MAHARASHTRA STATE ROAD DEVELOPMENT CORPORATION LIMITED MUMBAI

BID DOCUMENT

FOR

FOUR LANING AND IMPROVEMENTS OF MUMBAI - PUNE SECTION OF NH-4 (K.M. 131/200 TO K.M. 20/400) ON SELF-FINANCE ALONGWITH TOLL COLLECTION AND OPERATION AND MAINTENANCE ON MUMBAI-PUNE SECTION OF N.H.4 AND EXISTING MUMBAI PUNE EXPRESSWAY

VOLUME - IV

TECHNICAL SPECIFICATIONS AND DESIGN CRITERIA

For Ideal Road Builders Pvt. Ltd.

Director
MAHARASHTRA STATE ROAD DEVELOPMENT CORPORATION LIMITED, MUMBAI.

BID DOCUMENT

FOR

FOUR LANING AND IMPROVEMENTS OF MUMBAI - PUNE SECTION OF NH-4 (K.M. 131/200 TO K.M. 20/400) ON SELF-FINANCE ALONGWITH TOLL COLLECTION AND OPERATION AND MAINTENANCE ON MUMBAI-PUNE SECTION OF N.H.4 AND EXISTING MUMBAI PUNE EXPRESSWAY

VOLUME - IV

1. Specifications for road and Bridge works
2. Design standards and Criteria for road works
3. Structural Design criteria for Bridges and C.D. works
4. Specifications and Standards for maintenance works
5. Technical Specifications for Automation of Toll Plaza

ISSUED TO (NAME OF BIDDER) [Signature]
ON DATE 02-01-04 [Date]
ACCOUNTANT [Signature]

For Ideal Road Builders Pvt. Ltd.

Director

EXECUTIVE ENGINEER

MAHARASHTRA STATE ROAD DEVELOPMENT CORPORATION (LTD.)
MUMBAI-36.
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For Ideal Road Builders Pvt Ltd.

Director
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SPECIFICATIONS FOR ROAD AND BRIDGE WORKS

1.0 PREAMBLE

The Technical Specifications contained herein shall be read in conjunction with the other Bidding Documents e.g. Vol-I to Vol-VI.

1.1 SITE INFORMATION

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.

1.2 GENERAL TECHNICAL SPECIFICATIONS

The General Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" (Forth Revision, August 2001, reprinted in September 2002) issued by Ministry of Surface Transport (Road Wing), Government of India and the Ministry of Road Transport and Highways (formerly the Ministry of Surface Transport) respectively, and published by the Indian Roads Congress. These specification shall be applicable to all items of construction and maintenance work under this project.

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 of...
revision of the relevant standards as on date of tender and codes in effect 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 recognised standards which ensure a substantially equal or higher performance than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. 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 engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the documents.

1.3 ADDITIONAL TECHNICAL SPECIFICATIONS

The Clauses SP-1 to SP-9 have been added to the 'Specifications for Road and Bridge Works (forth revision, August 2001).

These additional specifications are supplementary to the MORT&H specifications Clause 120, as given in specifications.

CLAUSE SP 1 ADDITIONAL SPECIFICATIONS FOR P.M.C.'S SITE OFFICE

1.1 Permanent features of buildings and facilities needed have been defined below.

1.2 DESCRIPTION OF BUILDING

The Contractor has to arrange to provide office accommodation of carpet area together with all electrical items, water supply and

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Contractor

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Competent Officer
drainage arrangements, as defined in the MORT&H specifications. The building plan, plumbing and other facilities as well as other architectural aspects should conform to the requirements of building by-laws of local bodies responsible for giving building approvals in respective locations. The minimum acceptable standard of construction is as follows:

The structure shall be of RCC. The foundation should rest on rock or hard murum of bearing capacity of not less than 25 T/sq.m. The external walls should be at least 230 mm thick and internal walls be 150 mm thick. The external walls can be either having rough cast cement plaster / sand-faced cement plaster. The internal surface should have cement plaster with neeru finish coated with approved plastic emulsion, or other paint, as approved by the Engineer. External painting should be of 2 coats of cement base paint. The roof shall be of RCC M 20 concrete as per standards and specifications of MORT&H. The flooring shall be marble mosaic tiles (grey). The window shall be aluminum authorized with sliding shutters with 4 mm thick glass. Doors shall be flush commercial type painted with approved oil paint. W.C. shall be European type. Overhead water tank of minimum 1000 liter capacity shall be provided. The layout of the office shall be got approved from the Engineer, which should include the minimum facilities described above.

The construction shall be carried out as per the reference drawing of office building in Volume – V of the bid document.

1.3 OWNERSHIP

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Contractor

Director

Competent Officer
The site office with all permanent fixtures and electrical wiring / fittings etc., shall become the property of the MSRDC at the end of contract period. The office should be properly maintained during the contract period as per the directions of the Engineer and it should be handed over to the MSRDC after the contract period in living conditions.

CLAUSE SP 2  WIDENING OF EXISTING BRIDGES – METHODOLOGY

Widening of existing bridges shall be done either on one side or on both sides to match the geometry of the road. Foundation and substructure for various components of the widening portion shall be cast against such components of the existing portion. Cut water of existing piers, wherever present shall be carefully dismantled without disturbing any other parts of the piers. For widening of the superstructure portion, existing railing and kerb towards the side to be widened shall be dismantled. Portion of the deck slab near the region shall be chipped off to expose the slab reinforcement. The existing kerb reinforcement shall be cut and bent so that they are well accommodated within the deck slab and no portion of the reinforcement remains exposed after the area is filled with concrete. The deck slab reinforcement of the widening portion shall be lapped with the exposed top reinforcement of the existing deck slab. The chipped portion of the existing deck shall be filled up with new concrete along with concreting of superstructure of the widening portion.

Before pouring of concrete against the face of existing structure, the same shall be kept wet with water so as to control absorption of slurry of fresh concrete by the existing structure.

All joints between existing and new structure shall be properly treated as per specification and as shown and directed by the Engineer-in-charge.

While excavating earth close to existing bridge or chipping/ demolishing any of its parts, extreme care shall be taken by the contractor so that no other part of the existing structure is disturbed or affected due to such breaking works and the existing structure remains safe and sound.

For Ideal Road Builders Pvt. Ltd.

Contractor  Director  Competent Officer
CLAUSE SP 3 REPAIR AND WIDENING OF EXISTING BRIDGES

METHODOLOGY

The Contractor shall get the traffic diversion scheme required for widening of existing old bridge, approved by the Engineer-in-charge and by other concerned authorities/statutory bodies before taking up such works at site. The contractor should also put up a scheme for diverting the existing services, if any, supported on the bridge under widening. The Contractor shall make all arrangement to ensure that smooth flow of traffic is maintained. The Contractor shall take all precautions to guard against any accident of traffic and shall use all necessary road signs, etc. for the purpose.

The repair and widening works shall be carried out strictly as per detailed drawings, specification and as directed by the Engineer-in-charge. If in the opinion of the Engineer-in-charge, any such work is not up to the desired standard, the Contractor shall promptly make good such works to the satisfaction of the Independent Engineer or his authorised representative. While carrying out such works, care shall be taken by the Contractor not to damage or disturb any part of the bridge, its approaches or any associated existing works. In case any part of the existing bridge or associated structures is damaged, the Contractor shall promptly repair the same as per the direction of the Independent Engineer or his authorised representative to his satisfaction.

The Contractor shall remove the debris after dismantling works, etc. from the site as per the direction of the Engineer-in-charge or his authorised representative.

After completion of the repair and widening work, the Contractor shall clean the existing structure and the newly widened portion and shall make good in such a manner that it is traffic-worthy.

Director

Competent Officer
After completion of repair and widening of the existing bridge, temporary works carried out for diversions shall be made good by the Contractor and all arrangements shall be made so that both the old and the new portion of the bridge at the site can be used by the traffic.

**CLAUSE SP 4  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 cementitious grout in relatively sound concrete.

4.1 **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, good bonding characteristics even in presence of moisture shall be used. (Phenolics, polysters, 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
- Potlife at 30°C : 30 minutes minimum
- Compressive strength under water (for 14 days) of a 5 cm cube : 90-100 N/mm²
- For Ideal Road Builders Pvt. Ltd. : Concrete failure
- Bond strength (14 days) : 

  Contractor  
  Director  
  Competent Officer
Approx. injection pressure : 2 kN/cm²
Shrinkage : Conforming to ASTM C 883

4.2 Equipment (Epoxy grout materials)

Injection equipment which should possess the following characteristics:

- Ease of handling, simple function
- Low failure rate
- Cater for varying viscosity and pot life suited for the job
- Capable of injecting into cracks of width >=0.3mm
- Simple cleaning and maintenance routines
- Provision of an arrangement for controlling and stopping the injection before the gun is withdrawn

Fitted with pressure gauge to indicate grouting pressure

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

4.3. Procedure

4.3.1 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 bonding agent/PMC slurry be applied over the freshly cut surface. Epoxy repair mortar shall be used to fill the groove while the

Director

Contractor

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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 grouting nipple shall be fixed using epoxy mortar/PMC mortar. The spacing of the ports shall be about 300mm c/c or be suitable for the site condition. The first and last entry ports should be established at or near the top and bottom respectively of all vertical cracks or at the ends of any horizontal crack.

