

<p>SECTION-B</p> <p>GENERAL SPECIFICATION</p>

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GENERAL SPECIFICATION OF MATERIAL
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- (1) All materials to be used shall conform to the relevant specifications as per the latest edition of Indian Standard, unless otherwise stated in the detailed specifications of items of work.
- (2) Wherever a reference to any Indian Standard appears in the specification, it shall be taken to mean as a reference to the latest version of the standard.
- (3) Test for material shall be invariably is carried out by the contractor, when the same are specified in the specifications. Tests shall also have to be carried out, even though the same are not specifically mentioned in the specifications but in the opinion of the Engineer-In-Charge, the same are required to be carried out. All such tests shall be carried out in Government Lab or laboratories approved by the Engineer-in-charge and cost shall be entirely borne by the Contractor.
- (4) No collection of materials shall be made before it is not approved from the Engineer-In-Charge.
- (5) Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent deterioration or intrusions of foreign matter and to ensure the preservation of their quality and fitness for the work.
- (6) Materials, if rejected by the Engineer-In-Charge, shall be immediately removed from the site of work. If they are not removed within twenty four hours of receiving such intimation, Engineer-In-Charge shall get the same removed at contractor's cost. The Engineer-In-Charge shall dispose off such materials in a manner as he chooses and the contractor shall not be entitled to any compensation for the cost of such materials.
- (7) Approval to the samples of various materials given by the Engineer-In-Charge will not absolve the contractor from the responsibility of replacing the defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials rejected by the Engineer-In-Charge.
- (8) The contractor shall be responsible for observing the laws, rules and regulations imposed under the "Mineral Acts" and such other laws and rules prescribed by Government from time to time.

1.0 M-1 WATER:

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Water shall conform to IS: 456.

- 1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material, which will either weaken the mortar or concrete or cause efflorescence or attack the steel in RCC. Container for transport, storage and handling of water shall be clean.
- 1.1 If required by the Engineer-In-Charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests soundness time of setting and mortar strength as specified in IS-269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 percent in strength of mortar, prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.
- 1.3 Water fit for drinking will generally be found suitable for mortar or concrete.
- 1.4 Water for curing of mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free from elements, which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete or produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.
- 1.5 Hard and bitter water shall not be used for curing. Potable water will generally be found suitable for curing of mortar or concrete.

2.0 M-2 CEMENT:

- 2.1 Cement shall be ordinary Portland cement as per I.S. 269 or Pozzolana cement as per IS 1489. The Grade of cement should be of 43 grade or higher grade.
- 2.2 The contractor shall take every precaution to store the cement properly so that it is not spoiled by dampness etc. Cement required for use shall be fresh as far as possible and stored on planks raised 15 to 20 Cms above the floor and stacked 30 Cms away from the wall in suitable closed weather proof go down at the site of work. Cement shall be stored in such a way so as to allow the removal and use of cement in chronological order of receipt i.e. first received being first used. Not more than 15 bags shall be stacked vertically in one pile and maximum width of the piles should not be more than 3 meters. Any cement, which has deteriorated, caked or which has been set or partially set shall not be used. When temporarily stored in open for use, it shall be kept on a suitable platform and suitably protected as necessary.
- 2.3 Different brands of cement or cement of the same brand from different factories shall be stored in separate groups and shall not be mixed during use. Cement shall be kept in a store under double locking arrangements. A board indicating stock and daily transactions of cement shall be kept in each room of the cement store. Daily account of receipt and use of cement

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bags shall be maintained by the Contractor in the preformed prescribed by the Engineer-In-Charge.

