

TECHNICAL SPECIFICATION

S-01: GENERAL

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ADDITIONAL SPECIFICATION - GENERAL**1.1 General:**

- 1.1.1 These Specifications contained herein shall be read in conjunction with other tender documents.
- 1.1.2 The Work shall be carried out in accordance with the "Good for Construction" drawings and designs as would be issued to the Contractor by the Engineer duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing Engineer's signature and stamp. Similarly, the Contractor shall not take cognizance of instructions given by any other authority except the instructions given by the Engineer in writing.
- 1.1.3 The work shall be executed and measured as per metric units given in the Schedule of Quantities, drawings etc. (FPS units where indicated are for guidance only) (Not applicable for Viaduct D&B Works).
- 1.1.4 Absence of terms such as providing, supplying, laying, installing, fixing etc. in the descriptions does not even remotely suggest that the Contractor is absolved of such providing, supplying etc. unless an explicit stipulation is made in this contract. The Employer / Owner shall bear no costs of materials, labour, equipment, duties, taxes, royalties etc.
- 1.1.5 The specifications may have been divided into different sections / sub-heads for convenience only. They do not restrict any cross-references. The Contractor shall take into account interrelations between various parts of works/trades. No claim shall be entertained on the basis of compartmental interpretations.
- 1.1.6 The classification of various items of works for purpose of measurements and payments shall be as per schedule of payment. Except where distinguished by BOQ, the rates apply to all heights, depths, sizes, shapes and locations. They also cater for all cuts and wastes. No floor wise separation shall be made for the rates. Likewise all heights of centering, shuttering, staging, formwork and scaffolding, launching trusses and other launching methods are covered by the rates including multi stage propping for heights greater than one floor as per drawings.
- 1.1.7 Reference to the Standard Codes of Practice:
The contractor shall make available at site all relevant Codes of practice as applicable.

Legend:

ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
BS	British Standard

CPWD	Central Public Works Department
DIN	Deutsches institute fur Normunge.V.
IRC	Indian Road Congress
IRS	Indian Railway Standards
IS	Indian Standards
JIS	Japanese Industrial Standard
MORTH	Ministry of Road Transport and Highways

1.1.8 Contractor to Provide:

The Contractor shall provide and maintain at site throughout the period of works the following at his own cost and without extra charge, Except for the items specified in the Bill of Quantities the cost being held to be included in the Contract Price.

1. General works such as setting out, site clearance before setting out and on completion of works. All weather approach roads to the site office should also be constructed and maintained in good condition.
2. All labour, materials, plant, equipment and temporary works, Overhead charges as well as general liabilities, obligations, insurance and risks arising out of GCC required for completing and maintaining the works to the satisfaction of the Engineer.
3. Adequate lighting for night work, and also whenever and wherever required by the Engineer.
4. Continuous and rigid temporary fences, barricades, guards, lights and protective work necessary for protection of workmen, supervisors, engineers, general public and any other persons permitted access to the site. Contractor shall provide proper signages as directed.
5. All fences, barricade shall be painted with colour shades / designs as specified by the Engineer. The barricading should be of adequate height to ensure visual obstruction of work from public view.
6. All equipment, instruments, labour and materials required by the Engineer for checking alignment, levels, slopes and evenness of surfaces measurements and quality etc.
7. Design mixes and testing them as per relevant clauses of specifications giving proportion of ingredients, sources of aggregates and binder along with accompanying trial mixes. Test results to be submitted to the Engineer for his approval before adoption on works.
8. Method Statements, for each main activity of the work (temporary and permanent) to be executed detailing the purpose, scope, resources required, sequence / procedure of execution, persons responsible, time frame, safety requirements & measures, risk analysis, Inspections, and Test Procedures along with standard values / acceptable criteria etc. duly approved by the Engineer before start of that particular activity at site.
9. Contractor shall also prepare / approve and make available to the Site Engineer the work procedure for each sub-activity to be done at the site, detailing the procedure / process to be followed including work sequence, safety measures, to be followed, level of quality to be maintained, type of material to be used, type of finishing required and responsibility assigned etc.
10. Cost of preparation and compliance with provision of a quality assurance control program.
11. Cost of safe guarding the environment.
12. Cost of safety measures and requirements of site safety plan.
13. A testing laboratory as specified by the Engineer equipped with the apparatus as mentioned in Employers requirement will be set up.

