engineer</td>
</tr>
</tbody>
</table>

| Traffic Safety | Available at legal limit | | |
|----------------|--------------------------| | |

<table>
<thead>
<tr>
<th>Features (Railings, Parapet, Walls drainage spouts etc.)</th>
<th>Present</th>
<th>Functional</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Timeliness Required :</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>repair or replace badly damaged traffic safety features within 1-2 days</td>
</tr>
</tbody>
</table>

---

*Contractor: MSRDC*
<table>
<thead>
<tr>
<th>Component</th>
<th>Condition</th>
<th>Tolerance/s Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Deck</strong></td>
<td>Smooth</td>
<td>• damaged but functional traffic safety features will be replaced within a week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tolerance/s Criteria:</td>
</tr>
<tr>
<td></td>
<td>Stable</td>
<td>• minimal spalls, cracks or scaling</td>
</tr>
<tr>
<td></td>
<td>Wide enough</td>
<td>• clean deck</td>
</tr>
<tr>
<td></td>
<td>Drains properly</td>
<td>• drains/scuppers are clean and functional</td>
</tr>
<tr>
<td><strong>Super-structure</strong></td>
<td>Stable</td>
<td>• no loss of section or cracks</td>
</tr>
<tr>
<td></td>
<td>Clearance</td>
<td>• paint in good shape</td>
</tr>
<tr>
<td></td>
<td>Aesthetic</td>
<td>• no spalling</td>
</tr>
<tr>
<td><strong>Substructure</strong></td>
<td>Strong/Stable</td>
<td>• proper vertical clearance</td>
</tr>
<tr>
<td></td>
<td>Looks good</td>
<td>• proper opening</td>
</tr>
<tr>
<td></td>
<td>Safe from scour</td>
<td>• Tolerance/s Criteria:</td>
</tr>
<tr>
<td></td>
<td>Stable</td>
<td>• no spalls, cracks, scaling</td>
</tr>
<tr>
<td></td>
<td>from settlement</td>
<td>• bearing assemblies functional</td>
</tr>
<tr>
<td></td>
<td>All components</td>
<td>• abutment seats cleaned and sound</td>
</tr>
<tr>
<td></td>
<td>functional</td>
<td>• pier seats clean and sound</td>
</tr>
<tr>
<td><strong>Expansion Joints</strong></td>
<td>Smooth, does not leak</td>
<td>• bearings clean, sound and lubricated periodically</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No settlement</td>
</tr>
<tr>
<td><strong>Structural</strong></td>
<td></td>
<td>• Tolerance/s Criteria:</td>
</tr>
<tr>
<td>Culverts</td>
<td></td>
<td>• no jerks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• joint are sealed</td>
</tr>
<tr>
<td><strong>Culverts</strong></td>
<td></td>
<td>• Tolerance/s Criteria:</td>
</tr>
<tr>
<td></td>
<td>&lt; 10% deteriorated barrel</td>
<td>• &lt; 10% deteriorated barrel</td>
</tr>
<tr>
<td></td>
<td>&gt; 90% diameter open</td>
<td>• &gt; 90% diameter open</td>
</tr>
<tr>
<td></td>
<td>minimal erosion at ends</td>
<td>• minimal erosion at ends</td>
</tr>
<tr>
<td></td>
<td>correct grade</td>
<td>• correct grade</td>
</tr>
<tr>
<td></td>
<td>joints intact</td>
<td>• joints intact</td>
</tr>
<tr>
<td></td>
<td>no evidence of flooding</td>
<td>• no evidence of flooding</td>
</tr>
<tr>
<td></td>
<td>end protection intact</td>
<td>• end protection intact</td>
</tr>
<tr>
<td></td>
<td>no dip in road over pipe indicating structural problems</td>
<td>• no dip in road over pipe indicating structural problems</td>
</tr>
<tr>
<td>Retaining Walls</td>
<td>Stable / strong</td>
<td>Tolerance / Criteria:</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- no spalling or cracks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- weep holes open</td>
</tr>
<tr>
<td>Drainage</td>
<td></td>
<td>- no indication of settlement or rotation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tolerance / Criteria:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No vegetation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- protection present and functional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- no embankment erosion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- no channel drift</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Road Signs and Road Furniture</th>
<th>Good reflectivity</th>
<th>Tolerance / Criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs (includes overhead signs)</td>
<td>100 – regulatory</td>
<td>- 100% clear of obstruction</td>
</tr>
<tr>
<td></td>
<td>90 – other</td>
<td>- 95% surface free of damage</td>
</tr>
<tr>
<td>Pavement Markings</td>
<td>Bright visible</td>
<td>- placement works for motorist at posted speed</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td><strong>Timeliness Required:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- replace warning and regulatory signs within 24 hours of notification</td>
</tr>
<tr>
<td>Object markers and Delineators</td>
<td>Reflective</td>
<td>Tolerance / Criteria:</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>- 90% reflective</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- properly mounted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &lt;10% of surface damaged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>placement meets IRC standards</td>
</tr>
<tr>
<td>Bench marks reference pillars</td>
<td>Present</td>
<td>Tolerance / Criteria:</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>- 100% clear of any obstruction</td>
</tr>
<tr>
<td></td>
<td>Referenced</td>
<td>- referenced</td>
</tr>
<tr>
<td>Service Type</td>
<td>Condition</td>
<td>Percentage</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Regulatory and Informatory Sign</td>
<td>Present, Referenced</td>
<td>100%</td>
</tr>
<tr>
<td>Board</td>
<td>Painted</td>
<td>100%</td>
</tr>
<tr>
<td>Painting and Printing letters on road signs</td>
<td>Painted to match with existing</td>
<td>100%</td>
</tr>
<tr>
<td>OFC Ducts</td>
<td>Continuous connectivity</td>
<td>100%</td>
</tr>
</tbody>
</table>