- 2.4 The cement shall be measured by no. of bags for all use in concrete (except otherwise stated) and masonry etc. In no case, cement shall be measured by boxes or other means for the volumetric proportion of concrete and mortar. For calculation for the proportion, the volume of the cement bag shall be taken as 0.0342 cu.m. (1.20 cft.) And measuring box of size of 30 cm x 30 x 38 Cms for concrete works. If weigh-batch concrete is to be used, the cement shall have to be used as per actual weight and the contractor shall not be entitled for any compensation for loss in weight due to shifting of bags or on account of any other reasons. The cement should be brought from Major Plants

3.0 M-3 SAND:

- 3.1 Sand shall be natural, clean, well graded, hard, strong, durable and gritty particles free from injurious amounts of dust, clay, kankar nodules, or of flaky portion, alkali, salts, organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-In-Charge. If sand is covered with dust, it shall be washed with water to make it clean.

- (A) The sand to be used in cement mortar for masonry works and first coat of plaster should generally satisfy the following grading.

I.S. Sieve	Percentage by weight passing sieve
480	100
230	80-95
120	70-90
60	40-85
30	5-50
15	0-10

The fineness modulus shall not exceed 3.0

- (B) Sand to be used in cement mortar for lining work, pointing and second coat of plaster may have the following gradings:

I.S. Sieve	percentage by weight passing through
480	100
240	100
120	75-100
60	40-85
30	5-50
15	0-10

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The fineness modulus shall not exceed 1.6

- (C) Sand to be used for concrete works shall of grades as specified in I.S. 383. Fineness modulus varying from 2.6 to 3.6 as per requirement.

4.0 M-4 BLACK TRAP GRIT:

- 4.1 Grit shall consists of crushed or broken stone and be hard, strong, dense, durable, clean of proper gradation and free from skin or coating likely to prevent proper adhesion of Mortar. Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provision of IS-383-1970. Unless special stone of particular quarries is mentioned, aggregate shall be broken from the best black trap stone as approved by the Engineer-In-Charge. Grit shall have no deleterious reaction with cement.

- 4.2 The grit shall conform to the following gradation as per sieve analysis.

I.S. Sieve Designation	Percentage passing for sieve
12.50mm	100%
10.00mm	85-100%
4.75mm	0-20%
2.36mm	0-5 %

- 4.3 The crushing strength of grit will be such as to allow the concrete in which it is used to built-up the specified strength of concrete.
- 4.4 The necessary test for grit shall be carried out as per the requirements of IS: 2386 or as revised from time to time as per instructions of the Engineer-In-Charge.

5.0 M-5 BLACK TRAP STONE COARSE AGGREGATE FOR PLAIN AND ORDINARY REINFORCED CONCRETE.

- 5.1 Coarse aggregate shall be of machine crushed stone of black trap and be hard strong, dense durable, clean and free in skin and coating likely to prevent proper adhesion of mortar. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best black trap stone as approved by the Engineer-In-Charge. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However, in case of reinforced cement concrete the maximum limit may be restricted to 6 mm less than the minimum lateral clear distance between bars or 6 mm less than the cover whichever is smaller

TABLE - SIZE OF COARSE AGGREGATE

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I.S. Sieve Designation	Percentage Passing for single and nominal sized aggregate		
	40 mm	20 mm	16 mm
40 mm	85-100	100	-
20 mm	0-20	85-100	100
16 mm	-	-	85-100
12.5 mm	-	-	-
10 mm	0.5	0-20	0-30
4.75 mm	-	0-5	0-5
2.36 mm	-	-	-

Note: This percentage may be varied somewhat by the Engineer-in-charge who considered necessary for obtaining better density and strength of concrete.

5.2 Single size coarse aggregates confirming to the requirements in table No.1 above, or following nominal sizes shall be used at site with the other ingredients of concrete as indicated below. The mixing shall be in a mixture or on the 1:2:4 and C.C. 1: 1 ½:3 mixing with the other ingredient of concrete shall be done in the mixture only except for small work.