The spacing of injection points shall be such as to help in maximum resin or cementations grout material penetration and easy filling of cracks with low operating pressure.

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.

**CLAUSE SP 5 CHUTE DRAIN FOR HIGH EMBANKMENT SECTIONS**

5.1 Scope

This work shall consist of construction of chute drain on the slope of the road embankment including erosion protection works at the locations and to dimensions shown on the Drawings or as directed by Engineer. Schedule of works shall be so

For Ideal Road Builders Pvt Ltd.

Director Competent Officer
arranged that the drains are completed in proper sequence with roadway to ensure that no damage is caused due to lack of drainage.

5.2 Materials

The drains shall be of half round pipe of 600-mm dia formed by joining pre-cast semicircular RCC sections at site as shown in the drawings. The RCC work shall conform to the relevant clauses of these specifications.

Dumped riprap for erosion protection at ground level shall be hard, unweathered and durable rubble stone of size 150 to 250 mm.

5.3 Construction Operations

5.3.1 Excavation for fixing drain sections: At the locations where the chute drains are to be installed, a semi-circular cut on the side slope of the embankment along the line of the chute drain shall be made in such a way that the RCC drain sections could be fixed snugly with their edges flush with the adjoining embankment slope. The sloping bed of the drain shall be to a regular line and suitably compacted to provide a firm bed.

CLAUSE SP 6  FIXING DOWEL BARS IN CONCRETE

6.1 Scope

The work shall consist of fixing HYSD bars in the existing concrete deck slab/other concrete components to facilitate bonding of a structural component with an existing one.

At least 14 days before start of the work, the contractor shall furnish detailed methodology of construction including sources of supply of
material, tools, equipment and appliances be used on work, details of personnel and supervision.

The contractor's personnel shall be qualified and experienced in repair and rehabilitation work of such nature.

6.2 Materials

HYSD bars shall conform to Section 1000

The grout material used for fixing HYSD bars in drilled holes in concrete shall be obtained from a reputed manufacturer and grout mix shall be prepared in conformity with the manufacturer's recommendations. The material shall be either of the following:

6.2.1 Two/three component low viscosity epoxy resin system, having required characteristics of bonding with concrete and resistances to moisture penetration (Resicrete 21 or Resicrete 212 of M/S Structural Waterproofing Co. or SIKADUR BTP of M/S Sika Qualcrete or equivalent).

6.2.2 Cement grout in powder form consisting of cement, good quality sand and admixtures when mixed with required amount of water forms a pourable mix to be used for bonding HYSD bars in concrete (EXCEM - E1 manufactured by M/S Structural Water Proofing Company or M/S SIKADUR or equivalent).

The epoxy resin system shall conform to Clause 2803.

6.2.3 The cement grout shall basically be shrinkage compensated, chloride free and of very high strength (50 MPa at 28 days). The mix should be capable of pumping or pouring and shall have excellent bond strength.

Director

Contractor

Competent Officer
with concrete and steel (bond strength of 15 MPa with HYSD bars at 28 days).

6.3 Construction Operations

The construction operation shall be in the following sequence, and shall be supervised by the Contractor's Engineer well experienced in such works:

6.3.1 Drill holes of required diameter and depth at desired locations as shown on drawings.

6.3.2 Clean the hole with air blast through air nozzle of 6-mm dia connected to air compressor to remove the drilled powder, which may remain inside the drilled hole.

6.3.3 Mix the required quantity of grout so that the work could be completed within the normal setting time as specified by the manufacturers.

6.3.4 Pour required quantity of mixed grout in the holes.

6.3.5 Insert the dowel rod in the hole where grout has been placed. Move the rod up and down several times to drive out entrapped air, if any.

6.3.6 Allow the curing time as per manufacturers specifications.

6.3.7 Inclined dowels shall be straightened to match their intended profile only after the grout has finally set and required strength has been achieved.

For Ideal Road Builders Pvt. Ltd.

Director

Contractor

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Competent Officer
CLAUSE SP 7 ADDITIONAL SPECIFICATIONS FOR BLASTING

7.1 General

The specification for excavation in rock are covered by MORTandH "Specifications for Road and Bridge Works" (August 2001 revision) The following specifications are additional a supplementary to the same.

7.2 Control Blasting

The rock blasting shall be controlled so that vibration generated during the blasting do not cause damage to the building and installation around built up areas as given in the table below. Similarly the rock pieces should not fly off the pits and thus damage the buildings and installation and life and limb of people around. Apart from the general precautions mentioned in the MORTandH specifications, following protective measures and limits for use of explosives are suggested as guidelines. Tenders shall carefully check the site conditions and submit the details of the scheme they propose to adopt for controlling the blast.

7.3 Protective Measures

The following precautionary measures (single or in combination) as required by site conditions shall be adopted by the contractor while carrying out controlled blasting.

7.3.1 Short delay blasting with light charges shall be used.

For Ideal Road Builders Pvt. Ltd

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7.3.2 The blast hole shall be covered with 0.6 to 1.0 Sqm mild steel plate of minimum 6mm thickness.

7.3.3 Reinforcement rod mesh not less than 20mm dia at 150 mm centres in both directions shall be placed over the steel plates.

Steel plate and reinforcements shall be inspected after every blasting operation and all twists shall be removed before reuse to the satisfaction of the engineer.

The thickness of the covering plate and the kind of dead weight is to be duly approved by the Engineer.

When blasting is necessary adjacent in partially or completely built structures the Contractor shall take all precautions necessary to prevent flying rock from causing damage to the structures.

7.4 Blasting Within Certain Limit

No blasting shall be allowed for any of the excavation until freshly placed concrete of nearby structures has reached a minimum strength of 7 N/Sqmm.

Normally blasting shall be resorted to only after 7 days of concreting work in case of OPC (10 days in case of PPC) in adjacent structures.

In no case shall blasting be allowed closer than 15m to any structure after concrete placing has started.

For Ideal Road Builders Pvt Ltd.

[Signature]

Director

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Competent Officer
The Contractor shall submit the scheme with charges and delay detonators he proposes to use for blasting, for approval of the Engineer.

7.5 Permissible Standards:

Depending on the type of structures and the dominant excitation frequency, the permissible peak velocity (ppv) due to blast induced ground vibrations adjacent to the structures shall not exceed the values given below in the table:

Permissible Peak Particle Velocity (PPV) at the foundation level of structures in Blasting Areas in mm/s is recommended as below.

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Dominant excitation Frequency Hz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Buildings / Structures not belonging to the owner</td>
<td>PPV</td>
</tr>
<tr>
<td>i) Domestic houses / Structures (Kuchha, Brick and Cement)</td>
<td>5</td>
</tr>
<tr>
<td>ii) Industrial Buildings (RCC and Framed Structures)</td>
<td>10</td>
</tr>
<tr>
<td>iii) Objects of historical importance and sensitive structures</td>
<td>2</td>
</tr>
<tr>
<td>(B) Buildings belonging to owner with limited span of life</td>
<td></td>
</tr>
<tr>
<td>i) Domestic houses / structures (Kuchha, brick and Cement)</td>
<td>10</td>
</tr>
<tr>
<td>ii) Industrial building (RCC and Framed Structures)</td>
<td>6</td>
</tr>
</tbody>
</table>
It is generally recommended that where the blasting is to be done, within 20 metres of the nearest point of permanent building, the area shall be line drilled on periphery before blasting.

The Contractor shall be responsible for all damage caused by blasting whether to permanent or temporary structures and shall replace or repair the structures at his own cost. Contractor will have to design the charge per delay to restict the PPV as indicated above.

7.6 Precautions After Blasting

After the blast, the Supervisor must carefully inspect the work and satisfy himself that all the charges have disappeared from the face.

If it is suspected that part of the blast has failed to fire or is delayed, sufficient time shall be allowed to elapse before entering the danger zone. When fuse and blasting caps are used, a safe time should be allowed and then the Supervisor alone shall leave the shelter to inspect the blasting zone.

