

**S.17: ADDITIONAL SPECIFICATION FOR  
STEEL BRIDGE GIRDER ERECTION****17. STEEL BRIDGE GIRDER ERECTION**

(Fabrication and erection as per RDSO guidelines to be incorporated)

**17.1 STRUCTURAL STEEL ERECTION WORK - GENERAL****17.1.1 Scope of Specification**

This specification covers the scope of work for structural steel erection works, submittals by the Contractor, applicable codes of practice and the specifications for the materials to be used, including steel, bolts and nuts, washers etc. and the storage thereof.

**17.1.2 Scope of Work**

The scope of work for the contractor in respect of structural steel erection work shall cover, but shall not be limited to the following:

Preparation of complete erection sequence drawing based on the suggested erection scheme(s) as proposed by contractor, required for all the permanent and temporary structures including launching nose / truss.

Submission by the contractor, for examination by the Engineer, detailed particulars of the proposed method of erection of the superstructure steelwork, together with complete calculations relating to strength and deflection. If the erection scheme necessitates the strengthening of the permanent steel work, the contractor shall submit, for approval of the Engineer, the methods he proposes for making good the permanent steelwork after removing the temporary work. The contractor shall also submit the design and fabrication drawings incl. detailed calculations of launching nose I truss, counter weight, all temporary supports, staging, bracings etc. required for safe erection, for approval of the Engineer.

Providing all construction and transport equipment, tools, tackle and consumables, materials, labour and supervision required for the erection of the structural steelwork.

Receiving, unloading, checking and moving to storage yard I storage, guarding and upkeep of fabricated steelwork and other consumable materials and fasteners at site.

Compiling and furnishing detailed bill of materials of fabricated parts received from the fabricator.

Loading, Transportation and unloading of all fabricated structural steel materials from storage yard to erection site, handling, assembling, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location, according to approved erection drawings and I or as directed by the Engineer.

Setting out, aligning, keeping in plumb, bolting, welding and securely fixing the fabricated steel structures in accordance with the erection scheme, or as directed by the Engineer.

Requisite, site planning to all fabricated steelwork, as per requirements of related specification of the painting.

Carrying out all major modifications of the fabricated steel structures, as directed by the Engineer, including but not limited to the following:

- (a) Removal of bends, kinks, twists etc. for parts damaged during transport and handling.
- (b) Cutting, chipping, filing, grinding etc. as required or preparation and finishing of site connections.
- (c) Drilling of holes which are either not drilled at all or are wrongly drilled.

**17.1.3 Submittals**

- A. On commencement of the Project, the Contractor shall submit the following:
- i) Prior to the technical submittals, the contractor shall submit the proposed overall schedule for documentation such as calculations, erection drawings, shop I working drawings for all temporary structures etc. It is highlighted that structural steel member dimensions indicated in tender drawings are tentative only, and may be modified during final design stage.
  - ii) A detailed list of all constructional Plant & Equipment, such as cranes, derricks, winches, welding sets, erection tools etc. their make, model, present condition and location, available to the contractor and the ones he will employ on the job to maintain the progress of work in accordance with the contract.
  - iii) The total number of experienced personnel of each category, like fillers, welders, riggers etc., which he intends to deploy on the work.
- B. The contractor shall submit a detailed erection programme for completion of the work in time and in accordance with contract. This will show, in a Proforma approved by the Engineer, the target programme, with details of erection proposed to be carried out in each week, details of major equipment required and an assessment of required strength of various categories of workers.
- C. The contractor shall submit complete design calculations for any alternatives sections (for permanent structure) proposed by him, for approval of the Engineer. Use of any alternative section shall be subjected to approval of the Engineer. However, no escalation in unit price of work shall be allowed for such cases.