- | | | | |
|-----|--------------|---|---------------------------------|
| (1) | C.C. 1:5:10 | - | Nominal size of aggregate 40 mm |
| (2) | C.C. 1:4:8 | - | Nominal size of aggregate 40 mm |
| (3) | C.C. 1:3:6 | - | Nominal size of aggregate 40 mm |
| (4) | C.C. 1:2:4 | - | Nominal size of aggregate 20 mm |
| (5) | C.C. 1:1 ½:3 | - | Nominal size of aggregate 20 mm |

5.3 The grading test shall be taken in the beginning and at the change of the source of materials.

5.4 The necessary test indicated in IS – 383 and IS – 456 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner to prevent the inter-mixing of different aggregates. If the aggregates are covered with the dust, it shall be washed with water to make it clean. The course/aggregates for plain and reinforced concrete shall be measured by volume in the steel or wooden boxes prepared as per the direction of the Engineer-In-Charge.

6.0 M-6 BLACK TRAP STONE COURSE AGGREGATES FOR CONTROLLED REINFORCED CONCRETE
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6.1 Coarse aggregate shall be of machine-crushed stone of black trap and be hard / strong, dense, and durable clean and free from skin and coating likely to prevent proper adhesion of mortar. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap

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stone as approved by the Engineer-In-Charge. Aggregate shall have no deleterious reaction with cement.

- 6.2 In proportion concrete, the quantity of coarse aggregates shall be determined by weight only. The grading of coarse aggregate shall be controlled by obtaining the aggregate in different sizes and blending them in the right proportions as per concrete mix design approved by the Engineer-In-Charge. The different sizes shall be stocked in separate stockpiles; the grading of aggregates shall be checked as frequently as possible. The frequency for verification of the grading shall be as directed by the Engineer-In-Charge to ensure that the grading is maintained uniform with that of the samples used in the preliminary tests.
- 6.3 The necessary test indicated in IS - 383 and IS - 456 shall have to be carried out to ensure the acceptability of the material.

6.4 If aggregate is covered with dust it shall be washed with water to make it clean.

7.0 M-7 BRICKS BAT AGGREGATES

- 7.1 Brick bat aggregate shall be broken from well burnt or slightly over burnt and dies brick. It shall be homogeneous in texture roughly cubical shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm. to 50 mm. size unless otherwise specified in the item. The unburnt or over burnt brick bats shall not be allowed.
- 7.2 The brick bats shall be measured by volume by suitable boxes or as directed.

8.0 M-8 BRICKS:

8.1. First class bricks

- 8.1.1 The bricks shall be hand or machine moulded and made from suitable soils and kiln burnt. They shall be free from cracks and flaws and modules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform colour. The bricks shall be moulded with a frog of 100 mm x 40 mm and 10 mm to 20 mm deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.
- 8.1.2 The size of modular bricks shall be 190 mm x 90 mm x 90 mm. The standard size of bricks shall be $8\frac{3}{4}'' \times 4\frac{1}{4}'' \times 2\frac{5}{8}''$. Bricks conform to I.S. 1077 in respect of tolerance for sub-class a bricks. The size of the conventional bricks shall be 225 mm x 110 mm x 75mm.
- 8.1.3 The crushing strength of the bricks shall not be less than 35 kg/sq.cm. The average water absorption shall not be more than 20 percent by weight. A necessary test for crushing strength and water absorption shall be carried out as per IS: 3495 (Parts I to IV) as directed by the Engineer-In-Charge

8.2. Second Class Bricks

- 8.2.1 The second class bricks shall be similar to first class bricks except that they may be permitted to have slight distorted and rounded edges provided no difficulty shall arise on this account in laying of uniform courses.

