



Technical Specification

Owner: Aathbiskot Municipality, Rukum(west)

Equipment Name: Fabrication of Steel Parts and transportation up to Road heads of Aathbiskot Trail Bridge

Quantity: 1 Set

4. TECHNICAL SPECIFICATION (TS)

4.1 Steel Work

Bid and actual fabrication of the bridge parts shall be based on the "Terms of Steel works" given below in addition to relevant ISI Codes. In case of discrepancies between the two the "Terms of Steelworks" shall prevail.

Safety and health provisions shall be made according to IS: 818-1968, and shall entirely be the Contractor/ Fabricator's responsibility.

The following "Terms of steel works" has to be strictly followed while performing the steel parts fabrication work.

a) Straightening

All materials shall be straight and if necessary, before being worked shall be straightened and/or flattened by pressure, unless required to be of curvilinear form and shall be free from twists.

b) Cutting

Cutting may be affected by shearing cropping or sawing. Gas cutting by mechanically controlled torch is permitted for mild steel only. Gas cutting of high tensile steel is also permitted provided special care is taken to leave sufficient metal to be removed by machining so that all metal that has been hardened by flame is removed. No loads shall be transmitted into metal (except welded joints) through a gas cut surface.

c) Holing and Punching

Holes for bolts or pins shall be drilled (not to be formed by gas cutting). Punching may be permitted for materials with thickness < 14mm, provided the holes are punched 3 mm less in diameter than the required size and reamed after punching to the full diameter. When holes are drilled or punched in one operation through two or more separable parts, these parts shall be separated after drilling or punching and the burrs removed. To obtain uniformity the use of templates and jigs is mandatory for holing.

d) Assembly

The component parts shall be assembled in such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified cambers, if any, are provided.

e) Bolting

Where necessary washers shall be tapered or otherwise suitably shaped to give the heads of nuts and bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least two threads. In all cases where the full bearing areas of the bolt is to be developed, the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. Threading of rods and holes shall be done by machines.

f) Welding



Welding shall be in accordance with any of the following standards as appropriate, and shall be conducted by appropriately qualified welders:

- IS: 816-1989 : Code of practice for use of metal arc welding for general construction in mild steel.
- IS: 823-1964 & : Code of practice for use of welding in bridges and structures
- IS: 1024-1979 : subject to dynamic loading.

If there are any new editions of Indian Standard those should be used as references. The use of templates and jigs is mandatory for welding of assembly. Following special requirement in conjunction with galvanization has to be made. Sections should have corners cropped to allow free flow of zinc during galvanization. Avoid narrow gaps between plates. Overlapping surfaces and back to back angles and channels should be avoided. Where small areas are unavoidable edges should be sealed by a continuous **pore free weld** to prevent penetration of pickle acids.

g) Standard Designs

The Standard Design and Drawings are integral parts of these technical specifications. Details for the steel works can be found in the set of Standard Steel Drawings, which will be made available to the Fabricator after the contract is signed / awarded.

h) Quality Requirements, Quality Control and Quality Assurance (Guarantee)

The quality control of the raw materials acquired, fabrication process, and that of ready made product is the responsibility of the prime contractor/fabricator, who should guarantee that all raw materials are of standard quality according to Indian Standards Institution and to the specifications given in the "Terms of Steel works" and fabrication of the bridge parts are correct according to Standard Design and Drawings. The cost for all damages due to use of low quality materials has to be borne by the contractor/fabricator. At the time of delivery the parts and materials shall have to be free from any defects in material or workmanship in all respects and shall remain reasonably perfect till the end of maintenance period when a final check shall be carried out.

If any mistakes in the Standard Designs and Drawings are found by the workshop, The Purchaser's Technical Section has to be informed immediately in writing. The changes in steel profile have to be done only with written permission from the Purchaser in case of proven non-availability of certain profiles in the market.