6. Other Facilities

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Condition</th>
<th>Percentage</th>
<th>Tolerance/s Criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSRDC / I E office including Laboratory</td>
<td>Functional, Clean, Hygienic</td>
<td>95%</td>
<td>100% functional of PIU office and laboratory</td>
</tr>
<tr>
<td>Building Structures</td>
<td></td>
<td>100%</td>
<td>98% functional of Laboratory testing equipment and apparatus</td>
</tr>
<tr>
<td>Toilet</td>
<td>Efficient</td>
<td>98%</td>
<td>100% testing facility of any type of tests</td>
</tr>
<tr>
<td>Water Supply</td>
<td>Dry</td>
<td>98%</td>
<td>98% lights functional, water supply and drainage functional</td>
</tr>
<tr>
<td>Drainage</td>
<td></td>
<td>100%</td>
<td>98% time (A.C. water cooler, heater) functional</td>
</tr>
<tr>
<td>Lighting</td>
<td></td>
<td>100%</td>
<td>100% furnishing item to be refinished once in every two years.</td>
</tr>
<tr>
<td>Pavement Equipment</td>
<td></td>
<td></td>
<td>100% furniture to be functional</td>
</tr>
<tr>
<td>Furniture</td>
<td></td>
<td></td>
<td>Total buildings to be painted every year</td>
</tr>
</tbody>
</table>

**Timeliness Requirement:**

Repair/replace/refinish within 24 hours of notification of Independent Engineer

---

**Contractor:** MSRDC
3.13 INSPECTION REPORTS AND REMEDIAL MEASURES

Periodicity of inspections for maintenance activities by the Contractor shall be regulated as per the Agreement, and governed by the exigencies of the situation.

The Contractor shall carry out maintenance; repair or rehabilitation works found necessary by these investigations in accordance with this Maintenance Manual and as stipulated in the Bid Document.

If in the opinion of the Independent Engineer, the repairs and maintenance is not being done satisfactorily by the Contractor, the same will be got done from the other agency at the cost and risk of the Contractor.
### SCHEDULE - G

*(See Clause 16.5)*

**MONTHLY FEE STATEMENT**

<table>
<thead>
<tr>
<th>Project:</th>
<th>Sea Link:</th>
<th>Month:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>For corresponding month of previous year</th>
<th>For month preceding</th>
<th>For the month reported upon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Vehicles</td>
<td>Fee collected (in lakh Rs.)</td>
<td>No. of Vehicles</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
</tbody>
</table>

**A** Car  
**B** LCV  
**C** Bus  
**D** Truck

**Note 1:** The above statement does not include Local Users and vehicles travelling on Passes.

**Note 2:** Monthly Fee Statements for Passes have been prepared separately in the above format and are enclosed.

**Remarks, if any:**
SCHEDULE – H
(See Clause 18.1.1 of Volume –II)

SAFETY REQUIREMENTS

1 Guiding principles

1.1 Safety Requirements aim at reduction in injuries, loss of life and damage to property resulting from accidents on the Project, irrespective of the person(s) at fault.