1.1.9 Quality Assurance & Quality Control:

- 1 The work shall conform to high standards of design and workmanship, shall be structurally sound and aesthetically pleasing. The Contractor shall conform to the Quality standards prescribed, which shall form the backbone for the Quality Assurance (QA) and Quality Control (QC) system.
- 2 At the site, the Contractor shall arrange the materials, their stacking/storage in appropriate manner to ensure the quality. The Contractor shall provide all the necessary equipment and qualified manpower to test the quality of materials, assemblies etc., as directed by the Engineer. The cost of all such testing shall be included in the quoted rates and nothing extra shall be paid for in this regard. The tests shall be conducted at specified intervals and the results of tests properly documented. In addition, the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of the surfaces.
- 3 The Engineer shall be free to carry out such tests as may be decided by him at his sole discretion, from time to time, in addition to those specified in this document. The Contractor may provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.
 - (a) The tests shall be conducted at the Site laboratory that may be established by the Contractor or at any other Standard Laboratory selected by the Engineer.
 - (b) The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of the Contractor failing to arrange transportation of the samples in proper time, the Engineer shall have them transported and recover two times the actual cost towards transportation and testing from the Contractor's bills.
 - (c) All testing shall be performed in the presence of Engineer. Testing may be witnessed by the Contractor or his authorized representative if permitted by the Test House. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.
 - (d) Cost of all such tests shall be borne by the Contractor and nothing extra shall be payable on this account
4. The Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, all equipment including the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and the Engineer's approval obtained prior to starting of the particular item of work. This shall however, not relieve the Contractor of his responsibilities. All materials which do not conform to these specifications shall be rejected and shall be removed from the site immediately. The Engineer shall have the powers to cause the Contractors to purchase and use materials from any particular source as may in the Engineer's opinion be necessary for the proper execution of work. Nothing extra shall be payable to the contractor on this account.

1.1.10 Dimensions:

- 1 Figured dimensions on drawings shall only be followed and drawings to a large scale shall take precedence over those to a smaller scale. Special dimensions or directions in the specifications shall supersede all others. All dimensions shall be checked on site prior to execution.
- 2 The dimensions where stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc.

- 3 The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or strata turning out different from what was expected or shown on the drawings.

1.1.11 **Setting out of Works:**

The Contractor shall set out the works indicated in the tender documents. The Contractor shall provide suitable stones with flat tops and build the same in concrete for temporary bench marks. All the pegs for setting out the Works and fixing the levels required for the execution thereof shall, if desired by the Engineer, likewise be built in masonry at such places and in such a manner as the Engineer may direct. The Contractor shall carefully protect and preserve all bench marks and other marks used in setting out the works. The contractor will make overall layout of complete work and get it checked from engineer. The cost of all operations of setting out including construction of bench marks is deemed to be included in the contract price.

All the survey work except levelling work shall be carried out using total stations with one second accuracy. The levelling work shall be carried out using Auto level.

The triangulation points given by the Client before start of work shall be maintained during execution and handed over back to the Client after completion of work.

1.1.12 **Materials:**

1. Source of Materials:

It shall be the responsibility of the contractor to procure all the materials required for construction and completion of the contract. The contractor shall indicate in writing, the source of materials well in advance to the Engineer, after the award of the work and before commencing the work. If the material from any source is found to be unacceptable at any time, it shall be rejected by the Engineer and the contractor shall forthwith remove the material immediately from the site as directed by the Engineer.

2. Quality:

All materials used in the works shall be of the best quality of their respective kinds as specified herein, obtained from sources and suppliers approved by the Engineer and shall comply strictly with the tests prescribed hereafter, or where tests are not laid down in the specifications, with the requirements of the latest issues of the relevant Indian Standards.

3. Sampling and Testing:

All materials used in the works shall be subjected to inspection and test in addition to manufacturer's test certificates. Samples of all materials proposed to be employed in the permanent works shall be submitted to the Engineer at least 45 days in advance for approval before they are brought to the site.

Samples provided to the Engineer for their retention are to be labelled in boxes suitable for storage. Materials or workmanship not corresponding in character and quality with approved samples will be rejected by the Engineer.

Samples required for approval and testing must be supplied sufficiently in advance in required quantity and number to allow for testing and approval, due allowance being made for the fact that if the first samples are rejected further samples may be required. Delay to the works arising from the late submission of samples will not be acceptable as a reason for delay in completion of the works.

Materials shall be tested before leaving the manufacturer's premises, quarry or resource, wherever possible. Materials shall also be tested on the site and they may be rejected if not found suitable or in accordance with the specifications, notwithstanding the results of the tests at the manufacturer's works or elsewhere or test certificates or any approval given earlier.

The contractor will bear all expenses for sampling and testing, whether at the manufacturer's premises at source, or at site or at any testing laboratory or institution as directed by the Engineer. No extra payment shall be made on this account.

4. Dispatch of materials:

Materials shall not be dispatched from the manufacturer's works to the site without written authority from the Engineer.

5. Test certificates:

All manufacturer's certificates of test, proof sheets, etc. showing that the materials have been tested in accordance with the requirement of this specification and of the appropriate Indian Standard are to be supplied free of charge on request to the Engineer.

6. Rejection:

Any materials that have not been found to conform to the specifications will be rejected forthwith and shall be removed from the site by the Contractor at his own cost within two weeks or as instructed by the Engineer.