None of the drillers are to work near the misfired hole until one of the two following operations have been carried out by the Supervisor.

Either (i) of the Supervisor should very carefully (when the tamping is of damp clay) extract the tamping with a wooden scraper or jet of water or compressed air (Using a pipe of soft material) and withdraw the fuse with the primer and a fresh detonator with fuse should be placed in these holes and fired out, or (ii) the hole may be cleared or 30m of tamping and its direction then be ascertained by placing a stick in the hole. Another hole may then be drilled at least 60 cms away and parallel to it and about 30 cms less in depth, this hole shall then be charged and fired. The balance of the cartridges and detonators found in the muck shall be removed.

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Director

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Before leaving his work, the Supervisor of the concluding shift shall inform the Supervisor of the relieving shift of any case of misfires and should point out the position with a red cross denoting the same and also stating what action, if any, he has taken in the matter.

The Supervisor should also at once report at the office of the Contractor and the Engineer all cases of misfire, the cause of the same and what steps were in connection with these.

The names of the day and night shift Supervisors must be noted daily in the Contractors office.

If a misfire has been found to be due to a defective detonator or dynamite the whole quantity or box from which the defective article was taken, must be thoroughly inspected by the Contractor.

Drilling in holes not completely exploded by blasting shall not be permitted.

7.7 Personal

Excavation by blasting will be permitted only under the personal supervision of competent and licensed blasters and trained workmen.

All Supervisors and workman in-charge of preparation, handling storage and blasting work shall be adequately insured by the Contractor.

Storage shall be in charge of a very reliable person approved by the Engineer, who may, if necessary conduct police enquiry's as to his reliability, antecedents etc. The Contractor shall have to produce a security for the person in-charge of the explosive, if and when required by the Engineer, or the civil authorities of the district.

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Competent Officer
The Contractor shall make sure that his Supervisor and workmen are fully conversant with all the rules to be observed in storing, handling and use of the explosives. It shall be ensured that the Supervisor in charge is thoroughly acquainted with the details of the handling of explosive and blasting operations.

7.8 To establish the safe charge per delay contractor will have to demonstrate by necessary instrumentation for the approval of the Engineer.

CLAUSE SP.8 ADDITIONAL SPECIFICATIONS FOR USE OF ROCKFILL IN EMBANKMENT and BEHIND STRUCTURES

8.1 General

These special additional specifications are supplementary to MORT&H specification NO. 313 (4th revision August 2001) and supersedes those provisions to the extended modified hereunder.

8.2 Scope Of Application

Material can be used only in the following circumstances by the approval of the Engineer:

8.2.1 Where height of embankment is more than 3 m (including formation level the lowest 1m thickness can be constructed by, rock fill.)

8.2.2 For all heights, the sloped portion beyond shoulder can be constructed using with provision that under all circumstances, minimum 500 mm thick earthen cushion shall be available between formation level and top level of rock fill.

For Ideal Road Builders Pvt Ltd.

Contractor Director Competent Officer
8.2.3 Behind the structures irrespective of height of embankment up to bottom of subgrade.

8.3 Material

The maximum size of stones in shall not exceed 300 mm in any direction. The voids between rocks shall be filled by smaller fragments.

8.4 Spreading And Compaction

The method of compaction as specified in MORTandH specification and / or as directed by the Engineer, should ensure that no boulders are loosely packed and can move or rock after compaction. The top layer of as well as the sides of the retaining normal earthfill on one side shall be fully blinded with filter media comprised of crushed aggregate and sand. The grading and layering of filter media shall be such as to form effective filter layer through which particles of inner soil fill of embankment are not able to migrate into the in the process of settlement / consolidation or due to movement of water. The layering shall confirm with the layers of adjacent rockfill so as to facilitate simultaneous compaction.

CLAUSE SP 9  ADDITIONAL TECHNICAL SPECIFICATIONS FOR ROAD SIGNS

9.1 General

The Colour, configuration

The Colour, size and location of all traffic signs for NH-4 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 For Ideal Road Engineer.

- Contractor

D: - 18 - Competent Officer
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 specification.

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.

9.2 Material

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

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

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

9.2.3 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 galvanised (zinc coated, 0.55 kg/sqm minimum single spot) and galvanising shall conform to relevant IS specifications.

9.2.4 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 galvanised (zinc coated, 0.55 Kg per Sq.m. minimum single spot.) and galvanising shall conform to relevant IS specifications.

9.2.5 Aluminium:- Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy conforming to IS: 736 – Material designation 24345 or 1900. The back of the sheet will be painted with two coats of Epoxy paint.

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

9.3 Structural Details

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

9.4 Retro-reflective sheeting

9.4.1 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 and 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.

For Ideal Road Builders Pvt Ltd,

Director

Competent Officer
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 (candelas / 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>
</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>

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.

**9.5 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

For Ideal Road Builders Pvt. Ltd.

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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.

9.5.1

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

9.5.2

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.

9.6

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 : French Blue</td>
</tr>
<tr>
<td>Red</td>
<td>IS Colour</td>
<td>537 : Signal Red</td>
</tr>
<tr>
<td>Green</td>
<td>IS Colour</td>
<td>284 : India Green</td>
</tr>
<tr>
<td>Orange</td>
<td>IS Colour</td>
<td>591 : Deep Orange</td>
</tr>
</tbody>
</table>
The colours shall be durable and uniform in acceptable hue when viewed in daylight or under normal headlights at night.

9.7 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.

9.8 Fabrication

9.8.1 Surface to be reflectorised shall be effectively prepared to receive the retro reflective sheeting. The aluminium shall be degreased 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 contaminates prior to the application of retro reflective sheeting.
9.8.2 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.

9.9 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

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for 1000 hours, using type E or £H weatherometer (AASHTO Designation M-268).

9.10 Installation

9.10.1 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 Galvanised 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.

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

9.10.3 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.

9.11 Foundation for Support

9.11.1 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.

9.11.2 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

For Ideal Road Builders Pvt. Ltd.

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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.

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

SECTION 100 GENERAL

CLAUSE 101 Replace the last sentence and read as under:
(Modification) The latest edition of all specifications/standards till 3 months before the final date of submission of the tender, shall be adopted.

CLAUSE 102 DEFINITIONS
(Addition) The following abbreviations shall be added in this Clause:
"MORT&H" : Ministry of Road Transport and Highways
"MSRDC" : Maharashtra State Road Development Corporation

CLAUSE 110 PUBLIC UTILITIES
(Substitution) Replace whole of this clause with the following:

Clause 110.1 The contractor shall be responsible to coordinate with service provider / concerned authorities for shifting of utilities and removal of encroachments etc. and making the site unencumbered from the project construction area required for completion of work. This shall include initial and frequent follow-up meetings / actions / discussion.

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with each involved service provider / concerned authorities. The contractor will not be entitled to any additional compensation for the delay in shifting of utilities and removal of encroachments by the service provider / concerned authorities. The expenses incurred for shifting of utilities as required by the respective departments shall be made as indicated in clause 110.2 below.

The information contained in the Bid Documents concerning the public utility services such as water, sewer, power transmission lines, telephone lines and oil/gas pipelines, OFC cables, etc. may not be exhaustive, and it shall be the responsibility of the Contractor to ascertain the utilities that are likely to be affected by the works through site investigations and collection of information from the concerned utility owners.

Clause 110.2 The contractor shall be responsible for payment towards shifting of utilities required for execution of works to the extent of Rs 5,00,00,000 (Rs five crores) during Construction period. The payment shall be made by the contractor to the utility department on recommendation of competent officer of MSRDC. If additional sum is required towards shifting of utilities the contractor shall also pay such sums but Contractor shall be compensated. If less sum is required then the balance amount out of Rs. 5.00 Crs shall be paid by the contractor in cash to MSRDC.

Clause 110.3 Any utility likely to be affected by Contractor’s work should be brought to the notice of the Engineer and such work shall be undertaken only after getting written clearance from the Engineer.

Clause 110.4 The Contractor may be required to carry out certain works for and on behalf of the various bodies and the Contractor shall also

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provide, with the prior approval of the Engineer, such assistance to
the various bodies as may be authorized by the Engineer.

**CLAUSE 112  ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION**

**Clause 112.2 (Addition)**

Where the National Highway under construction crosses existing
state highway, or an established road or cart track, the highway,
road or cart track 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 as described in the
clause 112.3 (see below). Temporary diversions for diverting the
traffic from existing carriageway to new carriageway or vice-
versa will have to be constructed by the contractor at his cost and
this work is treated as incidental to the work execution.