1.2 Users of the Project Facility include motorized and non-motorised vehicles as well as pedestrians and animals involved in, or associated with accidents. Vulnerable Road Users (VRU) include pedestrians as well as riders of two-wheelers, bicycles and other vehicles which do not provide adequate occupant protection.

1.3 Safety Requirements apply to all phases of operation and maintenance with emphasis on identification of factors associated with accidents, consideration of the same, and implementation of appropriate remedial measures.

1.4 Safety Requirements include measures associated with traffic management and regulation such as road signs, pavement marking, traffic control devices, roadside furniture, highway design elements, enforcement and emergency response.

2 Obligations of the Contractor

The Contractor shall abide by the following insofar as they relate to safety of the Users:

(a) Applicable Laws and Applicable Permits;
(b) Manual for Safety in Road Design, issued by MoRTH;
(c) relevant Standards/Guidelines of IRC relating to road geometrics, bridges, culverts, road signs, pavement marking and roadside furniture;
(d) provisions of this Agreement; and
(e) Good Industry Practice.

3 Appointment and functions of Safety Consultant

3.1 For carrying out safety audit of the Project under and in accordance with this Schedule-H, the Authority shall appoint from time to time, one or more qualified firms as its consultants (the “Safety Consultant”). The Safety Consultant shall employ a team comprising, without limitation, one road safety expert and one traffic planner to undertake safety audit of the Project Highway.

3.2 Once in every Accounting Year, a safety audit shall be carried out by the Safety Consultant. It shall review and analyse the annual report and accident data of the preceding year, and undertake an inspection of the Project Highway. The Safety Consultant shall complete the safety audit within a period of 1 (one) month and submit a
3.3 The accident data and the design details shall be compiled, analysed and used by the Safety Consultant for evolving a package of recommendations consisting of safety related measures for the Project Highway. The safety audit shall be completed in a period of three months and a report thereof (the “Safety Report”) shall be submitted to the Authority, in five copies. One copy each of the Safety Report shall be forwarded by the Authority to the Contractor and the Independent Engineer forthwith.

4 Safety measures during Contract Period

4.1 The Contractor shall develop, implement and administer a surveillance and safety programme for Users, including correction of safety violations and deficiencies and all other actions necessary to provide a safe environment in accordance with this Agreement.

4.2 The Contractor shall establish a Highway Safety Management Unit (the “HSMU”) to be functional on and after COD and designate one of its officers to be in-charge of the HSMU. Such officer shall have specialist knowledge and training in road safety and traffic engineering by having attended a course conducted by a reputable organization on the subject.

4.3 The Contractor shall keep a copy of every FIR recorded by the Police with respect to any accident occurring on the Project Highway. In addition, the Contractor shall also collect data for all cases of accidents not recorded by the Police but where a vehicle rolled over or had to be towed away. The information so collected shall be used in the form prescribed by IRC/MoRTH for this purpose. The Contractor shall also record the exact location of each accident on a road map. The aforesaid data shall be submitted to the Authority at the conclusion of every quarter and to the Safety Consultant as and when appointed.

4.4 The Contractor shall submit to the Authority before the 31st (thirty first) May of each year, an annual report (in ten copies) containing, without limitation, a detailed listing and analysis of all accidents of the preceding Accounting Year and the measures taken by the Contractor pursuant to the provisions of Paragraph 4.1 of this Schedule-H for averting such accidents in future.

