5.2 REINFORCEMENT

5.2.1 Description

This work shall consist of furnishing and placing bars of the grade, type and size shown in accordance with these Specifications and in conformity with the requirements shown on the Drawings.

5.2.2 Materials

5.2.2.1 Bar Reinforcement

All mild steel bars shall have a yield stress not less than 240 N/mm² and shall conform to ASTM A 615 or the latest such equivalent standard or specification in force that is considered by the Engineer to apply.

All high yield steel bars shall be deformed bars with a yield stress not less than 400 N/mm² and shall conform to ASTM A 615 or the latest such equivalent standard or specification in force that is considered by the Engineer to apply.

The use of cold twisted bars is not permitted. Steel for all bars shall be produced by open hearth, basic oxygen or electric arc furnace methods, unless otherwise called for on the Drawings or in special provisions.

5.2.2.2 Wire Mesh

Wire mesh shall conform to the requirements of AASHTO Standard Specification M 55 - Welded Steel Wire Fabric for Concrete Reinforcement.

5.2.2.3 Binding Wire

Reinforcement binding wire shall be best black annealed mild steel wire, approximately 1.6 mm in diameter.

5.2.2.4 Bar Sizes

AASHTO Standard Specifications refer to the Imperial measurement system. However, metric sizes of steel are shown on the Drawings and shall be used.

5.2.2.5 Ordering Material

The name of the proposed supplier (or names of proposed suppliers) of the reinforcement shall be submitted as soon as possible to the Engineer for his approval. The Contractor shall also submit all relevant data on the steel required by the Engineer, such as breaking strength, yield strength, characteristics on elongation, chemical composition etc.

Copies of orders placed shall be submitted to the Engineer.

Bar reinforcement shall be transported in standard bundles, tagged and marked in accordance with the Code of Standard Practice of the Concrete Reinforcing Steel Institute.

No steel shall be delivered without a manufacturers certificate guaranteeing the yield stress, which shall be submitted to the Engineer.

The steel shall be stored on Site and marked in a way that later enables identification of the steel corresponding to each certificate.
5.2.2.6 Additional Tests

The Contractor shall cut out steel samples as directed by the Engineer and these shall be tested according to the Engineer’s instructions by an approved Testing Institution. Expenses incurred in connection with cutting out, transporting and testing of the samples shall be paid for by the Contractor. In general, two samples shall be tested from each batch of a particular size of reinforcement delivered to the site.

5.2.3 Construction Methods

5.2.3.1 Protection and Storage

Reinforcement for structures shall be handled and stored in a manner that will prevent bending out of the desired shape and any accumulation of dirt, oil and paint. When placed in the works it shall be free from dirt, oil, grease, paint, mill scale and loose or thick rust.

5.2.3.2 Cutting and Bending

Bars shall be cut and bent cold to the dimensions indicated and with equipment and methods approved by the Engineer.

Stirrups and tie bars shall be bent around a pin having a diameter not less than four times the minimum thickness of the bar. Bends for other bars, where full tension in the bar may occur, shall be made around a pin having a diameter not less than twenty times the bar diameter. Hooks shall conform to American Concrete Institute Standard Building Code Requirements for reinforced concrete ACI 318-83, or as shown on the Drawings.

5.2.3.3 Placing, Supporting and Fastening

All bar reinforcement shall be placed, supported and secured prior to any concreting operations. The reinforcement shall be checked and approved by the Engineer before pouring of concrete.

Cover blocks required for ensuring that the reinforcement is correctly positioned shall be as small as possible, consistent with their purpose, of a shape and material acceptable to the Engineer, and designated so that they will not overturn when the concrete is placed. If made of concrete, the maximum size of aggregate shall be 6 mm and the mix proportion shall be one part of Portland cement to 2 parts of sand by weight. Wire shall be cast in the block for the purpose of tying it to the reinforcement. The wire must not be closer than 30 mm from the concrete surface. The use of small stones or wood blocks shall not be permitted.

The reinforcement shall be held securely in place at the exact position and at the exact spacing as indicated on the Drawings by the use of wire ties at bar intersections, supports and cover blocks. Wire ties shall be securely tied and folded so that they do not project beyond the planes formed by the reinforcing bars. The adequacy of the supports and ties to secure the reinforcement properly shall be subject to the approval of the Engineer.
5.2.3.4 Splicing

Reinforcement shall be furnished in the lengths indicated on the Drawings. When the Contractor wishes to use more splices than are indicated and/or necessary, the Contractor shall furnish Working Drawings to the Engineer for approval in accordance with the guidelines provided on the Contract Drawings. If such additional splices are approved, the extra weight occasioned by such splices shall not be included in the measurement of reinforcement for payment.

All splices for high yield deformed steel bars and mild steel plain steel bars shall have lap lengths as shown on the Drawings. Lap splices shall generally be located at points of minimum tension in bars. Except where otherwise shown on the Drawings lap splices shall be made with the bars placed in contact and securely wired together.

Welding of reinforcing steel shall be done only if detailed on the Drawings or approved in writing by the Engineer. Before the Engineer may approve of such welding, the Contractor shall submit and test any samples as the Engineer may require and make due allowance for the time elapsing before results are available.

5.2.3.5 Substitutions

Substitutions of bars shall be permitted only with specific authorisation by the Engineer and at the expense of the Contractor. If bars are substituted they shall have a cross sectional area equivalent to the design area, or larger. If substitutions of bars are permitted, the Contractor shall produce working drawings and reinforcing detailing at his own expense and to the approval of the Engineer.

5.2.4 Measurement

The quantity of reinforcement to be measured under this Section shall be the computed weight in tonnes of material used and accepted as shown on the Drawings provided that the quantity shall not include the reinforcement in any item of work for which the basis of payment includes the reinforcement. In computing the weight to be measured, the theoretical weights of bars of the cross section shown on the Drawings or authorised, shall be used. The weight shall be calculated based on a constant mass of 0.00785 kg/mm² per metre run.

The computed weight shall not include the extra material incurred when bars larger than those specified are used, or the extra material necessary for splices when bars shorter than those specified are used with the permission of the Engineer, or the weight of any devices used to support or fasten the reinforcement in the correct position including any necessary chairs.

However, payment shall be allowed for lap splices not shown when the bars are longer than 12 metres. Only one lap splice per every started 12 metres will be paid for.

5.2.5 Payment

This work measured as provided above, shall be paid for at the Contract unit price per metric tonne of reinforcement of the particular type. The payment shall be full compensation for furnishing and placing reinforcement of any size and for all labour, binding wire, equipment, tools and incidentals necessary to complete the work prescribed in this Section.
Pay items shall be:

- 5/2/1 Mild Steel Reinforcing Bars Tonne
- 5/2/2 High Yield Deformed Steel Reinforcing Bars Tonne
- 5/2/3 Wire Mesh Reinforcement Tonne