The cost of other materials thus proposed and used will be fixed according to their respective weight and the lower among the bid price and official cost of the Purchaser.

i) Inspection, Tests and Final Check

The Contractor/Fabricator shall coordinate to provide access and other facilities for the inspection and, if required, tests of the works at any/or all stages during fabrication of the steel parts. Unless otherwise agreed this inspection should be carried out at the place of fabrication. The inspection shall be facilitated by a properly accredited person (quality control manager) available at the fabricator's floor during all working hours together with a complete set of drawings and any further instructions which may have been issued.

Following steel parts have to be in assembled form during such inspection: The parts shall be assembled after completion of the galvanization, on a flat, level and hard top place. Once dismantled, any damage to the galvanization of the steel parts has to be rectified before delivery.

- All anchorage parts (100% assembly)
- Walkway deck with cross-beams (100% assembly)
- Both towers, complete (100% assembly)
- Windguy stay strut (100% assembly)
- Complete truss (100% assembly)

- Clamps and turnbuckles (100% assembly)

Such inspection shall be made prior to delivery and shall be conducted so as not to interfere unnecessarily with the operation of other work. Such inspections are supplementary and intended to clear the delivery only, and shall not be considered as a final acceptance.

The final check of all steel parts will be conducted along with the final check of the bridge and the discrepancies found during such final check have to be rectified by the Fabricator at its own cost. On a default situation, such works shall be conducted by the Purchaser and the cost incurred for such works shall be made a liability in the Fabricator's account (either from its retention money or from other payments and/or their property according to the prevailing rules and regulations).

All gauges and templates, measuring instruments (minimum: vernier calliper, hydrometer, PH-meter, adhesion testing hammer, zinc coat measuring instrument etc.) necessary to satisfy the inspector shall be supplied by the Fabricator. The inspector may at his discretion check the test results obtained at the Fabricator's works by independent tests and should the material so tested be found to be unsatisfactory, the costs of such tests shall be borne by the Fabricator, and, if satisfactory, the costs shall be borne by the Purchaser. In any case the quality assurance of Principal Fabricator has to be made available, whenever required by the Purchaser.

j) Storing, handling and protection of steel parts (specially Threads)

All structural and reinforcement steel shall be stored and handled without subjecting them to excessive stresses and damage. The threaded parts including anchorage rods, clamps, suspenders etc. have to be protected with grease and jute immediately after completion.

k) Labelling, Packing and delivery

Each member (or set of members) has to be labelled clearly indicating both the drawing number and the part number corresponding to the steel-part list and the drawing number provided by the Purchaser, **but only after galvanization**.

Straight bars and plates shall be bundled. All bolts, nuts, washers and other small and loose parts shall be packed in cases or strong bags and labelled in order to prevent damage or distortion during transportation. The costs of packing and labelling shall be included in the bids. The Wire mesh netting has to be delivered in bundles. Each transport unit shall not exceed 45 kg in weight. For each delivery the workshop has to prepare a detailed list of the bridge parts to be delivered, containing the drawing numbers, part numbers, and description of parts, quantities and weights.

4.2. Supply and Fabrication of Steel Parts

4.2.1 Structural Steel

Structural steel supplied by the workshop shall comply with the requirements of IS: 226-1975, specification for Structural Steel (Standard Quality). The dimensions for hot rolled materials are specified in IS: 800-1984 & 808-1989 (General construction in steel). Steel grade shall be standard quality FE 410, and should have following properties:

$$\text{Yield stress} \geq 250 \text{ N/mm}^2$$

$$\text{Tensile strength} \geq 410 \text{ N/mm}^2$$

$$\text{Elongation} \geq 23\%$$

$$\text{Permissible tolerance of physical dimension} = \pm 2.5\%$$

4.2.2 Reinforcement Steel

Reinforcement steel supplied by the workshop shall be *ribbed torsteel* with high yield strength deformed bar of grade FE 415 confirming to IS: 1786-1985. All reinforcement shall be clean and free from loose mill-scales, dust, loose rust and coats of paint,



oil or other coatings, which may destroy or reduce bond. All reinforcement steel shall be cold bent. Points for anchor rods shall be formed by grinding. **Joining of reinforcement steel bars by welding is prohibited.**

4.2.3 Supply of Thimbles

Thimbles supplied by the workshop shall conform to the standard specifications of Thimbles (IS: 2315-1978). The workshop is responsible that all thimbles can be fitted to the provided pins, steel parts etc. Thimbles should be hot dip galvanized with minimum zinc coat of 40µm.