5 Costs and expenses

Costs and expenses incurred in connection with the Safety Requirements set forth herein, including the cost of works and services, safety audit, and costs incidental thereto, shall be met by the Authority, provided such costs and expenses are not required to be borne by the Contractor under the provisions of Clauses 2.1, 15.2 and 18.1.3 of the Contract Agreement.
### SCHEDULE - I
(See Clause 19.1 of Volume –II)

1. **WEEKLY TRAFFIC CENSUS**

<table>
<thead>
<tr>
<th>Project: Sea Link</th>
<th>Week ending:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Vehicle</strong></td>
<td><strong>No. of vehicles using the Project Highway during</strong></td>
</tr>
<tr>
<td></td>
<td>Corresponding week/last year</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td><strong>A</strong> Fee paying Traffic</td>
<td></td>
</tr>
<tr>
<td>A1 Car</td>
<td></td>
</tr>
<tr>
<td>A2 LCV</td>
<td></td>
</tr>
<tr>
<td>A3 Bus</td>
<td></td>
</tr>
<tr>
<td>A4 Truck</td>
<td></td>
</tr>
<tr>
<td>A5 Three-axle Vehicle</td>
<td></td>
</tr>
<tr>
<td><strong>Total (A)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>B</strong> Local Users</td>
<td></td>
</tr>
<tr>
<td>B1 Car</td>
<td></td>
</tr>
<tr>
<td><strong>Total (B)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>C</strong> Exempted Vehicles</td>
<td></td>
</tr>
<tr>
<td>C1 Motor Cycle</td>
<td></td>
</tr>
<tr>
<td>C2 Car</td>
<td></td>
</tr>
<tr>
<td>C3 LCV</td>
<td></td>
</tr>
<tr>
<td>C4 Bus</td>
<td></td>
</tr>
<tr>
<td>C5 Truck</td>
<td></td>
</tr>
<tr>
<td><strong>Total (C)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>D</strong> Total Traffic (A+B-C)</td>
<td></td>
</tr>
<tr>
<td>D1 Motor Cycle</td>
<td></td>
</tr>
<tr>
<td>D2 Car</td>
<td></td>
</tr>
<tr>
<td>D3 LCV</td>
<td></td>
</tr>
<tr>
<td>D4 Bus</td>
<td></td>
</tr>
<tr>
<td>D5 Truck</td>
<td></td>
</tr>
<tr>
<td>D6 Three-axle Vehicle</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total (E)</strong></td>
<td></td>
</tr>
</tbody>
</table>

2. **WEEKLY REPORT FOR WEIGH STATIONS**

(DELETED)
SCHEDULE – J
(See Clause 19 of Volume -II)

TRAFFIC SAMPLE

1 Traffic census

The Contractor shall install, maintain and operate electronic/computerized traffic counters at the Toll Plazas and collect data relating to the number and types of vehicles using the Project. A weekly statement of such data shall be compiled and furnished forthwith by the Contractor to the Authority substantially in the form specified in Schedule-I.

2 Traffic survey

MSRDC shall also take daily traffic count independently in presence of Contractor and this traffic count will be used to ascertain the actual traffic at the toll station. If due to unavoidable circumstances the independent survey is interrupted, the average traffic count will be considered for the period for which survey could not be taken.

3 Automatic traffic count

Deleted

4 Variation between manual and automatic count

Deleted
SCHEDULE – K  
(See Clause 20.1)  

SELECTION OF INDEPENDENT ENGINEER

1 Selection of Independent Engineer

1.1 The provisions of Part II of the Standard Bidding Documents for Consultancy Assignments: Time Based (Volume V) issued by the Ministry of Finance, GOI in July, 1997 or any substitute thereof shall apply, mutatis mutandis, for invitation of bids and evaluation thereof save as otherwise provided herein.

1.2 The Authority shall invite expressions of interest from consulting engineering firms or bodies corporate to undertake and perform the duties and functions set forth in Schedule-L and thereupon shortlist qualified firms in accordance with pre-determined criteria.

1.3 The Authority shall invite the aforesaid firms to submit their respective technical and financial offers, each in a separate sealed cover. All the technical bids so received shall be opened and pursuant to the evaluation thereof, the Authority shall shortlist eligible firms on the basis of their technical scores. The financial bids in respect of such firms shall be opened and the order of priority as among these firms shall be determined on the basis of financial bids and the lowest financial bid shall rank first for award of contract.

1.4 Deleted

2 Fee and expenses

The fees to the Independent Engineer shall be paid from the amount the Contractor has deposited vide Article 4A of Volume II and in case the amount exceeds Contractors deposit the same shall be borne by the Authority.