7. The Engineer shall have power to cause the Contractors to purchase and use such materials from any particular source, as may in his opinion be necessary for the proper execution of the work.

1.1.13 **Storing of Materials at site:**

All materials used in the works shall be stored on racks, supports, in bins, under cover etc. as appropriate to prevent deterioration or damage from any cause whatsoever to the entire satisfaction of the Engineer.

The storage of materials shall be in accordance with IS 4082 "Recommendation on stacking and storage of construction materials on site" and as per IS 7969 "Safety code for handling and storage of building materials".

The materials shall be stored in a proper manner at places at site approved by the Engineer. Should the place where material is stored by the Contractor be required by the Employer for any other purpose, the Contractor shall forthwith remove the material from that place at his own cost and clear the place for the use of the Employer.

1.1.14 **Water:**

1. Water from approved source:

Potable water only shall be used for the works. Contractor shall have his own source of water duly approved by Engineer. The water shall be free from any deleterious matter in solution or in suspension and be obtained from an approved source. The quality of water shall conform to IS 456.

2. Storage:

The Contractor shall make his own arrangements for storing water, if necessary, in drums or tanks or cisterns, to the approval of the Engineer. Care shall be exercised to see that water is not contaminated in any way.

3. Testing:

Before starting any concreting work and wherever the source of water changes, the water shall be tested for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of arranging, storing and testing of water shall be deemed to be included in the quoted rates in the Bill of Quantities and nothing extra shall be payable in this regard.

1.1.15 **Workmanship:**

1. All works shall be true to level, plumb and square and the corners, edges and arises in all cases shall be unbroken and neat.
2. Any work not to the satisfaction of the Engineer or his representative will be rejected and the same shall be rectified or removed and replaced with work of the required standard of workmanship at no extra cost.

1.1.16 **Load Testing on Completed Structures**

1.1.16.1 During the period of construction or within the defect liability period the Engineer may at his discretion order the load testing of any completed structure or any part thereof if he has reasonable doubts about the adequacy of the strength of such structure for any of the following reasons:

- a) Results of compressive strength on concrete test cubes falling below the specified strength.
- b) Premature removal of formwork.
- c) Inadequate curing of concrete.
- d) Over loading during the construction of the structure or part thereof.
- e) Carrying out concreting of any portion without prior approval of the Engineer.
- f) Honey combed or damaged concrete which in the opinion of the Engineer is particularly weak and will affect the stability of the structure to carry the design load, more so in important or critical areas of the structure.
- g) Any other circumstances attributable to alleged negligence of the contractor which in the opinion of the Engineer may result in the structure or any part thereof being of less than the expected strength.

1.1.16.2 All the load tests shall be carried out by the contractor strictly in accordance with the instructions of the Engineer, as per IRS: CBC-2014 Clause 18 and IRC: SP-51, as indicated in the Bill of Quantities and as indicated hereunder. Such tests shall be carried out only after expiry of minimum 28 days from day of casting or such longer period as directed by the Engineer.

1.1.16.3 Deleted.

1.1.16.4 In such cases the portion of the work concerned shall be taken down or cut out and reconstructed to comply with the specifications. Other remedial measures may be taken to make the structure secure at the discretion of the Engineer. However such remedial measures shall be carried out to the complete satisfaction of the Engineer.

1.1.16.5 All costs involved in carrying out the tests (unless and until mentioned otherwise in these specification) and other incidental expenses thereto shall be borne by the contractor regardless of the result of the tests. The contractor shall take down or cut out and reconstruct the defective work or shall make the remedial measures instructed at his own cost. If the load testing is instructed on any ground other than mentioned in a) to g) of 1.1.16.1, then the cost of the same shall be reimbursed if the result of the test are found to be satisfactory.

The load testing of spans / piles etc. shall be done using certified and calibrated dial gauges only. Use of levelling instruments for measuring deflections shall not be allowed.

- 1.1.16.6 In addition to the above load tests, non-destructive test methods such as pile integrity test, and ultrasonic pulse velocity test shall be carried out by the contractor at his own expense if so desired by the Engineer. Such tests shall be carried out by an agency approved by the Engineer and shall be done using only recommended testing equipment. The acceptance criteria for these tests shall be as specified by the testing agency or good engineering practices in accordance with the relevant codal provisions and as approved by the Engineer.