**Clause 112.3 (Substitution)**

In stretches where it is not possible to pass the traffic on part
width of the carriageway, a temporary diversion shall be
constructed as described below:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Type of Road</th>
<th>Carriageway width</th>
<th>Shoulder width each side</th>
<th>Pavement Element (compacted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National and State Highways</td>
<td>7.0m</td>
<td>2.5m</td>
<td>200mm Granular Subbase</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>225mm Granular base</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Premix carpet with seal coat/mix seal surfacing</td>
</tr>
<tr>
<td>2</td>
<td>Major and Other District Roads</td>
<td>5.25m</td>
<td>1.0m</td>
<td>150mm Granular subbase</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150mm W.B.M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Premix carpet with seal coat/mix seal surfacing</td>
</tr>
<tr>
<td>3</td>
<td>Village Roads and Cart tracks</td>
<td>3.25m</td>
<td>1.0m</td>
<td>150mm Granular subbase</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150mm W.B.M</td>
</tr>
</tbody>
</table>

*For Ideal Road Builders Pvt. Ltd.*

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Drainage should be provided as directed by Engineer.

The alignment and longitudinal section of diversion including junctions and temporary cross drainage provision shall be as approved by the Engineer.

Clause 112.4 Traffic Safety and Control
(Modification/Addition) 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."

CLAUSE 120 SITE OFFICE FOR ENGINEER AND OTHER SUPERVISORY STAFF

Clause 120.1 Add the following at the end:
(Addition) Supervisory staff of "Engineer" includes staff of Employer, as well as Staff of Independent Engineer and that of any separate QA agency appointed by the Engineer.

Clause 120.2 Table 100.2 "List of furniture to be provided and maintained for
(Changes/Addition) Site office for MSRDC and Independent Engineer to have following changes/addition:
For Ideal Road Builders Pvt. Ltd.

[Signature] Director

[Signature] Competent Officer
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Item</th>
<th>Specifications</th>
<th>Nos. Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Computer with Printer</td>
<td>Pentium IV with hard disc capacity 20.0 GB, 128 MB RAM, Maths coprocessor,</td>
<td>7 Nos.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One disc drivers of 1.44&quot;, One CD ROM drive, 14&quot; size colour VGA monitor,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laserjet Printer and 104 key board, 3 key mouse, colored plotter</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Water Cooler, with Filter</td>
<td>Usha (Litre 10) with Aquaguards 1000 or equivalent</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>19</td>
<td>165 Ltr. Refrigerator</td>
<td>Voltas / Godrej or equivalent Frost Free</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>20</td>
<td>Safety Hard Hats</td>
<td>Approved make by Engineer</td>
<td>7 Nos.</td>
</tr>
</tbody>
</table>

CLAUSE 121  FIELD LABORATORY

Clause 121.2  Description
(Modification /Addition / Substitution)

Replace the words "shown in drawings" in the first sentence of first paragraph of this Clause with the words "per provisions indicated in this clause and at a location approved by the Engineer."

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Add the words "including uninterrupted power supply" to the second sentence of first paragraph.

Delete the first sentence of second paragraph and substitute the following:

"The floor space required for the field laboratory shall be not less than 300 sqm."

Delete the fourth sentence of second paragraph shall be read as under.

"A good semi furnished office accommodation shall be provided to each of the Material Engineers of the Supervision Team as per the direction of the Engineer."

Add the following at the end of this Clause:

"There shall also be provided a concrete paved area, for storing samples adjacent to the laboratory, of about 300 sqm and another 200 sqm shall be suitably roofed with open sides giving protection against sun and rain. Within 14 (fourteen) days of the commencement date, the Contractor shall prepare and submit a layout plan and details of the laboratory building and make/supplier of the equipment to the Engineer for his approval.

The field laboratory to be provided under the Contract shall be ready and finished and fully equipped condition not later than 2 months after the receipt of Notice to Commence Work, and the field laboratory with all equipment/instrument shall be to the entire satisfaction of the Engineer. During the period specified, the laboratory tests shall be performed in another laboratory proposed by the Contractor and approved by the Engineer."

Clause 121.3 Laboratory Equipment

(Substitution) This Clause shall read as under:

For Ideal Road Builders Pvt Ltd.

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The following items of laboratory equipment as a minimum shall be provided in the field laboratory:

The equipment and instruments shall be new and shall be quality certified by Bureau of Indian Standards (BIS).

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Sub No.</th>
<th>Item, Specifications</th>
<th>Nos. required</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>(a)</td>
<td>7 kg to 10 kg capacity semi-self indicating Electronic Type – Accuracy 1 gm</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>500 gm capacity semi-self indicating Electronic Type – Accuracy 0.01 gm</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>Pan balance 10 kg capacity – Accuracy 0.5 gm</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>(d)</td>
<td>Platform Scale – 300 kg capacity</td>
<td>1</td>
</tr>
<tr>
<td>(ii)</td>
<td>(a)</td>
<td>Ovens – Electrically operated, thermostatically controlled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a)</td>
<td>From 100°C to 220°C – Sensitivity</td>
<td>2</td>
</tr>
<tr>
<td>(iii)</td>
<td>(a)</td>
<td>IS Sieves 450 mm internal dia. of sieve sets as per BIS of required sieve sizes complete with lid and pan</td>
<td>2 set</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>IS sieve 200 mm internal dia. (brass frame and steel or brass wire cloth mesh) consisting of sieve sets of required sieve sizes complete with lid and pan</td>
<td>2 set</td>
</tr>
<tr>
<td>(iv)</td>
<td>(a)</td>
<td>Sieve shaker capable of taking 200 mm and 450 mm dia. Sieves electrically operated with time switch assembly (As per BIS)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>200 tonnes compression testing machine</td>
<td>1</td>
</tr>
<tr>
<td>Sr.No</td>
<td>Sub No.</td>
<td>Item, Specifications</td>
<td>Nos. required</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>(vi)</td>
<td></td>
<td>Stop watches 1/5 sec. Accuracy</td>
<td>2</td>
</tr>
<tr>
<td>(vii)</td>
<td></td>
<td>Glassware comprising of Beakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) glass rods and funnels, glass thermometers range 0°C to 100°C and metallic thermometers range 300°C</td>
<td>6 each</td>
</tr>
<tr>
<td>(viii)</td>
<td></td>
<td>Hot plates 200 mm dia (1500 watt)</td>
<td>2</td>
</tr>
<tr>
<td>(ix)</td>
<td></td>
<td>Enamel trays</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td></td>
<td>600 mm x 450 mm x 50 mm</td>
<td>10</td>
</tr>
<tr>
<td>(b)</td>
<td></td>
<td>450 mm x 300 mm x 40 mm</td>
<td>10</td>
</tr>
<tr>
<td>(c)</td>
<td></td>
<td>300 mm x 250 mm x 40 mm</td>
<td>6</td>
</tr>
<tr>
<td>(d)</td>
<td></td>
<td>Circular plates of 250 mm dia.</td>
<td>6</td>
</tr>
<tr>
<td>(x)</td>
<td></td>
<td>Water Testing Kit</td>
<td>1</td>
</tr>
<tr>
<td>(xi)</td>
<td></td>
<td>First aid Box</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B: For Soils</td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td></td>
<td>Water still</td>
<td>1</td>
</tr>
<tr>
<td>(ii)</td>
<td></td>
<td>Liquid limit device with Casagrande and ASTM grooving tools as per IS : 2720</td>
<td>1</td>
</tr>
<tr>
<td>(iii)</td>
<td></td>
<td>Sampling pipettes fitted with pressure and suction inlets, 10 ml Capacity</td>
<td>2 set</td>
</tr>
<tr>
<td>(iv)</td>
<td></td>
<td>Compaction apparatus(Proctor) as per IS:2720 (Part 8) complete with collar, base plate and hammer</td>
<td>1 set</td>
</tr>
<tr>
<td>(v)</td>
<td></td>
<td>Modified AASHTO compaction apparatus as per IS. 2720 (Part 7) 1974 or Heavy Compaction Apparatus as per IS complete with collar, base plate and hammer</td>
<td>1 set</td>
</tr>
<tr>
<td>(vi)</td>
<td></td>
<td>Sand pouring cylinder with conical funnel and tap and complete as per IS 2720 (Part</td>
<td>6</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Sub No.</th>
<th>Item, Specifications</th>
<th>Nos. required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(vii)</td>
<td>Sampling tins with lids 100 mm dia x 75 mm ht 1/2 kg capacity and miscellaneous items like moisture, tins with lid (50 grams) etc</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(viii)</td>
<td>Lab CBR testing equipment for conducting CBR testing, load frame with 5 Ton capacity, electrically operated with speed control as per IS:2720 (Part 16), and consisting of following:</td>
<td>1 set</td>
</tr>
<tr>
<td></td>
<td>(a)</td>
<td>CBR moulds 150-mm dia - 175-mm ht complete with collar, base plate etc.</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>Tripod stands for holding dial gauge holder</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>CBR plunger with settlement dial gauge holder</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(d)</td>
<td>Surcharge weight 147-mm dia 2.5 kg. wt with central hole</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(e)</td>
<td>Spacer disc 148-mm dia, 47.7-mm ht. With handle</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(f)</td>
<td>Perforated plate (Brass)</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(g)</td>
<td>Soaking tank for accommodating 6 CBR moulds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(h)</td>
<td>Proving rings of 1000 kg, 2500 kg and 5000 kg capacity</td>
<td>1 each</td>
</tr>
<tr>
<td></td>
<td>(i)</td>
<td>Dial gauges, 25 mm travel- 0.01 mm/division</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(ix)</td>
<td>Standard Penetration test equipment</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(x)</td>
<td>Nuclear Moisture Density Meter or equivalent</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(xi)</td>
<td>Speedy moisture meter complete with chemicals</td>
<td>6</td>
</tr>
<tr>
<td>Sr.No</td>
<td>Sub No.</td>
<td>Item, Specifications</td>
<td>Nos. required</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>----------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>(xii)</td>
<td></td>
<td>Unconfined compression test apparatus</td>
<td>1 set</td>
</tr>
<tr>
<td>(i)</td>
<td></td>
<td>Constant temperature bath for accommodating bitumen test specimen, electrically operated and thermostatically controlled</td>
<td>2</td>
</tr>
<tr>
<td>(ii)</td>
<td></td>
<td>Penetrometer automatic type, adjustable weight arrangement and needles as per IS. 1203 - 1958</td>
<td>2</td>
</tr>
<tr>
<td>(iii)</td>
<td></td>
<td>Solvent extraction or centrifuge type apparatus complete with extraction thimbles with solvent and filter paper</td>
<td>1</td>
</tr>
<tr>
<td>(iv)</td>
<td></td>
<td>Laboratory mixer including required accessories about .02 cum capacity electrically operated fitted with heating jacket</td>
<td>1</td>
</tr>
<tr>
<td>(v)</td>
<td></td>
<td>Marshall compaction apparatus automatically operated as per ASTM 1559-62 T and complete with electrically operated loading unit, compaction pedestal heating head assembly, dial micrometer and bracket for flow measurement, load transfer bar, specimen mould 100 mm dia. (4 in) with base plate, collars, specimen extractor, compaction hammer 4.53 kg (10 lb.) x457 mm (18 in) fall</td>
<td>1 set</td>
</tr>
<tr>
<td>(vi)</td>
<td></td>
<td>Distant Reading Digital Thermometer for Measuring Temperatures in Asphalitic Mixes</td>
<td>As required</td>
</tr>
<tr>
<td>(vii)</td>
<td></td>
<td>Riffle Box</td>
<td>1</td>
</tr>
</tbody>
</table>