3 Constitution of fresh panel

Deleted

4 Appointment of government entity as Independent Engineer

Deleted
TERMS OF REFERENCE FOR INDEPENDENT ENGINEER

1 Scope

1.1 These Terms of Reference for the Independent Engineer (the “TOR”) are being specified pursuant to the Contract Agreement dated …………. (the “Agreement”) which has been entered into between the Authority and …………….. (the “Contractor”) for Operation and Maintenance of Rajiv Gandhi Sea Link and Toll Plaza as per Tender & Collection of Toll on Upfront Basis in the State of Maharashtra and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

2 Definitions and interpretation

2.1 The words and expressions beginning with or in capital letters used in this TOR 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 Role and functions of the Independent Engineer

3.1 The role and functions of the Independent Engineer shall include the following:

(i) review of the Drawings and Documents as set forth in Paragraph 4;
(ii) determine the Project Facilities Completion Schedule;
(iii) review, inspection and monitoring of Construction Works as set forth in Paragraph 5;
(iv) conducting tests on completion of construction and issuing Completion Certificate as set forth in Paragraph 5;
(v) review, inspection and monitoring of O&M as set forth in Paragraph 6;
(vi) review, inspection and monitoring of Divestment Requirements as set forth in Paragraph 7;
(vii) determining, as required under the Agreement, the costs of any works or services and/or their reasonableness;
(viii) determining, as required under the Agreement, the period or any extension thereof, for performing any duty or obligation;
(ix) assisting the Parties in resolution of disputes as set forth in Paragraph 9; and
(x) Undertaking all other duties and functions in accordance with the Agreement.
3.2 The Independent Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.

4 Review of Drawings and Documents :

4.1 Deleted

4.2 The Independent Engineer shall review any modified Drawings or supporting Documents sent to it by the Contractor and furnish its comments within 7 (seven) days of receiving such Drawings or Documents.

4.3 The Independent Engineer shall review the Drawings sent to it by the Safety Consultant in accordance with Schedule-H and furnish its comments thereon to the Authority and the Contractor within 7 (seven) days of receiving such Drawings. The Independent Engineer shall also review the Safety Report and furnish its comments thereon to the Authority within 15 (fifteen) days of receiving such report.

4.4 The Independent Engineer shall review the detailed design, construction methodology, quality assurance procedures and the procurement, engineering and construction time schedule sent to it by the Contractor and furnish its comments within 15 (fifteen) days of receipt thereof.

4.5 Upon reference by the Authority, the Independent Engineer shall review and comment on the EPC Contract or any other contract for operation and maintenance of the Project Highway, and furnish its comments within 7 (seven) days from receipt of such reference from the Authority.

5 Construction Works - deleted

6 Operation & Maintenance

6.1 The Independent Engineer shall review the annual Maintenance Programme furnished by the Contractor and send its comments thereon to the Authority and the Contractor within 15 (fifteen) days of receipt of the Maintenance Programme.

6.2 The Independent Engineer shall review the monthly status 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.

6.3 The Independent Engineer shall inspect the Project Highway once every month, preferably after receipt of the monthly status report from the Contractor, but before the 20th (twentieth) day of each month in any case, and make out an O&M Inspection Report setting forth an overview of the status, quality and safety of O&M including its conformity with the Maintenance Requirements and Safety Requirements. In a separate section of the O&M Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in O&M of the Project
Highway. The Independent Engineer shall send a copy of its O&M Inspection Report to the Authority and the Contractor within 7 (seven) days of the inspection.

6.4 The Independent Engineer may inspect the Project Highway more than once in a month, if any lapses, defects or deficiencies require such inspections.

6.5 The Independent Engineer shall in its O&M Inspection Report 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.

6.6 In respect of any defect or deficiency referred to in Paragraph 3 of Schedule-F, the Independent 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.

6.7 The Independent Engineer shall determine if any delay has occurred in completion of repair or remedial works in accordance with the Agreement, and shall also determine the Damages, if any, payable by the Contractor to the Authority for such delay.