1.1. Structural Work:

- 1.2.1 Unless specified, only controlled concrete with design mix and weigh batching is to be used for the work.
- 1.2.2 Minimum cement content specified in CPWD specification is purely from durability point of view. Larger content of cement shall have to be provided if demanded by mix design.
- 1.2.3 Provision of cement slurry to create bond between plain / reinforced concrete surface and subsequent applied finishes shall not be paid extra.
- 1.2.4 Mix design using smaller aggregates of 10mm down size shall also be done in advance for the use in the junctions having congested reinforcement.
- 1.2.5 Procedure of mixing the admixtures shall be strictly as per the manufacturer's recommendations if not otherwise directed by the Engineer.
- 1.2.6 All the water tanks and other liquid retaining concrete structures shall undergo hydro testing.
- 1.2.7 Special benches shall be provided at site for stacking reinforcement bars of different sizes.
- 1.2.8 Formwork for beams of RCC areas shall be designed in such a way that the formwork of the adjacent slabs can be removed without disturbing the props / supports of the beams.
- 1.2.9 Wherever there are tension / suspended concrete members which are suspended from upper level structural members, the shuttering / scaffolding of such members at lower level shall have to be kept in place till the time the upper level supporting members gain minimum required strength. Cost of such larger duration of keeping in place the shuttering/scaffolding shall be deemed to be included in the price quoted for respective structural members.
- 1.2.10 Formwork is required for full height at all locations. Special precaution for such tall formwork shall be taken to ensure its safety. Extra costs for such formwork shall be deemed to have been included in the price quoted against relevant items.
- 1.2.11 During the mobilization period, the contractor shall carry out expeditiously and without delay the following works:
- a. Material testing and mix designs of various grades of concrete as contemplated in the specifications.
 - b. Setting up of full-fledged site laboratory as per the requirements of these specifications.
 - c. Any other pre-requisite items required for final execution.

- d. Site office for the use of the Engineer staff.
 - e. Casting yard with full facilities.
 - f. Setting up concrete batching and mixing plant.
 - g. Any other prerequisite items required for final execution.
- 1.2.12 Casting yard to have following minimum facilities.
- a. Casting beds as required.
 - b. Sets of form work /moulds as required.
 - c. All handling facilities for precast elements.
 - d. Curing arrangements as required.
 - e. Stacking arrangements for precast elements.
 - f. Storing of materials.
 - g. Segments shall be stacked with Three-Point support in stacking yard, Two tier stacking of girders is acceptable in Pre-cast yard subject to the satisfaction of Engineer-in-Charge.
 - h. Proper drainage and approach roads.

1.2. Supply of Progress photographs and albums:

The work covers the supply of colour photographs, negatives and albums to serve as a permanent record of various stages/facets of work needed for an authentic documentation as approved by the Engineer.

The photographs shall be of acceptable quality and they shall be taken by a professionally competent photographer with camera having the facility to record the date of the photographs taken in the prints and the negative. Each photograph in the album shall be suitably captioned and dated.

The photographs and materials including negatives/softcopies shall form a part of the records of BSRP and prints of the same cannot be supplied to anybody else or published without the written permission of the client.

1.3. Supply of Video CDs:

The work consists of taking video films of important activities of the works as directed by the Engineer during the currency of the Project and editing them to a video film of playing time not less than 60 minutes. It shall contain narration of the activities in English by a competent narrator. The edition of the film and script of the narration shall be approved by the Engineer.

1.4. Survey Work:

The said work involves at the very start of work taking-over of reference point from the Engineer, establishment of control points, triangulation points, bench marks, grid layout for all the piers and other structures maintaining horizontal and vertical control within the permissible limits, incorporating changes (if any), submission of full data in the tabulation form and survey drawings including setting and layout of various works during the progress of work and matching of the station area track alignment with the alignment of the approaches at station ends and incorporating the changes (if any).

1.5. Barricading

The work includes/covers barricading for the work to be carried out along the median and areas affecting road traffic. Barricading for the areas like casting yard, batching plant, storage and similar working area shall be done at own cost by the contractor. Other barricading along the median and areas affecting road traffic will be paid as schedule A (General Works) of BoQ. The detailed scope of work is as follows:

- i. Providing and installing the barricades of the design and type as shown in the typical sketch furnished as per the approved plan firmly to the ground and maintaining it during the progress of work.
- ii. It is the primary responsibility of the contractor to ensure sufficient illumination (e.g.: rope lights etc.) along the barrication line to guide the road traffic. Any shortfall in this regard shall attract a penalty of ` 5000/- per instance or as decided by the Engineer-in-Charge.
- iii. In case of EOT granted to the contractor for any reason whatsoever, no additional compensation shall be paid to the contractor.
- iv. Dismantling of barricading and other temporary installations from the site and cleaning the site as per direction of Engineer upon completion and acceptance of work. The barricading boards shall be the property of the contractor upon completion of the work.
- v. 50 % of the barrication boards shall be painted and the remaining 50% shall be filmed as per the approved scheme and methodology. Repainting and re-filming of the same shall be ensured without fail at a regular interval of every six months. Nothing extra shall be paid in this regard.
- vi. To facilitate certain category (ies) of construction activities, it may be necessary to temporarily remove the barricades from a particular location and reinstall the same at the same location. No additional payment shall be made or can be claimed on account of such reinstatement(s). However permanent removal of barrication boards from any location shall be permitted only just prior to road restoration.