**17.1.4 Furnishing of information**

- A. Design drawings shall be furnished to the contractor and all such drawings shall form part of these Specifications.
- B. The Engineer reserves the right to make changes in the design drawings even after release for preparation of shop drawings to reflect addition, omission & modifications in data I details and requirements. Contractor shall consider such changes as part of these Specifications and the contract, and no claims shall be entertained on this account.
- C. Design drawings, approved by the Engineer, will show as appropriate the salient dimensions, design loads, sizes of members, location of openings at various levels and other necessary information required for the preparation of fabrication drawings, designs and erection details.
- D. It shall be clearly understood that the drawings of the Engineer are design drawings. The typical details of connection, cuts, notches, bend etc where shown in the design drawings are only for general guidance of the contractor. The contractor shall design and develop all such details based on the design forces and functional requirements.
- E. In case of variations between design drawings and specifications, the decision of the Engineer shall be final. Should the contractor, find any discrepancy in the information furnished by the Engineer, same shall be immediately brought to the notice of Engineer for resolution. The contractor shall obtain clarifications on discrepancies from Engineer before proceeding with the work.
- F. No detailed erection or shop drawings for temporary structures will be accepted for examination by the Engineer unless the same, have first been completely checked by the contractor's qualified structural engineer (independent agency to be appointed by contractor) and are accompanied by an erection plan showing the location of all pieces detailed. The contractor shall check and ensure that detailing of connections is carefully planned to obtain ease in erection of structures, including field-welded connections and I or bolting.

- G. No fabrication work shall be started by the contractor without prior approval of Engineer on the relevant drawings. Approval by the Engineer of any of the drawings shall not relieve the contractor of his responsibility to provide correct design of connections, workmanships, fit of parts, details, materials and errors or omissions of all work shown thereon. The approval of Engineer shall constitute approval of the size of members, dimensions and general arrangement, but shall not constitute approval of the connections between members and other details.
- H. Drawings, for approval, shall be submitted by the contractor in an orderly manner commensurate with erection sequence and approved construction programme.
- I. The contractor shall furnish ten prints of all approved final drawings including soft cop in CD ROM for interface I field use and record purpose.
- J. The drawings prepared by the Contractor, and all subsequent revisions thereof shall be at the cost of the Contractor, and no separate payments shall be made for the same. Revisions shall incorporate all modifications, field changes, substitutions etc. effected. The Lumpsum Price quoted for fabrication work shall be deemed to include the cost of such drawing work.
- K. All the drawings shall be prepared in metric units. The drawings should preferably be of A-1 standard size, and the details shown therein shall be clear and legible. These drawings shall include but shall not be limited to the following:
- i) Assembly drawings, giving exact sizes of the sections to be used and identification marks of the various sections.
  - ii) Shop details of temporary structures together with detailed calculations.
  - iii) Detailed shop drawings for proper co-ordination with the concrete components to which the steel members shall be connected, as required.
  - iv) Any other drawings or calculations that may be required for proper completion of the works and clarification of the works of substituted parts thereof.
  - v) All 'as-built' drawings.

#### 17.1.5 Applicable Codes of Practice

The following specifications, standards and codes are included as part of this Specification. All Standards, specifications, codes of practice current on the date of signing of agreement and referred to herein shall be applicable.

IS:800 (1984)	Code of Practice for General Construction in Steel
IS:808 (1989)	Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle sections
IS:800 (1984)	Covered Electrodes for Manual Metal Arc Welding of Carbon & Carbon - Manganese Steel.
IS:816 (1969)	Code of Practice for Use of Metal Arc welding for General Construction in Mild Steel
IS:817 (1969)	Code of Practice for Training and Testing of Metal Arc Welders
IS:919 (1993)	ISO System of Limits & Fits (Part 1 & Part 2)
IS:1148 (1982)	Hot Rolled Rivet Bars (upto 40 mm) for Structural Purposes
IS:1182 (1983)	Recommended Practice for Radio Graphic Examination of Fusion Welded Butt joints in steel plates
IS:1363 (1992)	Hexagon Head Bolts, Screws and Nuts of Product Grade C (Part 1 to Part 3)
IS:1364 (1992)	Hexagon Head Bolts, Screws and Nuts of Product grade A & B.(Part 1 to Part 5)
IS:1367 (1991)	Technical Supply Conditions for Threaded Steel Fasteners
IS:1852 (1985)	Rolling & Cutting Tolerances for Hot-Rolled Steel Product
IS:1977 (1975)	Structural Steel (Ordinary Quality)
IS:2016 (1967)	Plain Washers