For Ideal Road Builders Pvt. Ltd.

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Director

Competent Officer
<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Sub No.</th>
<th>Item, Specifications</th>
<th>Nos. required</th>
</tr>
</thead>
<tbody>
<tr>
<td>(viii)</td>
<td></td>
<td>Automatic Asphalt Content Gauge [Nuclear or equivalent]</td>
<td>1</td>
</tr>
<tr>
<td>(i)</td>
<td></td>
<td>Water still</td>
<td>1</td>
</tr>
<tr>
<td>(ii)</td>
<td></td>
<td>Vicat needle apparatus for setting time with plungers, as per IS. 269-1967</td>
<td>1</td>
</tr>
<tr>
<td>(iii)</td>
<td></td>
<td>Moulds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a)</td>
<td>150 mm x 300 mm i.t cylinder with capping component</td>
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<tr>
<td></td>
<td>(b)</td>
<td>150mmx150 mm x150mm cubical for compressive strength</td>
<td>60</td>
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<tr>
<td></td>
<td>(c)</td>
<td>150mmx150 mm x700mm beam for flexural strength</td>
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</tr>
<tr>
<td>(iv)</td>
<td></td>
<td>Concrete permeability apparatus</td>
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</tr>
<tr>
<td>(v)</td>
<td></td>
<td>High frequency mortar cube vibrator for cement testing</td>
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</tr>
<tr>
<td>(vi)</td>
<td></td>
<td>Concrete mixer power driven, 1 cu ft capacity</td>
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</tr>
<tr>
<td>(vii)</td>
<td></td>
<td>Variable frequency and amplitude vibrating table size 1 metre x 1 metre, as per the relevant British Standard</td>
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<td>(viii)</td>
<td></td>
<td>Flakiness and Elongation test apparatus</td>
<td>2</td>
</tr>
<tr>
<td>(ix)</td>
<td></td>
<td>Aggregate impact test apparatus as per IS 2386 (Part 4) 1963</td>
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<tr>
<td>(x)</td>
<td></td>
<td>Los Angeles abrasion apparatus as per IS. 2386 (Part 4) 1963</td>
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<tr>
<td>(xi)</td>
<td></td>
<td>Flow table as per IS 712-1973</td>
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<td>(xii)</td>
<td>(a)</td>
<td>Equipment for slump test</td>
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<td>(b)</td>
<td>Compaction factor test equipment</td>
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<td>Sub No.</td>
<td>Item, Specifications</td>
<td>Nos. required</td>
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<tr>
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</tr>
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<td>(xiii)</td>
<td></td>
<td>Equipment for determination of specific gravity for fine and coarse aggregate as per IS 2386 (Part 3) 1963</td>
<td>2</td>
</tr>
<tr>
<td>(xiv)</td>
<td></td>
<td>Flexural attachment to compression testing machine</td>
<td>1</td>
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<tr>
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<td></td>
<td>Core cutting machine with 150 mm dia. Diamond cutting edge</td>
<td>2</td>
</tr>
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<td>(xvi)</td>
<td></td>
<td>Needle vibrator</td>
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<td>Vibrating hammer as per BS specification</td>
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<td>Air entrainment meter</td>
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<td>(xix)</td>
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<td>0.5 Cft, 1 Cft cylinder for checking bulk density of aggregate with tampering rod</td>
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<td>Soundness testing apparatus for cement</td>
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<td>(xxi)</td>
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<td>Flexural Beam testing machine with E: For Control of Profile and Surface</td>
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<td>(i)</td>
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<td>Digital Level complete with all accessories</td>
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<td>(ii)</td>
<td></td>
<td>Auto level</td>
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<td>(iii)</td>
<td></td>
<td>Alluminium staff</td>
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<td>(iv)</td>
<td></td>
<td>Total Station with all accessories</td>
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</tr>
<tr>
<td>(v)</td>
<td></td>
<td>3 metre straight edge and measuring wedge</td>
<td>2 sets</td>
</tr>
<tr>
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<td></td>
<td>Camber templates 2 lane</td>
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<tr>
<td>(a)</td>
<td></td>
<td>Crown type cross-section</td>
<td>2 sets</td>
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<td>(b)</td>
<td></td>
<td>Straight run cross-section</td>
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<td>Steel tape</td>
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</tr>
<tr>
<td>(a)</td>
<td></td>
<td>5 m long</td>
<td>as reqd</td>
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<td>(b)</td>
<td></td>
<td>10 m long</td>
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<td>20 m long</td>
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<td>(d)</td>
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<td>30 m long</td>
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<tr>
<td></td>
<td></td>
<td>50 m long</td>
<td>As reqd</td>
</tr>
</tbody>
</table>

For Ideal Road Builders [a]

Contractor

Director

Competent Officer
Note:
1. The laboratory set-up must be complete including a set of reference standards, adequately staffed and operational to the satisfaction of the Engineer before commencement of the works.

2. Following survey instruments shall be made available exclusively for the use of Engineer during the tenure of the contract.
   i) Auto level - 2 nos.
   ii) Total station - 1 set
   iii) Alluminium staff - 4 nos.

Clause 121.5 Maintenance

(Substitution) This Clause shall read as under:

"The Contractor shall arrange to maintain the field laboratory including sample store yards in a satisfactory manner until the issue of Taking over Certificate for the complete work. Maintenance includes all activities described in Clause 120.4 and maintenance of equipment and running of the same including chemicals and consumables."

CLAUSE 202 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS

Clause 202.5 Disposal of Materials

(Modification) This Clause shall read as under

All materials obtained from dismantling structures including houses / bungalows etc. shall be the property of contractor and shall be removed and disposed off as instructed by Engineer.

For Ideal Road Builders Pvt. Ltd.