Tentative Road Safety Devices

Brief Description

No.

1. Supply of Red portable heavy duty traffic cones of 750 mm height with white reflective tape bands on min. 100 mm width all around.
2. Hazard warning light flasher with rechargeable, maintenance free battery & charging system.
3. Safety light island post with 11 nos. parallel reflector.
4. Red reflective arrow fitted on enamelled mild steel board of 360 x 220 mm size.
5. Traffic Triangular Tripod made of fluorescent cloth fitted on steel frame.
6. Retro-reflective tape (I) 50 mm width.
7. Fluorescent Jackets with reflective tape all around.
8. Yellow reflective cat eyes of size 115 x 11 x 22 mm made of ABS material having 19 glass beads on each side.
9. Metal Tubular Delineator of 610 mm height with reflective tapes.
10. Retro-reflective arrows diversion board 450 x 900 mm with crystal clear protective transparent coat to avoid damage on 14 gauge Mild Steel sheet with and without pole.
11. Retro-reflective "Men at work" triangular board of size 900 mm with crystal protective transparent coat to avoid damage on 14 gauge Mild steel board with and without poles.
12. Retro-reflective board for "Go Slow Work in progress" of size 1200 x 750 mm with crystal clear protective transparent coat to avoid damages to the Mild Steel sheets with and without pole.
13. Retro-reflective advance direction sign cum diversion boards of size 1200 x 900 mm with crystal clear protective transparent coat to avoid damage to the 14-gauge mild steel sheet with and without pole.
14. Retro-reflective speed limit circular sign boards of 600 mm diameter with crystal clear protective transparent coat to avoid damage to the 14-gauge mild steel sheet (without pole).
15. 'SORRY FOR INCONVENIENCE' Retro-reflective boards of size 900 x 300 mm size with crystal clear protective transparent coat to avoid damage to the 14 gauge Mild Steel Sheet (without pole).

16. HAZARD MARKERS (Yellow & Black) must be put all over the construction site. This Retro- reflective board is of size 300 x 900 mm with crystal clear protective transparent coat to avoid damage to the 14 gauge mild steel sheet with or without pole.
17. 'CAUTION' tape which is normally yellow tape of special polythene material having 75 mm width 'CAUTION' written all over with black colour in rolls of 300 meter.

Measurement

The barricading including all the required safety devices as listed under the above table shall be measured as per relevant item in BOQ.. Payment shall be deducted for the period during which the barricading and arrangements for traffic diversion are not satisfactory to the Engineer.

1.6. DELETED

1.7. Finishing Work:

- 1.8.1 The Contractor shall incorporate seismic considerations of anchoring and isolation in the design and detailing of the finishes as directed by the Engineer. The element to be anchored shall have its motion suitably restrained whilst at the same time it shall be suitably isolated so as not to be affected by the deformations/ vibrations of the building during Construction.

- 1.8.2 Sub-Contractor:

Works as listed below and those dealing with proprietary materials/ products may be carried out by the Contractor through the Sub-Contractors as may be approved by the Engineer in writing. The Sub-Contractors must be firms of repute and long standing, having adequate experience and complete facilities to carry out all items of work required for completion as per Specifications and expected quality to the satisfaction of the Engineer. The Sub- Contractor must also have personnel experienced in preparing shop drawings. All such works shall be carried out under the direct supervision of the manufacturers of the proprietary materials/ products or their trained and accredited licensee.

- (a) Waterproofing
- (b) Caulking & Sealants
- (c) Seismic Joints
- (d) Expansion joints
- (e) Application of Silicone water repellent solution where specified.
- (f) Bearings
- (g) Structural Glazing/cladding
- (h) Landscaping
- (i) Roof sheeting

- 1.8.3 Guarantees and Building Maintenance for Finishes:

The Contractor shall guarantee and undertake to maintain and rectify the various components of the Civil Works for their successful performance for the periods as specified below. The Contractor shall indemnify the Engineer for a similar period against any damage to property and injury to persons on account of any defective work or maintenance carried out by the Contractor. The format and text of the Guarantee and the Indemnity Bond shall be as followed in CPWD or as approved by the Engineer.

- a. External/Internal cladding of Stone, Marble and Granite shall be guaranteed for 5 years.