6.8 The Independent Engineer shall examine the request of the Contractor for closure of any lane(s) of the carriageway for undertaking maintenance/repair thereof, keeping in view the need minimise disruption in traffic and the time required for completing such maintenance/repair in accordance with Good Industry Practice. It shall grant permission with such modifications, as it may deem necessary, within 3 (three) days of receiving a request from the Contractor. Upon expiry of the permitted period of closure, the Independent Engineer shall monitor the re-opening of such lane(s), and in case of delay, determine the Damages payable by the Contractor to the Authority under Clause 15.7.

6.9 The Independent Engineer shall monitor and review the curing of defects and deficiencies by the Contractor as set forth in Clause 16.4.

6.10 In the event that the Contractor notifies the Independent Engineer of any modifications that it proposes to make to the Project Highway, the Independent Engineer shall review the same and send its comments to the Authority and the Contractor within 15 (fifteen) days of receiving the proposal.

6.11 The Independent Engineer shall undertake traffic sampling, as and when required by the Authority, under and in accordance with Article 19 and Schedule-J.

7 Termination

7.1 At any time, not earlier than 90 (ninety) days prior to Termination but not later than 15 (fifteen) days prior to such Termination, the Independent Engineer shall, in the presence of a representative of the Contractor, inspect the Project Highway for determining compliance by the Contractor and, if required, cause tests to be carried out at the
Contractor’s cost for determining such compliance. If the Independent Engineer determines that the status of the Project Highway is such that its repair and rectification would require a larger amount, it shall recommend arrangement of the required amount from performance security and the period of arrangement thereof.

7.2 The Independent Engineer shall inspect the Project Highway once in every 15 (fifteen) days during a period of 90 (ninety) days after Termination for determining the liability of the Contractor under Article 31 in respect of the defects or deficiencies specified therein. If any such defect or deficiency is found by the Independent Engineer, it shall make a report in reasonable detail and send it forthwith to the Authority and the Contractor.

8 Determination of costs and time

8.1 The Independent Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.

8.2 The Independent Engineer shall determine the period, or any extension thereof, that is required to be determined by it under the Agreement.

9 Assistance in Dispute resolution

9.1 When called upon by either Party in the event of any Dispute, the Independent Engineer shall mediate and assist the Parties in arriving at an amicable settlement.

9.2 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 Independent Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

10 Other duties and functions

The Independent Engineer shall perform all other duties and functions specified in the Agreement.

11 Miscellaneous

11.1 The Independent Engineer shall notify its programme of inspection to the Authority and to the Contractor, who may, in their discretion, depute their respective representatives to be present during the inspection.

11.2 A copy of all communications, comments, instructions, Drawings or Documents sent by the Independent Engineer to the Contractor pursuant to this TOR, and a copy of all the test results with comments of the Independent Engineer thereon shall be furnished by the Independent Engineer to the Authority forthwith.

11.3 The Independent Engineer shall obtain, and the Contractor shall furnish in two copies thereof, all communications and reports required to be to submitted under this Agreement by the Contractor to the Independent Engineer, whereupon the Independent Engineer shall
send one of the copies to the Authority along with its comments thereon.

11.4 The Independent 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.

11.5 Upon completion of its assignment hereunder, the Independent Engineer shall duly classify and list all Drawings, Documents, results of tests and other relevant records, and hand them over to the Authority or such other person as the Authority may specify, and obtain written receipt thereof. Two copies of the said documents shall also be furnished in micro film form or in such other medium as may be acceptable to the Authority.
SCHEDULE - M

TOLL NOTIFICATION

PUBLIC WORKS DEPARTMENT
Madam Cama Marg, Hutatma Rajguru Chowk,
Mantralaya, Mumbai 400 032, dated the 28th March 2012

Notification

BOMBAY MOTOR VEHICLE TAX, ACT, 1958.
No. PAMUSA. 2008/C.R. 86/Road-6 – In exercise of the powers conferred by sub-sections (1-A), (1-B), (1-C), (1-D) and (1-E) of section 20 of the Bombay Motor Vehicles Tax Act, 1958 (Bom. LXV of 1958), and of all other powers enabling it in that behalf, the Government of Maharashtra hereby declares that Toll shall be levied and collected on the classes of motor vehicles specified in column (2) of the schedule appended hereto, passing over the Bandra-Worli Sea Link Road (Bandra to Worli), at the rates specified against each of the said vehicles in column (3) of the said Schedule during the period commencing from 1st April 2012 and ending on the 31st March 2015, at the toll collection centre constructed under Package IV of the project located near Bandra Reclamation, Bandra at Chainage No. 1/745.