Contractor

Director

Competent Officer
CLAUSE : 507  DENSE GRADED BITUMINOUS MACADAM

Clause : 507.2  Materials

Clause : 507.2.1  This clause shall read as under :

(Substitution)  The Bitumen shall be paving bitumen of Penetration Grade 60/70 preferably with CRMB / PMB as per Indian Standard Specifications for Paving Bitumen – IS:73

Clause : 507.2.2
(Modification)  Coarse Aggregates

i)  Delete the words from 2nd line of 1st para “Crushed gravel or other hard material retained on the 2.36mm sieve”.

ii)  Delete the entire para 2 of Clause 507.2.2

iii)  From the table 500.8 delete at the bottom of the table asterisk “Aggregate may satisfy requirements of either of these two tests” and modify as under:

“Aggregate should satisfy both the tests value of Los Angeles Abrasion Values and Aggregate Impact Value”.

Clause 507.3.3
(Modification)  Insert the following paragraph between existing paragraph 3 and 4

For Ideal Road Builders Pvt Ltd.

[Signature]

Director

Contractor

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Mix design shall be carried out in accordance with the modified Marshall method described in Asphalt Institute Manual MS-2.

CLAUSE 509

BITUMINOUS CONCRETE

Clause 509.2.1

(Addition)

This clause shall be read as under:

The Contractor has to use 30/40 grade Bitumen/ polymer modified Bitumen / Crumb Rubber Modified Bitumen conforming to the IRC standards.

Clause 509.2.4

(Substitution)

This Clause shall read as follows:

"Filler shall consist of cement minimum of 3% by weight of mix."

Clause 509.2.5

(Modification)

Aggregate Grading and binder content

Add the note below Table 500-18.

"The grading of the aggregate mix as used in work shall be a smooth curve within the approximate parallel of the envelope in Table 500.18"

CLAUSE 601

DRY LEAN CEMENT CONCRETE SUB BASE

Clause 601.2.3.2

In the 5th line of this clause, replace "25 mm" by "40 mm"

For Ideal Road Builders Pvt Ltd.

Director

Competent Officer
Clause 601.2.3.4  
(Replacement)  
Replace Table 600-1 Aggregate gradation for Dry Lean Concrete by Table 600-4. Aggregate gradation for Dry Lean Concrete.

CLAUSE 602  
CEMENT CONCRETE PAVEMENT

Clause 602.2.2  
(Replacement)  
Ordinary Portland Cement, 43 Grade (IS 8112) shall only be used.

Clause 602.2.3  
(Modification)  
To be added at the end of Clause 602.2.3
Admixtures containing calcium chloride shall not be used.

Clause 602.2.4.1  
(Modification)  
Los Angelis abrasion test results should not be more than 25%.

Clause 602.2.8  
(Substitution)  
Joint Seals

a) 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 confirm to the performance requirements of ASTM Standard D2628-81 for oven ageing, oil and ozone resistance, low temperature stiffening and recovery. Seals made of ethylene vinyl acetate in microcellular 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.

For Ideal Road Builders Ltd.

[Signature]

Contractor  
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Competent Officer
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%.

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, oxidisation, fuels and salt.

When compression seals are used, the widths of the seal 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 side of the groove shall be not less than 20mm and that the top of the seal shall be a minimum of 3mm below the surface of the concrete.

Clause 602.3.3 Concrete Strength

Clause 602.3.3.1 The last sentence of this Para shall read as under:

For Ideal Road Builders Pvt. Ltd.

[Signature]

Contractor    Directo    Competent Officer
(Modification) "The water content shall be the minimum required to provide the agreed workability for full compaction of the concrete to the required density as determined by the trial mixes or other means approved by the Engineer and the maximum free water-cement ratio shall be 0.45."

Add the following at the end of this Clause:

"The concrete for the rigid pavement shall be of minimum M40 Grade with a 28-day compressive characteristic strength of not less than 40 MPa and a flexural strength of not less than 4.8 MPa with a corresponding tolerance factor of 2.33."

Clause 602.3.4 Workability

Clause 602.3.4.1 Delete the last sentence of the para and replace with:

(Modification) "The control of workability in the field shall be exercised by Slump Test (IS: 1199) and shall be further confirmed/controlled by Compaction Factor Equipment and the compaction factor shall be in the range of 0.8 to 0.92."

Clause 602.5 Separation Membrane

(Modification) To be added at end of this Clause

"There shall be no standing water on or under the separation membrane when concrete is placed upon it."

CLAUSE 809 CONCRETE CRASH BARRIER

Clause 809.2.2 Replace "M-20 by M-30"

For Ideal Road Builders Pvt Ltd

Director Competent Officer
CLAUSE 1013
(Replacement)

REINFORCED CONCRETE PIPES
In place of existing para, substitute the following:

Reinforced concrete pipes for highway structures shall be of the class specified by the designer for the particular application. In absence of such specification, the class shall be NP 4 type conforming to the requirements of IS : 458.

For Ideal Road Builders Pvt. Ltd.

Director
Contractor

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Competent Officer
SECTION - II
DESIGN STANDARDS AND CRITERIA FOR
ROAD WORKS
SECTION - II
DESIGN STANDARDS AND CRITERIA FOR ROAD WORKS

1. GENERAL

The Project/Project Facilities shall conform to the minimum design requirements. Alternate or additional Drawings, if any, submitted by the Contractor should also meet these requirements.

Alternative design for pavement can be adopted by the Contractor subject to review of the same by IE/MSRDC. However, in no case, the finished top level of the new two lane rigid pavement can be reduced/ lowered.

Alternative design for structures i.e. bridges, culverts, underpasses, overpasses and retaining walls can be adopted by the Contractor in accordance with Design Requirements' subject to review of the same by IE/MSRDC.

2. CODES AND STANDARDS

2.1 The codes and standards applicable for the design of the Project / Project Facilities are:

i) Indian Road Congress (IRC) Codes and Standards; and

ii) Ministry of Surface Transport (MORT& H) Specifications

Both as applicable to National Highways and shall include policy circulars, guidelines and special publications, issued in respect thereof by IRC or MORT& H, as the case may be, from time to time and shall incorporate all amendments and/or modifications to such codes and standards which are available to public 30 days before the Proposal Due Date.

For Ideal Road Builders Pvt Ltd.

Contractor

Director

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Competent Officer
2.2 Where the aforesaid are silent on any aspect, the following standards in order of preference shall be adopted in consultation with the Independent Engineer, unless otherwise specified in this Schedule:

(a) Bureau of Indian Standards (BIS)
(b) American Association of State Highway and Transport officials (AASHTO)
(c) Geometric Design Standards for Ontario Highways
(d) American Society of Testing Materials (ASTM)
(e) British Standards (BS)
(f) Suitable specification/standard devised by the Independent Engineer
(g) Any other standard proposed by the Contractor

2.3 MATERIALS AND SPECIFICATIONS

2.3.1 All materials and specifications shall be consistent with IRC/MORT&H specifications. Where these are silent, the standards in the same order of preference as in above Clause shall be used.

2.3.2 For items other than road and bridge works, where tailor made specifications are not available, the same shall be finalised in consultation with the Independent Engineer.

2.3.3 Any specifications and materials used shall be consistent with MORT&H specifications and other publications referred to therein.

2.3.4 Guidelines on Selection of the Grade of Bitumen and Use of Anti-stripping Agents for Bituminous Materials and Mixes are given in Appendix 4 and 5 of MORT&H Specifications shall be followed.

For Ideal Road Builders Pvt. Ltd.

Contractor

Director

Competent Officer
2.3.5 In addition to Road and bridge works, there will be other works, described hereinunder, on the Project Highway.

2.4 HIGHWAY LANDSCAPING

2.4.1 Planting along the highway shall follow a variety of schemes depending upon location requirement as per the IRC:SP:21-1979. The choice of trees to be planted shall also be made as per IRC:SP:21-1979: "Manual on Landscaping". Eucalyptus (all species) is not recommended for planting. Local indigenous species that grow in high salinity microclimate shall be planted.

2.4.2 On medians and as under-crop, planting of dust and gaseous substance-absorbing shrubs is recommended. To ensure survival from herbivorous animals, shrubs/plans containing latex shall only be planted.

2.4.3 Preparation of schemes for highway development, restriction on building lines, control lines, control of access, prevention of unauthorised occupation of land and removal of encroachment shall be as per IRC guidelines.

2.4.4 The treatment of the highway embankment slopes shall be as per the recommendations of IRC:56-1974, depending upon the soil types involved. Pitching works on the slopes shall be as per the MORT&H Specifications.