- b. All Fire Rated Door sets shall be guaranteed to remain integral and absolutely stable in the event of a fire. All moving parts of the Fire Rated Door sets shall be guaranteed to give trouble free service for 5 years and the finish shall be guaranteed to last for at least 5 years.
 - c. Waterproofing for basements (which include raft, retaining walls, and expansion/ separation joints in retaining walls) and roofs shall be guaranteed for 10 years. The waterproofing shall include all allied works on the roof such as concrete screed and the China Mosaic roof finish/ stone cladding on the parapet between which the waterproofing treatment shall be sandwiched.
 - d. Waterproofing for the other areas such as toilets, kitchens, chhajjas etc. shall be guaranteed for 10 years. The waterproofing shall include all allied works on the slab etc. such as concrete/ mortar screeding, if any, floor finish between which the waterproofing treatment shall be sandwiched.
 - e. The manufacturer / Supplier / fabricator/ contractor of the roofing system shall give a guarantee for 15 years with regarding to its composition, surface and tensile strength.
- 1.8.4 Responsibility for Shop drawings, Samples and Mock-ups:
Approval of shop drawings, samples and mock-ups for the various components shall not absolve the Contractor of his responsibility of completing the work to the specifications, standards, tests for performance and guarantees given in these documents and to a quality of finish as desired by the Engineer.
- 1.8.5 Cleaning:
Surfaces on which finishes are to be provided shall be cleaned with water jets or oil free compressed air or power tools with wire brushes and detergents all as approved by the Engineer.
- 1.8.6 **Expansion bolts/fasteners:**
- 1. Unless specified otherwise all expansion bolts/ fasteners shall be fabricated from austenitic stainless steel sheet, strip or plate conforming to ASTM A 240 Gr 304 or bar to ASTM A 479 Gr 304 of approved make and design. The material of the bolt shall not cause any bimetallic corrosion with the reinforcing bars of the RCC/ brickwork or with any other fixings or doors or windows or skylights etc.
 - 2. For steel backings the fasteners shall be prevented from contact with other metals, which would lead to bimetallic corrosion.
 - 3. For brick masonry backing the sleeves of the expansion bolts shall be fixed in wedge shaped pockets having an area of 75mm x 75mm at the surface and 100mm x 100mm at the inner surface and shall be 125mm deep. The wedge could also be as a truncated cone of 75mm dia/ 100mm dia. The dimensions shall be reviewed by the Engineer during execution of the work. The wedge shall be filled with PCC 1:1:2 (1 Cement, 1 Sand and 2 Coarse Aggregate) mixed with non-Shrink Compound in the proportion as recommended by the manufacturer.
 - 4. The holes drilled for the expansion fasteners shall be cleaned of all ground material, dust etc. before inserting the expansion sleeves.
 - 5. All expansion bolts fixed into soffits shall be bonded to the backing with epoxy/ polyester resin of approved make.
 - 6. All expansion bolt fixings shall be tightened in accordance with the recommended torque figures by the manufacturer. Where such values are not available the Contractor shall test at least 6 samples to determine the safe torque values. All bolts shall be tightened using torque spanner/ wrenches. All bolts shall be checked 24 hours (minimum) after installation and retightened if necessary.
- 1.8.7 No walls, terraces shall be cut for making any opening after water proofing has been done without written approval of the Engineer. Cutting of waterproofing when authorised by the Engineer in writing shall be done very carefully so that no other portion of the waterproofing is damaged. On completion of the work at such places, the water proofing membrane shall be made good and ensured that the opening / cutting is made fully

water proof as per specifications and details of water proofing approved by the Engineer at no extra cost. No structural member shall be cut or chased without the written permission of the Engineer.

- 1.8.8 Provision of grooves in plaster, drip courses etc., if directed, at junction of walls-ceilings, columns-walls, frames-plaster and such other generally typical locations shall not be paid extra, including grooves in concrete, masonry, stonework. **Painting of concrete surfaces.**
- 1.8.9 All exposed concrete surfaces, either bare or plastered visible to the common public shall be provided with epoxy paint of approved colour as per relevant IS and IRS codes specification except for the surfaces which are provided with cladding material.

Applicable Codes, Standards & Publications for Structural Work:

The more important Codes, Standards and Publications to Contract are listed here under:

A General

IS: 875 (Part 1 to 5) Code of practice for design loads (other than earthquake) for buildings and structures.

IS: 1893 Criteria for earthquake resistant design of structures

SP-7 National Building Code of India

SP-23 (S&T) Hand Book on Concrete Mixes

B Bitumen

IS :702 Industrial Bitumen Specification for bitumen primer for use in waterproofing and damp-proofing.

C Building Construction Practices

IS:1838 Part I & II Specifications for preformed fillers for expansion joint in concrete pavements and structures.

IS: 1964 Code of Practice for use of fixing devices in walls, ceilings, and Floors of solid construction.

IS: 3414 Code of Practice for Design and installation of joints in buildings.

IS: 6509 Code of Practice for installation of joints in concrete

IS: 11134 Pavements. Code of Practice for setting out of buildings.

IS: 11133 Parts I and II. Specifications for one part Gun grade polysulphide based joint sealant.

IS: 12200 Code of Practice for provision of water stops at transverse contraction joints in masonry and concrete dams.

D Cement

IS: 455 Portland Slag Cement

IS: 650 Specification for standard sand for testing cement.