Schedule

<table>
<thead>
<tr>
<th>Serial No. (1)</th>
<th>Particulars of motor vehicle (2)</th>
<th>Rate of Toll (in rupees per trip) (3)</th>
</tr>
</thead>
</table>
| 1              | Light motor vehicles as defined in the Motor Vehicles Act, 1958 (59 of 1958) –
|                | a) Car, Jeep such as Tata Sumo, Trax, Commandor, or any other similar vehicles (having carriage capacity upto twelve passengers, excluding driver) six seater Auto-Rickshaw excluding driver;  
|                | b) Mini bus or any other similar vehicles (having carriage capacity of more than twelve and upto twenty passengers, excluding driver) and goods carriage vehicles which are not included in serial number 2. | 55 |
| 2              | Truck or Bus.                    | 80                                  |

1. The following types of vehicles are exempted from payment of toll namely:
   i. VVIP vehicles carrying President of India, Vice President of India, Governor of State or Representatives of Peoples entitled for Red Lamp on vehicle.
   ii. Vehicles carrying sitting Members of Parliament, Maharashtra Legislative Assembly or Maharashtra Legislative Council.
iii. Vehicles carrying Ex-Members of Parliament from Maharashtra and Ex-Members of Maharashtra Assembly or Maharashtra Legislative Council.


vi. Police vehicles

vii. Firefighting vehicles.

viii. Ambulances.

ix. Hearses.

x. Vehicles of the Post and Telegraph Department.

2. The Maharashtra State Road Development Corporation Limited, Mumbai is authorized to collect and retain the amount of toll collected at the above toll collection centre, for the above mentioned period.

Notes --

a) Ten percent rebate will be given to the purchaser of booklet containing 50 coupons in advance.

b) Twenty percent rebate will be given to the purchase of booklet containing 100 coupons in advance.

c) The rates of return journey pass and daily pass of the frequently plying vehicles shall be one and half times and two and half times respective one way travel rates. Return journey pass and daily pass shall be valid upto 12.00 midnight of the day of issuing the pass.

d) The rates of monthly will be 50 times of their respective one way travel rates

By order and in the name of the Governor of Maharashtra.

(S.S. SOLANKI)
Deputy Secretary to Government

Note: Toll rates after 31st March 2013 shall be as per Govt. Notification issued at that time and the notification shall be based on GR No. 1099/PK. 112/RD-6 Dated 18/08/2000 as per Annexure –I of Volume- I.
Annex – I  
(Schedule M)  
Rate of Toll applicable for Concessions rounded to nearest Rs. 5

<table>
<thead>
<tr>
<th>Serial No. (1)</th>
<th>Particulars of motor vehicle (2)</th>
<th>Rate of Toll (in rupees per trip) (3)</th>
<th>Booklet containing 50 Coupons</th>
<th>Booklet containing 100 Coupons</th>
<th>Return Journey pass</th>
<th>Daily pass</th>
<th>Monthly Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 a</td>
<td>Light motor vehicles as defined in the Motor Vehicles Act, 1958 (59 of 1958) – Car, Jeep such as Tata Sumo, Trax, Commandor, or any other similar vehicles (having carriage capacity upto twelve passengers, excluding driver) six seater Auto-Rickshaw excluding driver;</td>
<td>55</td>
<td>2475</td>
<td>4400</td>
<td>80</td>
<td>135</td>
<td>2750</td>
</tr>
<tr>
<td>1 b</td>
<td>Mini bus or any other similar vehicles (having carriage capacity of more than twelve and upto twenty passengers, excluding driver) and goods carriage vehicles which are not included in serial number 2.</td>
<td>80</td>
<td>3600</td>
<td>6400</td>
<td>120</td>
<td>200</td>
<td>4000</td>
</tr>
<tr>
<td>2</td>
<td>Truck or Bus.</td>
<td>110</td>
<td>4950</td>
<td>8800</td>
<td>165</td>
<td>275</td>
<td>5500</td>
</tr>
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</table>
SCHEDULE - N
(See Clause 23.1.2)

ESCROW AGREEMENT

Deleted
VESTING CERTIFICATE

Deleted