2.4.5 It shall be ensured that any sign, signal or any other device erected for traffic control, traffic guidance and/or traffic information shall not obscure any other traffic sign.

For Ideal Road Builders Pvt. Ltd.

Director

Contractor

Competent Officer
2.5 BUILDINGS

2.5.1 All building works shall be designed to meet the functional requirements and shall be compatible with the regional architecture and microclimate. Locally available materials shall be given preference but not at the cost of construction quality. All brick and stone masonry works shall be of first class type and as per good practice. All steel works shall conform to section 6, Part VI of the NBC and section 1900 and 2000 MORT&H specifications.

2.5.2 All building works shall conform to Maharashtra Public Works Department (PWD) specifications for class 1 building works and standards given in the National Building Code (NBC) as amended and/or modified from time to time. However, whenever any specific provision for any building works is given in the MORT&H specifications/IRIC standards those shall apply. For the purpose of this clause, building works shall be deemed to include road furniture, landscape elements or any other works incidental to the building works.

2.5.3 All the open spaces around the building(s) shall be landscaped. Boundary walls, fencing, controlled entry points and cattle catches at all entry and exit points to the buildings shall be provide to protect them from intruders and animals.

2.5.4 The design of water distribution and storage systems, laying of mains and pipes, cleaning and disinfecting of the water supply system shall be as per relevant clauses of section 1, Part IX of the NBC.

2.5.5 The design, layout and construction of drains for sewerage disposal system with all ancillary works such as connections, manholes and

For Ideal Road Builders Pvt. Ltd.

Contractor Director - 48 - Competent Officer
inspection chambers and septic tanks shall be as per relevant clauses of Section 2, Part IX of the NBC. Each septic tank, if provided, shall have a soak pit of adequate size. The location of the septic tanks and subsurface absorption system shall be as per clause 12.15.1 of part III of NBC.

2.5.6

The design and location of all electrical installations, distribution system, wiring, fittings, accessories and lighting protection of buildings shall be as per relevant clauses of Section 2, Part VIII of the NBC.

2.6

LIGHTING SYSTEM

2.6.1

The following codes shall be followed, while designing the lighting system on the Project Highway for toll plazas, mast lighting etc.

i) IS:1944 (Parts 1 and 11) – 1970

ii) IS:1944 (Part V) – 1981; and

iii) IS:1944 (Part VI – 1981)

The layout of the lighting system together with type of luminaries and level of illumination for different locations shall be determined in consultation with the Engineer.

2.6.2

Overhead electric power and telecommunication lines erected within the ROW by the Contractor shall be provided with adequate clearance so that safe use of road is not affected. Vertical and horizontal clearance shall conform to the IRC:32-1969.

2.7

TOLL PLAZA

For Ideal Road Builders Pvt. Ltd.

[Signature]

Director

Contractor

Competent Officer
2.7.1 Toll Plaza Complex

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.

2.7.2 The Toll Plaza complex including its canopy, having 5.5 m clear height covering 8 lanes with 5.5m wide extreme lane for oversized and non tollable 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.

2.7.3 The Toll Plaza Complex shall have its surface and sub surface drainage system.

2.7.4 Fire fighting equipment including smoke detectors and audio visual alarm system shall be planned and installed as per section 4.17.1 of NBC.

2.7.5 The pavement of all service lanes shall be bituminous/cement concrete and shall be designed as stipulated under pavement design. Pavement markings shall conform to the requirements.

2.7.6 Semi automatic toll collecting system shall be followed.

For Ideal Road Builders Pvt. Ltd.

[Signature]

Contractor

Director - 50 -

Competent Officer
2.8 TRAFFIC SAFETY MEASURES

2.8.1 Safety Barriers

- The safety barriers along the Highway shall be constructed as per specifications.
- The Safety Barrier shall conform to Circular IS:10748.

2.9 TRAFFIC CONTROL

2.9.1 Highway Signs

2.9.1.1 The road signs erected on Project Highway shall conform to IRC 67-1977, Code of Practice for road signs. Road signs such as Chevron, overhead etc. not covered by IRC 67 will be as per BIS/AASHTO/ASTM British Standard in that order.

2.9.1.2 All road signs shall be with retro-reflective sheet of prismatic grade with encapsulated lens fixed over aluminum substrate as per clause 801 MORT&H specifications.

2.9.1.3 The overhead signs shall be placed on a structurally sound gantry or cantilever structure made of circular/rectangular pipes. The said sign shall be of prismatic retro reflective sheeting. The height, lateral clearance and installation shall be as per the MORT&H Specifications.

2.10 PROJECT VEHICLES AND EQUIPMENT FOR OPERATION

2.10.1 All the vehicles used for activities pertaining to the highway operation shall conform to the Motor Vehicles Act 1988.

For Ideal Road Builders Pvt. Ltd.

[Signature]

Contractor

Director

Competent Officer
2.10.2 All the gadgets, equipment or any systems used for operation and maintenance of the highway shall be of standard make and shall conform to international standards.

2.11 ROAD FURNITURE AND FACILITIES ON ROADSIDE

2.11.1 Road furniture on the Project Highway provided as per IRC Codes shall meet requirements of MORT&H Specifications. Where any item is not covered by it, then its specification shall conform to BIS/AASHTO/ASTM/British standard in that order after approval by the Engineer.

2.12 PICK-UP BUS STOPS

2.12.1 The layout, design and location of the pickup bus stops shall be as per IRC:80-1981 and as per the drawing. Bus stops shall be provided on both sides of the road for either direction of traffic.

2.12.2 The bus stops layout shall provide safe entry and exit of buses from project highway and movement of passengers. The shelter structure to be provided by sponsors shall be structurally safe and functional so as to protect the waiting passengers adequately from sun, rain and wind. The covered structure shall be of steel pipes and with fiberglass roof. The seating and plinth of the structure shall be of coursed stone masonry. The bus bay area shall be provided with an effective drainage system.

2.12.3 The bus bays shall be paved properly with bituminous treatment as per crust proposed for main carriageway widening including the same renewal cycles.

For Road Builders Pvt. Ltd.

Contractor  

Director  

Competent Officer

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2.13 DESIGN STANDARDS

2.13.1 Design Standards comprise Ministry of Surface Transport, Roads Wing (MORT&H), policy circulars and IRC odes, guidelines and special publications applicable to National Highways. Where the said standards are silent on any item, the following standards in order of preference shall be adopted with the approval of the MSRDC.

i. Bureau of Indian Standards (BIS)
ii. American Association of State Highway and Transport Officials (AASHO)
iii. American Society of Testing Materials (ASTM)
iv. Any other National or International Standard suggested by the Contractor

2.13.2 Designs offered by the Contractor shall comply with the standards as spelt out above.

2.14 GEOMETRIC DESIGN STANDARDS

2.14.1 Geometric design standards shall be adopted as per IRC:73-1980 code as applicable to the National Highways. Main design criterion values are extracted there from.

2.15 GEOTECHNICAL DESIGN

2.15.1 Cut and fill slopes shall be appropriate to the nature of the material and the height or embankment or depth of cut. The slopes shall be safe against failure.

For Ideal Road Builders Pvt Ltd,

[Signature]

Director

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Material used in the fill and its compaction requirements shall conform to IRC – 36-1970. Where these specifications are in variance with the MORT&H specifications the latter shall govern and be followed.

2.16

PAVEMENT DESIGN

The strengthening of the existing 2 lane pavement and the pavement of the new lanes shall be designed keeping the following criteria in view for flexible and rigid pavement.

2.16.1

New flexible pavement shall be designed as per the IRC method. The pavement of service roads in urban section shall also be designed as per latest version of IRC-2001 (draft).

2.16.2

The new flexible pavement shall have Bituminous Concrete (BC) [also termed Asphalthic Concrete (AC)] wearing course over laid on Dense Bituminous Macadam (DBM). Underneath DBM a bituminous base course of Bituminous Macadam (BM) shall be provided. It will be overlaid on Wet Mix Macadam (WMM). The subbase granular material shall conform to the grading, density and other physical requirements stipulated in MORT&H Specifications and shall have a minimum CBR of 30% at 97% Maximum Dry Density (MDD). Material chosen for subgrade shall have CBR not less than 7% at 97% MDD.

2.16.3

Design of service roads in Urban Areas shall be covered by IRC 37:1984 (revised version) the ADB modified IRC design curves along with the suggested thickness combination of different payment layers known as MORT&H-ADB guidelines shall be used.
The same procedure shall be adopted for cross road improvement where applicable.