4.2.4 Supply of Bulldog Grips

Bulldog grips supplied by the workshop shall confirm to the standard specifications of Bulldog grips (IS: 2361-1970). In addition it also should fulfil the following requirements:

The bridges must be drop-forged and suitably scored to grip a round strand rope of right hand lay having six strands. Bridge, U-bolts and nuts should be hot dip galvanized with minimum zinc coat of 40µm. The thread of U-bolt and nuts on it should withstand specific torque.

The bulldog grips should have minimum grip strength of :

13mm ≥ 2.7 tone, 26mm ≥ 6.6 tone, 32mm ≥ 8.3 tone,
36mm ≥ 9.0 tone, 40mm ≥ 9.7 tone,

Note: Thimbles, bulldog grips, nuts, bolts and washers have to be galvanized according to IS: 2629-1966, and Recommended practice for Hot-dip Galvanizing of Iron and Steel.

4.2.5 Miscellaneous Supply

4.2.5.1 G.I. Wire

The wire used for weaving of wire mesh netting shall be of 12 SWG (2.64mm), conforming to IS: 280-1978, heavy coat galvanized according to IS: 4826-1979 (hot dip galvanized, minimum zinc coating of 270 gm/m² and should pass uniformity of zinc coat and adhesion test). In addition, G.I. wire should have tensile strength of 380-500N/mm².

4.2.5.2 Bolts, Nuts & Washers

Bolts, nuts, & washers shall confirm the standard specification of bolts, screws, nuts & washers (IS: 1363-1984 for hexagon head bolts) / (IS: 1367-1979/1980 conditions for threaded fasteners) / (IS: 6610-1972 for heavy washers) / (IS: 5369-1975 for plane & lock washers) / (IS: 5372-1975 for taper washers). Type and strength grade of the nuts / bolts shall be as specified in the respective drawings. Nuts/bolts for walkway deck shall be of ordinary type of 4.6 grade and for truss and towers shall be high strength friction nuts/bolts of 8.8 grade.

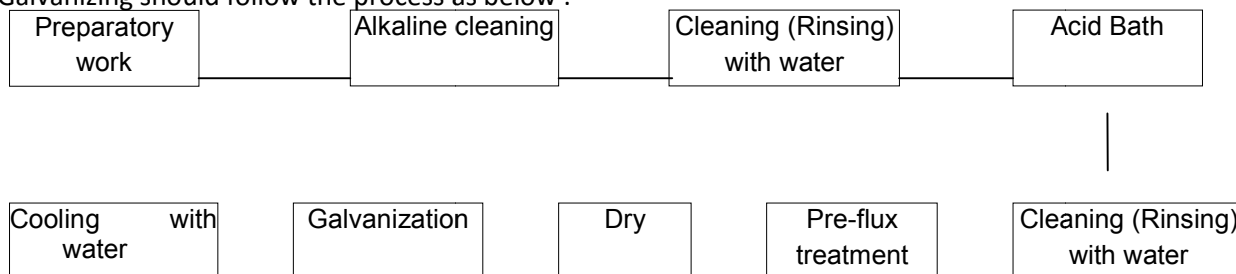
Bolts, nuts & washers shall be hot dip galvanized with minimum zinc coating of 40 um.

4.3 Hot Dip Galvanization of Steel Parts

Galvanizing of steel parts shall be executed in accordance with IS: 2629-1966 (Recommended Practice for Hot-Dip Galvanizing of Iron & Steel) and IS 4759-1984 (specification for hot-dip zinc coating on structural steel).

4.3.1 Galvanization Process

Galvanizing should follow the process as below :





4.3.1.1 Preparatory work

All welding slag should be removed from the steel parts to be galvanized. Acid traps should be avoided.