IS: 6925	Me Methods of test for determination of water soluble chlorides in concrete admixtures.
IS: 8042	White Portland Cement.
IS: 8112	Specification for 43 grade ordinary Portland cement.
IS: 12269	Specification for 53 grade ordinary Portland cement.
IS: 12330	Specification for sulphate resistant Portland cement.
IS: T 40	Indian Railways standard specifications for special grade cement for use in concrete sleepers.

E Concrete

IS: 456	Code of practice for plain and reinforced concrete.
IS: 457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
IS: 460 (Part I to II i)	Specification for Test Sieves.
IS: 516	Methods of test for strength of concrete.
IS: 1199	Methods of sampling & analysis of concrete.
IS: 1200	Method of measurement of building and civil engineering.
IS: 1343	Code of practice for prestressed concrete.
IS: 1607	Method of Test Sieving.
IS: 2386 part I-VIII	Methods of tests for aggregates for concrete.
IS: 2430	Methods of Sampling of Aggregates of Concrete.
IS: 2438	Specification for roller pan mixer.
IS: 2514	Specification for concrete vibrating tables.
IS: 2571	Code of practice for laying in-situ cement concrete flooring.
IS: 2645	Specification for integral cement water proofing compounds.
IS: 2722	Specification for portable swing batchers for concrete (double bucket type).
IS: 2770	Method of testing bond in reinforced concrete part I pull out test.
IS: 3025	Methods of sampling and test (physical and chemical) for water & waste water.
IS: 3935	Code of practice for composite construction.
IS: 4326	Code of practice for earthquake resistant construction of building.
IS: 6925	Methods of tests for determination of water soluble chlorides in concrete admixtures.
IS: 7242	Specification for concrete spreaders.
IS: 7251	Specification for concrete finishers.
IS: 7861 parts I & II	Code of practice for extreme weather concreting.
IS: 7969	Safety code for handling and storage of building materials.
IS: 8989	Safety code for erection of concrete framed structures.
IS: 8142	Methods of tests for determining setting time of concrete by penetration resistance.
IS: 9103	Specification for admixtures for concrete.
IS: 9013	Method of making, curing and determining compressive strengths of accelerated cured concrete test specimens.
IS: 9284	Method of test for abrasion resistance of concrete.
IS: 10262	Recommended guidelines for concrete mix design.

MORTH	Specifications for Road and Bridge Works, Ministry of Road Transport and Highways (Roads Wing).
IRS	Concrete Bridge Code Standard Specification and Code of Practice for Road Bridges Section III Cement Concrete (Plain & Reinforced (First Revision)).

F Construction Plant and Machinery

IS: 1791	Specification for batch type concrete mixers.
IS: 2505	General requirements for concrete vibrators: Immersion type.
IS: 2506	General Requirements for screed boards concrete vibrators.
IS: 3366	Specification for pan vibrators.
IS: 2558	Code of Practice for use of immersion vibrators for consolidating concrete.
IS: 4656	Specifications for form vibrators for concrete.
IS: 4925	Specification for concrete batching and mixing plant.
IS: 11993	Code of Practice for use of screed board concrete vibrators.

G Formwork

IS: 4990	Specification for plywood for concrete shuttering work.
IS: 87	Guidelines for the design and erection of false work for Road bridge.
IS: 806	Code of Practice for use of steel tubes in general building construction.
IS: 1161	Specification of steel tubes for structural purpose.
IS: 1239	Specification for mild steel tubes, tubular and other wrought steel fittings.

H Gypsum and Gypsum Board**I Handling and Storage**

IS: 4082	Recommendation of slacking and storage of construction materials.
IS: 8348	Code of Practice for stacking and packing of stone slabs for transportation.

J Instruments for Testing cement and Concrete

IS: 5513	Specification for Vicat Apparatus.
IS: 5514	Specification for apparatus used in Le-Chatelier.
IS: 5515	Specification for compaction factor apparatus.
IS: 5320	Specification for concrete slump test apparatus.
IS: 7325	Specification for apparatus to determine constituents of fresh concrete.
IS: 10080	Specification for vibration machine.
IS: 10086	Specification for moulds for use in tests of cement and concrete.
IS: 10510	Specification for Vee-bee consistometer.

K Joint Fillers

IS: 1838 (part 1)	Preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type): Bitumen impregnated fib.
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L Paints and Coatings

IS: 2074	Ready mixed paint. Air drying, red oxide-zinc chrome, priming.
BS:EN:10152	Specification for electrolytically zinc coated cold rolled steel flat products. Technical delivery conditions.