IS:2062 (1992)	Steel for General Structural Purposes.
IS:2595 (1978)	Code of Practice for Radio Graphic Testing.
IS:3600 (1985)	Methods of Testing Fusion Welding joints (Part 1 to Part 9)
IS:3613 (1974)	Acceptance Tests for Wire Flux Combinations for Submerged Arc
IS:3658 (1981)	Code of practice for Liquid Penetrant Flow, Detection
IS:3757 (1985)	High Strength Structural Bolts
IS:4000 (1992)	High Strength Bolts in Steel Structures Code of Practice
IS:4353 (1967)	Recommendations for Submerged Arc Welding of Mild Steel and Low Alloy Steel
IS:4943 (1968)	Assessment of Butt and Fillet Fusion Welds in Steel Sheet, Plate and Pipe
IS:5334 (1981)	Code of Practice for Magnetic Particle Flow Detection of Welds
IS:5369 (1975)	General requirements for Plain Washers and Lock Washers
IS:5372 (1975)	Taper Washers for Channels
IS:5374 (1975)	Taper Washers for I Beams
IS:6623 (1985)	Specifications for High Strength Structural nuts
IS:6649 (1985)	Specifications for hardening and tempering washers for high strength structural nuts
IS:6755 (1980)	Double Coil Helical Spring Washers
IS:7215 (1974)	Tolerances for Fabrication of Steel Structure
IS:7318 (1974) (Part I)	Approval Test for Welders when welding procedure approval is not required - fusion welding of steel
IS:8500 (1974)	Structural steel - Micro alloyed (Medium and high Strength Qualities)
IS:8910 (1978)	General requirements of Supply of Weldable Structural Steel
IS:9595 (1980)	Recommendations for Metal Arc Welding of Carbon & Carbon - Manganese Steels
	RDSO Specifications and guide lines along with IR bridge manual to be referred for compliance

**17.1.6 Storage of Materials****17.1.6.1 General**

All materials shall be so stored as to prevent deterioration, and to ensure the preservation of their quality and fitness for the work. If required by the Engineer, the materials shall be stored under cover the suitably painted for the projection against weather. Any material, which has deteriorated or has been damaged shall be removed from site and replaced by new members, as directed by the Engineer at no extra cost and time.

- A. Steel to be used in fabrication shall be stored in separate stacks clear of the ground, section wise and lengthwise.
- B. The storage area shall be kept clean and properly drained. Structural steel shall be so stored and handled to such a manner that members are not subjected to excessive stresses and damage. Girders and beams shall be placed in upright position. Long members shall be supported on closely spaced skids to avoid unacceptable deflection.

**17.1.6.2 Storage Yard**

- A. The Contractor shall be required to establish to suitable yard, at an approved location at site for storing the fabricated steel structures and other materials which will be delivered to site. The yard shall have proper facilities such as drainage and Lighting including access for cranes, trailers and other heavy equipment's.
- B. The Contractor shall have been deemed to have visited the site, prior to submission of his tender, to acquaint himself with the availability of land and the development necessary by way of filling, drainage, access roads, fences, sheds etc., all of which shall be carried out by the Contractor at his own cost and as directed by the Engineer.

**17.1.6.3 Covered Store**

All field connection materials, paints etc. shall be stored on racks and platforms, off the ground in a properly covered building by the Contractor.

**17.2 Field Bolts**

1. Requirements stipulated under bolting shall apply for field bolts. Field bolts, nuts and washers(DTI) shall be supplied by the authorized fabricators of the structural member in excess of the nominal numbers required. Only HSFG bolts of class 8.8/10.9 shall be used.
2. At the time of assembly, the surfaces in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid seating of the parts or would interface with the development of friction between them.
3. In any other surface condition, including a machined surface, is specified, it shall be the responsibility of the Contractor to work within the slip factor specified for the particular case.
4. Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be, used when the surfaces are not parallel. The angle between the bolts axis and the surface under the non-rotating component (i.e., the bolt head or the nut) shall be  $90 + 3$  degree. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.
5. No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving of bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nuts and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in any one joint, they shall be tightened from the centre of the joint outwards.
6. If, after final tightening, a nut or bolt gets slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again.