4.3.1.2 Alkaline cleaning

Rust, oil and other contaminants should be removed from the steel by preliminary treatment with Alkaline cleaning in Sodium Hydroxide Solution of 10 ~ 15% concentration.

The concentration of the solution should be monitored at regular intervals and adjusted accordingly to have good cleaning effect.

4.3.1.3 Rinsing

After Alkaline cleaning, steel should be flushed with running water.

4.3.1.4 Acid Bath

The preliminary treated steel is then cleaned by Acid Bath in Hydrochloric Acid Solution of 50% concentration.

During the operation, close control of acid content in the solution is necessary. It is done by testing for acid (PH value = 1 to 3, measured by PH meter) and iron contents at regular intervals. The strength of the solution should be maintained by periodic addition of fresh concentrated acid. If the iron content in the solution is more than 100g/liter (density measured by hydrometer, maximum permissible value = 1.2), it should be changed by the new fresh solution.

4.3.1.5 Rinsing

After Acid Bath steel should be flushed with running water.

4.3.1.6 Pre-flux treatment

Acid bathed steel is dipped in a solution of Zinc Ammonium Chloride ($\text{ZnCl}_2 \cdot 3\text{NH}_4\text{Cl}$) of 20 ~ 40% concentration. This solution is prepared by mixing 45% of Zinc Chloride (ZnCl_2) + 55% of Ammonium Chloride (NH_4Cl).

The concentration of solution should be controlled at regular intervals. For this specific gravity of the solution is maintained (Hydrometer reading in range of 1.1 to 1.15) by adding required quantities of pre-flux chemicals in proportions.

4.3.1.7 Dry

After pre-flux treatment, steel is dried for galvanization.

4.3.1.8 Galvanization

The treated steel is dipped into the molted Zinc (zinc bath). Temperature of the molted Zinc should be maintained within the range of 450^0C to 470^0C . Appropriate dipping time also should be maintained.

4.3.1.9 Cooling

After the hot dip, steel is cooled with water.

4.3.2 Quality Checking of Galvanization

4.3.2.1 Galvanizing Process

Check the galvanizing plant and its set up to be ensured that all the galvanizing process is available and maintained.

4.3.2.2 Quality of Zinc

This can be checked by chemical testing of raw zinc used for the galvanization. Zinc content should not be less than 98.5%.

4.3.2.3 Quality of galvanization

By visual check the following:

- Galvanized steel should be free from rust and black spots, acid traps, welding slags.
- Galvanized coating should be free from ash, pimple and bulky deposition.
- Galvanized coating should be continuous, smooth and evenly distributed as far as possible.
- Zinc coat should be adherent. This can be checked by hammering or scratching.
- No zinc paint or ammonium paint is applied to hide rust spots. This is very unhealthy practice, which frequently applied by the galvanisers.
- Zinc thickness can be measured by Delta scope (electromagnetic instrument for measuring coating thickness over ferrous material). In our case zinc coat should not be less than 80 μm in any steel parts.
- **Treatment of Threads:** Extra zinc on threads should be removed with a rotating wire brush immediately after galvanizing or with gas blow and cleaning with rotating brush if galvanization is already hardened. Re-threading of the galvanized parts is not permitted.

4.4 Assurance

The Supplier shall have in built quality management system and ensure that the above technical specifications are met as per the requirement of the Purchaser through submission of quality assurance document.

4.5 Transportation

It is wholly the responsibility of the Supplier to control transportation activities and quality/quantity of any materials, loading and off-loading of the same, and the delivery at designated point.

Steel parts should be transported with due attention so as not to incur any damage to them either due to exposure to excessive moisture or mishandling. The Supplier shall entirely be responsible for the quality and quantity of materials received at the point of origin and their delivery at designated point in the same quantity and quality. No reasons whatsoever will be accepted for materials not reaching to site in proper condition and in required quantity. Loss during transportation, if any is entirely on the Supplier's account.

Work being delayed because of steel parts and other materials being damaged during transportation is Supplier's concern, which shall not be considered a reason for time extension.

Prepared By



Approved by

Ram Bahadur K.C.

For Chief Administrative Officer