2.16.3 Strengthening of the existing 2-lane pavement shall be done with a bituminous overlay in accordance with the IRC-81-1997. Benkelman beam deflection tests shall be carried out on the Project Highway. The profile corrective course before laying the overlay layers shall be carried out with DBM/BM. The strengthening layers will comprise of Dense Bituminous Macadam (DBM) overlaid with Bituminous Concrete surfacing.

2.16.4 Cement Concrete pavement shall be designed based on IRC method for the axle load spectrum obtained by Contractor by axle load survey in the project area. The CC pavement shall be laid over dry lean concrete subbase over layers of WMM and GSB.

2.16.5 To ensure internal drainage of the pavement structure, the road subbase shall extend right across the paved shoulders on the embankment to the side drain.

2.16.6 Earthen shoulders shall be provided at the edge of paved shoulder. Paved shoulders shall have the same thickness as that of the carriageway pavement. The paved shoulder surface shall have the same wearing course as that of the carriageway pavement for monolithic construction.

2.16.7 Roughness Index of the pavement on completion shall not be more 2000 mm per km measured by 5th Wheel Bump Integrator or an equivalent device approved for monolithic construction.

For Ideal Road Builders Pvt Ltd.

Director

Contractor

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Competent Officer
2.16.8 The design basis for the design of flexible pavement i.e. strengthening overlays and new pavement and rigid pavement.

2.17 DRAINAGE SYSTEM

2.17.1 An effective surface and sub-surface drainage system of pavement structure shall be designed as stipulated in IRC SP:42 (1994).

2.17.2 An effective drainage system shall be planned and designed for the drainage of medians, toll plazas, bus-bays and other highway features ensuring that there shall be no pooling of water at any time on the highway.

2.17.3 Surface channels used to intercept and remove surface run off from the highway and the adjacent areas shall have adequate capacity for the design run off and should be located and shaped to avoid creating traffic hazard and erosion of soil.

2.17.4 There shall be no open drains in designated urban lengths of the Project Highway.

2.17.5 Profiles of channels and pipe runs shall be provided at crossings with services and utilities to ensure that conflicts do not occur.

2.18 DESIGN STANDARDS FOR CULVERTS, BRIDGES, UNDERPASSES, OVER BRIDGES

2.18.1 The design standards and loading to be considered for culverts, bridges, underpasses and overbridges shall be those laid down in the latest relevant IRC codes and/or IS codes. Where the codes

For Ideal Road Builders Pvt. Ltd.

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are found wanting or are silent other codes as stipulated shall be followed. The structural design standards are enclosed.

2.19 EXISTING CULVERTS, BRIDGES, UNDERPASSES, OVERBRIDGES

2.19.1 The unsafe and/or deficient bridge and culvert structures on the existing 2 lane carriageway shall be rehabilitated or replaced by sound structures to carry the IRC design loads.

2.19.2 Where the existing structures are retained and extended, the extension shall be properly adjusted and matched with the existing structure.

2.20 SPECIAL REQUIREMENT FOR CULVERTS AND BRIDGES

2.20.1 The major bridges shall be designed with footpath on shoulder side.

2.20.2 All bridge bearings shall be easily accessible for inspection and maintenance.

2.20.3 For box girder superstructure minimum clear depth inside the box shall be 1.8 m with suitable opening in the end cross girder for inspection of box in the entire length.

2.21 AT-GRADE INTERSECTIONS

2.21.1 At-grade intersections shall be designed according to IRC Special Publication 41 "Guidelines for the Design of at-grade intersections in Rural and Urban Area" and the MORT&H Type Designs for...
Intersections on National Highways, with modifications where required.

2.21.2 For the design of elements not covered in the said publications, the AASHTO publication "A Policy on the Geometric Design of Highways and Streets" shall be followed.

2.22 GRADE SEPARATED INTERSECTIONS

2.22.1 Design standards for elements of grade separated intersections are enclosed.

2.22.2 For elements not covered in the said Annexure, design Guidelines IEC-92-1986 supplemented by relevant MORT&H and the AASHTO publication "A Policy on Geometric Design of Highways and Streets" shall be used.

2.23 LIGHTING SYSTEM

2.23.1 The lighting system shall be provided in consultation with the Engineer in the areas of significant pedestrian movement in urban areas. High mast lighting shall be adopted for lighting of Toll Plaza.

2.23.2 The layout of masts, their height and spacing shall be fixed in consultation with the Engineer so that the minimum illumination level is achieved.

2.24 TOLL PLAZA

For Ideal Road Builders Pvt. Ltd.

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Competent Officer
2.24.1 The design of toll plaza shall be done in accordance with the guidelines given in Drawing. The design shall aim at optimising efficiency of toll collection and minimising vehicle delays.

2.24.2 Toll Collection System shall be mainly semi-automatic with one electronic lane on each side. There shall be a separate lane for traffic not required to pay fees. For each direction of traffic the toll plaza shall consist of:

- Three toll lanes each 3.20 m wide
- One 5.5 m lane for oversized vehicles and non-tollable vehicles
- A toll canopy covering all service lanes
- An office building with public telephone facility

2.24.3 The height of the canopy shall be such that a vertical clearance of 5.5 m is provided.

2.25 TRAFFIC SAFETY MEASURES

2.25.1 SAFETY BARRIERS

2.25.1.1 The layout of guardrails at footpaths of subways shall be as per the drawing.

2.25.1.2 Safety barriers shall be located at sharp horizontal curves with radius less than 450 m, high embankments and bridge approaches with height more than 5 m.

2.26 HIGHWAY SIGNS

For Ideal Road Builders Pvt. Ltd.

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2.26.1 The design and location of route marker signs for National Highways shall be as per the IRC:2-1968. The design and placement of highway kilometer stones, the dimensions of stones, size, colour, arrangement of letters shall be as per IRC:26-1967 and IRC:8-1980.

2.26.2 For the road signs the standards set in IRC 67-1977, Code of Practice for Road signs shall be followed. As regards, the overhead signs the standards prescribed by MORT&H shall be followed. Where these are silent, standards prescribed in BIS/AASHTO/ASTM/British Standards or any other international standard in that order shall be adopted.

2.27 PAVEMENT MARKINGS

Pavement markings shall be designed and provided in accordance with IRC: 35-1997 “Code of Practice for Road Markings” in consultation with the MSRDC.

2.28 LANDSCAPING

2.28.1 Trees shall be planted in rows and on either side of the road with staggered pitch as per the IRC:SP:21-1979. The pit size, fencing, watering and manure requirements shall also conform to the above standard. Planting shall be such that it does not obstruct the visibility of traffic from any side and shall be pleasing in appearance.

2.28.2 Shrubs in medians shall not normally exceed 1-1.5 m in height and shall be as per same guidelines.

For Ideal Road Builders Pvt. Ltd.

Contractor Director Competent Officer
2.28.3 Landscaping of important location shall be provided as per IRC the guide lines

2.28.4 For safe traffic operation vertical clearance between the crown of the carriageway and lowest part of the overhang of the tree available across the roadway shall conform to the standards set down in IRC:SP:21-1979.

2.29 SAFETY DURING PROJECT EXECUTION, OPERATION AND MAINTENANCE

2.29.1 The Contractor shall ensure complete safety of construction staff during the construction work of the Project Highway. It shall also ensure minimum interference to the flow of traffic during widening of the existing 2-lane pavement. The additional lanes shall be constructed first and the traffic diverted to it before improvements to the existing road are taken up. During construction the Contractor shall take all necessary measures for the safety of traffic by providing and maintaining barricades, traffic signs and illumination during night.

2.29.2 The Contractor shall also ensure complete safety of Road Users during the construction work of various nature.

2.29.3 Guidelines for safety measures during construction, operation and maintenance shall be followed.

2.29.4 A situation arising at site shall be carefully studied for solution.

For Ideal Road Builders Pvt. Ltd.

Director

Contractor

Competent Officer
3. GEOMETRICAL STANDARDS FOR ROAD WORKS

3.1 General Concept

The project road is an existing double-lane National Highway section that passes generally through in plain and rolling terrain. The highway also passes through villages/population centres and ribbon development along the roadside.

Considering the physical difficulties and high costs likely to be involved in the widening of the highway, it is considered desirable that the improvement proposals are conceived and developed under two sets of standards namely:

(i) the desirable standards which could be adopted as a rule
(ii) the minimum standards which could be accepted for difficult stretches where application of the desirable standards would lead to exorbitant costs.

Accordingly, design standards for geometric elements have been proposed under "desirable" and "minimum" categories. These proposed standards are consistent with and fall within the parameters recommended in the related standards of the Indian Roads Congress.

3.2 Terrain Classification

The following terrain classification recommended by IRC, is proposed to be adopted.

For Ideal Road Builders Pvt Ltd.

[Signature]

Director

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