**Structural Steel Work Painting Works****17.2.1 General****17.2.1.1 Scope of specification**

This Specification covers the scope of painting, methods for the surface preparation, application of paints and precautions to be taken for the painting of structural steel work. It covers the supply and delivery of all necessary materials, labour, scaffolding, tools, equipment and everything that is necessary for the job completion on schedule.

**17.2.1.2 Applicable Codes**

The following Specifications, Standards and Codes are included as part of this Specification. All standards and Codes of practice referred to herein shall be the current editions during the currency of project including all applicable official amendments and revisions.

In case of discrepancy between this Specification and those referred to herein, this specification shall govern. In case of discrepancy between Contract drawings and this specification, the Contract drawings shall govern.

IS: 102 (1962)	Ready Mixed Paint, Brushing, Red lead, Non Setting, Priming
IS: 159 (1981)	Ready Mixed Paint, Brushing, Acid Resisting for Protection against Acid Fumes, Colour as required
IS: 341 (1973)	Brushes, Paints and Varnishes, Flat
IS: 384 (1979)	Brush, paint and varnish i) Oval Ferrule Bound ii) Round Ferrule bound

IS: 487 (1985)	Temporary Corrosion Preventive Grease, Soft film, Cold Application
IS: 958 (1975)	Temporary Corrosion Preventive, Fluid, Hard film, solvent deposited
IS:1153 (1975)	Temporary Corrosion Preventive, fluid, hard film, solvent deposited
IS:1477 (1971)	Code of practice for painting of Ferrous metals in building Part I – Pretreatment Part II – Painting
IS:1674 (1960)	Temporary corrosion preventive fluid, soft film, solvent deposited
IS:2074 (1992)	Ready mixed paints, red oxide - Zinc Chrome, Priming

**17.2.2 Products and Materials****17.2.2.1 Paint**

1. All paint delivered to the site shall be ready mixed, in original sealed containers, as packed by the paint manufacturers, and no thinners shall be permitted.
2. Paint shall be stirred frequently to keep the pigment in suspension.

**17.2.2.2 Storage of Paints**

1. All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flame, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.
2. All paint containers shall be clearly labeled to show, paint identification, date of manufacture, batch number, order number and special instructions in legible form. The containers shall be opened only at the time of use. Paints which have liveried, gelled or otherwise deteriorated during storage, shall not be used. Paints for which the shelf life specified by the supplier has expired shall not be used.

**17.2.3 Execution****17.2.3.1 Painting system**

Painting work shall be carried out as detailed in Table 12.1 follows:

**TABLE 12.1**  
**PAINTING SPECIFICATIONS**

DESCRIPTION	GENERAL SURFACE	
FABRICATION SHOP	EXTERNAL SURFACES	INTERNAL SURFACES
Surface Treatment	Abrasive blast cleaning to minimum SA-2.5 SIS-055900 near - white blast cleaning	Abrasive blast cleaning to minimum SA-2.5 SIS-055900 near - white blast cleaning
1 <sup>st</sup> Under - Coat	Inorganic zinc silicate primer (self- curing solvent type) DFT 75 cum shall be Berger Zinc Anode 11 or approved equivalent. The primer should be applied by spray only.	Epoxy Zinc phosphate primer polyamide cured DFT-35µm
2 <sup>nd</sup> Under-Coat	Epoxy zinc phosphate primer polyamide cured DFT - 35µm shall be Berge Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.	Epoxy zinc phosphate primer polyamide cured DFT-35 µm shall be Berger Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.
3 <sup>rd</sup> Under-Coat	Epoxy zinc phosphate primer polyamide cured DFT- 35 µm shall be Berge Epilux 610 Primer or approved equivalent. The primer should be applied by spray or brush only.	Polyamide cured coal tar epoxy coating DFT 100 µm
4 <sup>th</sup> Under Coat	Epoxy high build micaceous iron oxide coating polyamide cured DFT-90 µm shall be Berger Epilux 4 High Build MIO. The primer should be applied by spray or brush only.	Polyamide cured coal tar epoxy coating DFT 100 µm

DESCRIPTION	GENERAL SURFACE	
ERECTION SITE	EXTERNAL SURFACES	INTERNAL SURFACES
Intermediate Coat	Acrylic polyurethane finish aliphatic isocyanate cured DFT-30 $\mu$ m shall be Bergerthane or approved equivalent applied by spray or brush in approved colour.	NA
Finishing Coat	Acrylic polyurethane finish aliphatic isocyanate cured DFT-30 $\mu$ m shall be Bergerthane or approved equivalent applied by spray or brush in approved colour.	NA

INTERNAL SURFACE = are those which will become inaccessible after fabrication.