9.0 M-9 UNCOURSED RUBBLE MASONRY:

- 9.1 Stone to be used for masonry work such as uncoursed course, R.R. Ashlar etc. shall be try, granite, and Ballast, and some, etc. if any other type of good stone. Any good stone available in the region shall be utilized. The Building Stone shall be through hard, dense, sound, durable, resistance to weathering action reanobly fine grained, uniform in colour and free form beams, creaks and other defects. The exposed face shall be free from discoloration.
- 9.2 Stones when immersed in water for 24 hrs. Shall not abserts water more than 5% of its dry weight when tested according to I.S. 1124-1974 sand stone shall be fine grained good colour and free from salt slabs and tiles of limestone shall confirm to I.S. 1128-1974.
- 9.3 Fare Stone shall be rashly quarried. With clean faces and short edges. It shall be of such character, that it can be brought to required line, carved surface etc. Rubble stone for hearting shall be approved quality. Free from regregnative etc. Royalist, composition, Octroi duties etc. payable in connection with securing stone shall be paid by the contractor.
- 9.4 The measurement shall be taken by volume length or number as the case may be with cubic meter, meter and one as the respective unit. In case rubble, the measurement shall be volume of stock, with cubic meter as unit without deduction of void.
- 9.5 n case of khandldes the measurement shall be numbers for specific size.

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- 9.6 In case of stones such as quoins, the measurement shall be numbers for specific size.
- 9.7 In case of stones such as slabs coping stones etc. the measurement shall be by volume with cubic meter as unit for specified dimensions.

10.0 M-10 MILD STEEL BARS

- 10.1 Mild steel bars reinforcement for R.C.C. work shall conform to IS. 432 and shall be of tested quality. It shall also comply with relevant part of IS. 456. All the reinforcement shall be clean and free from dirt, oil, paint, grease, mill scale or loose or thick rust at the time of placing.
- 10.2 Reinforcement steel shall be stored such as to avoid distortion and sags of long length and shall be protected as far as possible from surface deterioration. All bars of the same designation shall be stacked separately as far as possible and distinctly marked.
- 10.3 For the purpose of payment the bar shall be measured correct up to 10 mm length and weight payable worked out at the rate specified below.

(1)	6 mm	0.22 Kg/Rmt.
(2)	8 mm	0.39 Kg/Rmt.
(3)	10 mm	0.62 Kg/Rmt.
(4)	12 mm	0.89 Kg/Rmt.
(5)	14 mm	1.21 Kg/Rmt.
(6)	16 mm	1.58 Kg/Rmt.
(7)	18 mm	2.00 Kg/Rmt.
(8)	20 mm	2.47 Kg/Rmt.
(9)	22 mm	2.98 Kg/Rmt.
(10)	25 mm	3.85 Kg/Rmt.
(11)	28 mm	4.83 Kg/Rmt.
(12)	32 mm	6.31 Kg/Rmt.
(13)	36 mm	7.99 Kg/Rmt.
(14)	40 mm	9.86 Kg/Rmt.

M-11 TMT BARS:

11.1 Scope of work:

- 11.1.1 The scope of work consists of providing and laying mild steel reinforcement and TMT reinforcement for RCC works of various components of the structure. This may be of Tiscon, Sulekhram, SAIL or Punjab Rolling Mill or any other Approved make. This includes cuttings, bending, binding, placing, with all Equipments and labour required for the work as directed by
- 11.1.2 The Engineer-in charge and all operations covered within the intent and purpose of the Specification.

11.2 Bending of Reinforcement:

11.2.1 Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to the relevant IS codes (latest revision). Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-charge using a proper bar bender, operated by hand or power to attain proper radii of bends. Bars shall not be bent or strengthened in a manner that will cause injury to the material. Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending.

11.2.2 The bending of the TMT bars shall be carried out as per the following:

Operation Size TMT Fe-415

1. Bend Up to 22 mm dia. 3d
Over 22 mm dia. 4d
2. Rebend Up to 10 mm dia. 4d
Over 10 mm dia. 5d

11.3 Placing of Reinforcement:

11.3.1 All reinforcing bars shall be accurately placed in the exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and conforming to IS : 280 and by using stays blocks or metal chairs, spacer, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be neither allowed to sag between supports nor displaced during concreting or any other Operation over the work. All devices used for positioning shall be of no corrodible material. Wooden and metal supports will not extend to the Surface of concrete, except where shown on the drawings, Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout. In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed up to a level just below them. Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the Engineer-in-charge. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1 1/4 times the maximum size of the coarse aggregates whichever is greater, by concrete between them. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less

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than 1mm thickness twisted tight in eight shapes around the lapped bars. The overlaps shall be staggered for different bars and located at fixed locations only along the span where neither shear nor bending moment is maximum.

