Bid Document for
Detailed Scope of Work and
technical Specifications

Specifications and Standards for Operation and Maintenance Works
Section
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 Thane – 
Ghodbundar road (S. H.42) and all related assets including connectors at specified 
service level during the contract period excluding wayside amenities on Project 
Highway. This involves round the clock vigil of the Project Highway 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 

[Signature]

CONTRACTOR
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.

CONTRACTOR
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, 800, 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 Thane Ghodbundar 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:

CONTRACTOR

[Signature]
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 111.1 : 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.

CONTRACTOR
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. Not withstanding 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.

[Signature]
CONTRACTOR
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 expressway / N.H.4.

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."

CONTRACTOR
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:

[Signature]
CONTRACTOR
Replace the works "as shown in the applicable drawings", in line 4, by words "as directed by the Engineer"

Clause 501.2.2: 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.

CONTRACTOR
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 APPURRENCES

Clause 801  Traffic Signs:

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

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.

CONTRACTOR
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 1.3.9.7 Reinforcing steel:

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

Clause 1.3.9.8 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.

CONTRACTOR
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 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.

CONTRACTOR
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 give below:

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

<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 sign boards shall be screen painted. Screen-Printing shall be

**CONTRACTOR**
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

CONTRACTOR
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 on 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 than 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.

CONTRACTOR
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.

All concrete work will be carried out as per relevant MORT&H specifications.

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.

CONTRACTOR
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 ASTEM 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 19 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, oxidization, 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 scaling 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 a 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 long 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 debrjs 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.

[Signature]

CONTRACTOR
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

CONTRACTOR
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

CONTRACTOR

MSRDC
The 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.

a) Identification of all parties involved in QA and their inter-relationship.
b) Internal QA system of each party.
c) Levels of cross-checking / verification in case of multiple
verifications/controls, including system of inspection and audit,
wherever applicable.
d) Organization of personnel, responsibilities and lines of reporting for
QA purposes.
e) Criteria for acceptance/rejection, including identification of proper
authorities for such decisions.
f) Inspection at the end of the defect liability period.
g) Items to be covered in maintenance manual
h) 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

CONTRACTOR
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 statements include various procedures to be followed such as 'Guidelines for dealing with non conforming work', "Methodology of Quality Audits" etc.

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.
3012.4.2. Guidelines on Quality Systems for road bridges (Plain reinforced and prestressed concrete) IRC (document under publication.)

3012.4.3. Quality Control for Road Works : MORT&H Specification No. 900.