Astma 164-71	Specification for electrodeposited coatings of zinc on steel.
M Pigments for Cement	
BS: 1014	Specification for pigments for Portland cement and Portland cement products.
N Reinforcement & Structural Steel	
IS: 206	Code of Practice for use of Steel Tubes in General Building Construction
IS: 210	Grey Iron Castings
IS: 280	Mild steel wire for general engineering purposes
IS: 432	Part I. Mild steel and medium tensile steel bars. Part II Hard drawn steel wire.
IS: 451	Technical Supply conditions for Wood Screws
IS: 806	Code of practice for use of steel tubes in general building construction IS:815 Classification coding of covered electrodes for metal arc welding of structural steels
IS: 1239	Specification for mild steel tubes, tubulars and other wroughtsteel fittings
IS: 1363	Black hexagon bolts, nuts and lock nuts and black hexagon screws.
IS: 1365	Slotted countersunk screws.
IS: 1566	(Part-I) Specifications for hard-drawn steel wire fabric for concrete reinforcement.
IS: 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS: 2502	Code of Practice for bending and fixing of bars for concrete reinforcement.
IS: 2629	Recommended practice for hot-dip galvanising of iron and steel.
IS: 2751	Code of Practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
IS: 4759	Hot-dip zinc coating on structural steel and other allied products.
IS: 9417	Recommendations for detailing of reinforcement in reinforced concrete works
IS: 14268	Recommendations for welding cold-worked steel bars for reinforced concrete construction.
IS: 14268	Uncoated stress relieved low relaxation steel class 2 for Prestressed concrete
IS: 226	Structural steel (Standard Quality)
IS: 800	Code of practice for use of structural steel in general building construction.
IS: 813	Scheme of symbols for welding.
IS: 814	Covered electrodes for metal arc welding of structural Steel. (Part I & Part II)

IS: 816	Code of practice for use of metal arc welding for general construction in mild steel.
IS. 822	Code of practice for inspection of welds.
IS: 961	Structural steel (High Tensile)
IS: 1024	Code of practice for use of welding in bridges and structures subject to dynamic loading.
IS: 1030	Carbon steel casting for General Engineering Purposes
IS: 1120	Coach Screws
IS: 1367	Technical Supply Conditions for Threaded Fasteners
IS: 1161	Steel tubes for structural purposes.
IS: 1182	Recommended practice for radiographic examination of fusion welded butt joints in steel plates.
IS: 1915	Code of Practice for Steel Bridges
IS: 2016	Plain Washers
IS: 2062	Structural steel (Fusion welding quality)
IS: 3063	Single Coil Rectangular Section Sprint Washers for Nuts, Bolts and Screws
IS: 3443	Crane Rail Sections
IS: 3757	Specification for high tensile friction grip bolts.
IS: 3600	Code of practice for testing of fusion welded (Part I) joints And weld metal in steel.
IS: 5624	Specification for foundation bolts.
IS: 4923	Hollow steel sections for structural use.
IS: 6227	Code of practice for use of metal arc welding in tubular structure.
IS: 801	Code of practice for use of cold formed light gauge steel structural members' in general building construction.
IS: 811	Specifications for cold formed light gauge structural steel sections.
IS: 8500	Structural Steel Micro alloyed (Medium and high strength qualities) .
IS: 8910	General requirements of supply of weldable structural steel.
IS.: 9595	Recommendations for metal arc welding of carbon & carbon-Manganese steels.

O Sand

IS:383	Coarse and fine aggregates from natural sources for concrete.
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P Sand

IS.2750	Specification for steel scaffoldings
IS:3696 (Part 1)	Safety Code of scaffolds and ladders: Scaffolds
IS:3696 (Part 2)	Safety Code of scaffolds and ladders: Ladders
IS:4014 (Part 1)	Code of practice for steel tubular scaffolding: Definition and materials IS:4014
(Part 2)	Code of practice for steel tubular scaffolding: Safety regulations for Scaffolding

IRC:87	Guidelines for the design and erection of false work for road bridges
Q Sealants	
IS:10959	Glossary of terms for sealants for building purposes
IS:11433 (Part 1)	One part grade polysulphide base joint sealant: General requirements
IS:11433 Part 2)	One part grade polysulphide base joint sealant: Methods
IS: 13055	Methods of sampling and test for anaerobic adhesives and sealants
BS:5889	Specification for one part gun grade silicone-based sealant
R Wood	
IS:303	Plywood for General Purposes.
S Bearing	
IRC:83 Part-II	Standard specifications and code of practice for road bridges Elastomeric Bearings
IRC:83 Part-III	Standard specifications and code of practice for road bridges Pot Bearings
T Piling	
IS: 2911 PART-IRC:78	Bored Cast in-situ Concrete Piles
IRC:78	Standard specifications and code of practice for road bridges Foundation and Substructure.
U All Indian Railway Standards Metal	
V Metal	
	Specifications
	ASTM B 221 Specification for aluminium-alloy extruded bars, rods, wires, shapes, and tubes.
W Glazing	
X Stone and Facing/Linings	
Y	
IS: 9077	Code of practice for corrosion protection of steel reinforcement in reinforced brick work and RCC constructions.
U Stone and Facings/ Linings	
V All Indian Railway Standards Metal	
T PILING	
IS: 2911 PART-IRC:78	Bored Cast in-situ Concrete Piles
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