EXTERNAL SURFACE = are those which are prone to humidity and moisture from the atmosphere. The DFT (dry film thickness) shall be measured after completion of each coat

### 17.2.3.2 Surface Preparation

#### 17.2.3.2.1 General

1. The work shall be carried out in accordance with IS: 1477 (2008) (Part 1). Any oil, grease, dust or foreign matter deposited on the surface after preparation shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals.
2. All welding areas shall be given special attention for removal of weld flux slag, weld metal splatter, weld head oxides, weld flux fumes silvers and other foreign objects before blasting. If deemed necessary by the Engineer, acid washing and subsequent washing with clean water shall be used.
3. Any rough seams will have to be ground and must be inspected and approved by the Engineer - before application of the coatings.
4. The last finish paint shall be applied after structural steel erection and slab construction.

#### 17.2.3.2.2 Mixing and Thinning

1. All ingredients in a paint container shall be thoroughly mixed to break-up lumps and disperse pigments, before use and during application, to maintain homogeneity. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.
2. Dry pigments, pastes, tinting pastes and colours shall be mixed and made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.
3. Additives that are received separate such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturer's instructions. These shall be promptly used within the pot life specified by the manufacturers and unused paint thereafter shall be discarded.
4. Thinners shall not be used unless essential for proper application of the paint and approved by the Engineer. Where thinners are used, they shall be added during the mixing process and the type and quantity of thinner shall be in accordance with the instructions of paint manufacturer.

### 17.2.4 Paint Application

#### 17.2.4.1 General

1. Paint shall be applied in accordance with the manufacturer recommendations and as supplemented by these specifications. The work shall generally follow IS:1477 (1971) (Part II). Prior approval of the Engineer shall be taken in respect of all primers and paints, before their use in the works.
2. Paint shall generally be applied by brushing except that spraying may be used where specified and for finish coats only when brushing may damage the prime coats. Roller coat or other method of paint application shall not be used unless specifically authorized.
3. Spraying paint shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in difficult accessible areas.

4. Paint shall not be applied when the ambient temperature is 10° C and below. For paints which dry by chemical reaction the temperature requirements specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind fog or at relative humidity of 80% and above or when the surface temperature is below dew point, resulting in consideration of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying and the damaged area repainted after removal of the paint.
5. Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.
6. Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damages such as lifting or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of same color shall be tinted, whenever practical, to produce contrasts and help in identifying the progress of the work.

#### 17.2.4.2 **Brush Application**

1. Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS:487 (2012) are better suited for irregular surfaces, whereas flat brushes which conform to IS: 384 (2002) are convenient for large flat areas. The width of flat brushes shall not generally exceed 125 mm.
2. Paint shall be applied in short strokes depositing a uniform amount of paint in each stroke followed by brushing the paint into all surface irregularities, crevices and corners and finally smoothening or levelling the paint film with long and light strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

#### 17.2.4.3 **Spray Application**

1. The spraying equipment shall be compatible with the paint material and provided with necessary gauges and controls. The equipment shall be cleaned and free from dirt, dried paint, foreign matter and solvent before use.
2. The paint shall be applied by holding the gun perpendicular to the surface at a suitable distance and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.
3. Water trap acceptable to Engineer shall be furnished and installed on all equipment used in spray painting.

#### 17.2.4.4 **Shop Painting**

1. The painting system specified in Table 11.1 above shall be followed.
2. Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted but require protection shall be given a rust inhibitive grease conforming to IS:958-2000 or solvent deposited compound conforming to IS: 1153 (2000)) or IS: 1674 (1960) or treated as specified in the drawing.
3. Surface to be in contact with concrete shall not be painted.
4. The shop coats shall be continuous over all edges, including ends meant for jointing at site by bolting, except where the paint could be detrimental to bolting. In such cases, no paint shall be applied within 50 mm, and the unprotected surface shall be given a coat of corrosion inhibitive compound.
5. The unpainted area shall be cleaned prior to welding. The welded joint shall be cleaned and de-staged, and immediately after covered by the same paint as has been used for the remaining surface.

#### 17.2.4.5 **Protection of Paintwork**

1. The Contractor shall provide measures as necessary to prevent damage to the work and to other property or persons through all cleaning and painting operations. Paint or paint stains which result in other unsightly appearance on surfaces not designated to be painted shall be removed or obliterated by the contractor at this cost.
2. All painted surfaces that in the opinion of the Engineer are damaged in anyway, shall be repaired by the contractor at his own cost with materials and to a condition equal to that of the requirements



specified in these specifications.

3. If in the opinion of Engineer, any other work would have caused dust, grease or foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be thoroughly cleaned. At the time of commissioning of the work, the painting shall be completed and the surfaces shall be undamaged and clean.
4. The areas for high-strength bolts shall be protected by masking tape against undercoat application at the fabrication shop. Immediately prior to erection any rust in the paint shall be removed by power wire brushing to a standard equivalent to SA3.

#### 17.2.4.6 **Site painting**

After the erection of structures at the site, the contractor shall provide the necessary treatment as specified in Table 11.1 "PAINTING SPECIFICATIONS".

Surface which have not been shop coated, but require surface treatment shall be given necessary surface preparation and coats at site as specified in the Table 11.1 above.

#### 17.3 **Additional Specifications for Launching**

Truss launching for longer spans:

- a) Preferably no road traffic blocking will be used. Multiple day I night short blocks of 1h to 1h30 maximum are acceptable to ensure safety.
- b) Launching scheme shown in Tender drawings is suggestive only. Contractor has to provide his own proposed launching scheme and supporting calculations with the offer.
- c) Contractor has to provide principles of nose I truss connection details in tender.
- d) Truss design composite girder requirements will govern over nose I launching equipment requirements.
- e) Contactor will submit and get approval from Engineer of the detailed design of the full launching equipment and scheme before starting the launching.
- f) Contractor will coordinate with Bangalore Traffic Police and Engineer before and during the launching contractor to develop detailed traffic diversion scheme.
- g) Tentative allowable bearing pressure for temporary supports foundation concrete blocks shall be assumed at 10 tonnes I sqm.
- h) For location of storage and fabrication yard relevant clause of N.I.T shall be referred. Contractor shall indicate and justify in tender the proposed total needed yard area for the purpose.
- i) Any necessary precaution by proper and secure fixing shall be taken by the contractor to prevent the fall of any object onto the road below during the whole erection period.
- j) A minimum 15 m clear width (4 lanes) shall be kept during the whole construction period. These lanes can be obtained as 4 or 2+2.

#### 17.4 **Mode of Measurement**

The cost of steel bridge girder is included in Lumpsum price of Price Schedule. The quoted lumpsum price shall also includes the following:

- a. Erection of fabricated parts (fabrication and transportation of various parts I components including HSFG bolts I nuts I washers from workshop to storage yard will be done by approved sub-contractors)
- b. Receiving, unloading and keeping in safe custody and upkeep of all fabricated parts including HSFG bolts I nuts I washers at storage yard.
- c. Loading, transportation and unloading of all fabricated structural steel materials including HSFG bolts I nuts I washers from site storage yard to erection site, handling, assembling, bolting, welding if necessary and satisfactory installation of all fabricated structural steel materials in proper location according to approved erection drawings and I or as directed by the Engineer.
- d. Tightening of HSFG bolts for the field erection of fabricated parts. However, supply of HSFG bolts and its compatible nuts and washers will be arranged I supplied at the storage yard by approved sub- contractor.
- e. Preparation of complete detailed erection drawings and detailed calculation based on suggested

- erection sequence and design drawings as given by Engineer or alternative scheme proposed by contractor and approved by Engineer.
- f. Preparation of complete detailed fabrication drawings for all temporary structures such as temporary nose, staging, temporary support, bracing required for all permanent and temporary structures.
  - g. All tools, plants and equipment's I machinery
  - h. All other consumables including fuel and lubricants etc.
  - i. All safety and protection arrangements to be made at site I storage yards for road users, public and workmen.