11.4 Welding of Bars

11.4.133 per cent of the rods are welded. No pre-warming or post heat treatment is necessary. Interpose temperature should be limited to 200oC with low heat input and equivalent strength low hydrogen type electrode. Suitable means shall be provided for holding the bars securely in position. Welding of TMT bars can be permitted if specified on the drawings, joints of Reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section, not more than during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust. Grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer-in-charge.

11.0 M-12 C.R.S. BARS:

12.1 Scope of work:

12.1.1The scope of work consists of providing and laying mild steel reinforcement and CRS Bars reinforcement for RCC works of various components of the structure. This may be of Tiscon, Sulekhram, SAIL or Punjab Rolling Mill or any other Approved make. This includes cuttings, bending, binding, placing, with all Equipments and labour required for the work as directed by the Engineer-in charge and all operations covered within the intent and purpose of the Specification.

12.2 Bending of Reinforcement:

12.2.1Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to the relevant IS codes (latest revision)

12.2.2Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-charge using a proper bar bender, operated by hand or power to attain proper radii of bends. Bars shall not be bent or strengthened in a manner that will cause injury to the material. Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending.

12.2.3The bending of the CRS BARS bars shall be carried out as per the following:

12.3 Operation Size CRS BARS Fe-415

1. Bend Up to 22 mm dia. 3d

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Over 22 mm dia. 4d

2 .Rebend Up to 10 mm dia. 4d

Over 10 mm dia. 5d

12.4. Placing of Reinforcement:

12.4.1 All reinforcing bars shall be accurately placed in the exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and conforming to IS: 280 and by using stays blocks or metal chairs, spacer, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be neither allowed to sag between supports nor displaced during concreting or any other Operation over the work. All devices used for positioning shall be of no corrodible material. Wooden and metal supports will not extend to the Surface of concrete, except where shown on the drawings, Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout. In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed up to a level just below them. Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the Engineer-in-charge. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1 1/4 times the maximum size of the coarse aggregates whichever is greater, by concrete between them. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1mm thickness twisted tight in eight shapes around the lapped bars. The overlaps shall be staggered for different bars and located at fixed locations only along the span where neither shear nor bending moment is maximum.

12.5 Welding of Bars

12.5.133 per cent of the rods are welded. No pre-warming or post heat treatment is necessary. Interpose temperature should be limited to 200oC with low heat input and equivalent strength low hydrogen type electrode. Suitable means shall be provided for holding the bars securely in position Welding of CRS BARS can be permitted if specified on the drawings, joints of Reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section, not more than during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned property. Ends of the bars shall be cleaned of all

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loose scale, rust. Grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer-in-charge.

12.6 Chemical Composition

CRS Bars should have of grade Fe-415, IS:1786 grade.

Chemistry	Unit	IS:1786 Fe-415
Carbon	%	0.3 max
Carbon equivalent (C+Mn/6)	%	0.38 max
Sulphur	%	0.060 max
Phosphorous	%	0.060 max
S & P	%	0.110 max
Nitrogen	ppm	100x

12.6.1 Mechanical Properties

Mech. Properties	Unit	IS:1786 Fe-415
Yield Stress	N/mm	415 min
Tensile Stress	N/mm ²	10% over YS
Elongation	% min	14.5 min

12.6.2 Bond Strength

12.6.2.1 The rib pattern of CRS bars has been specially designed to ensure that excellent bond strength exists between the bar and the surrounding concrete. The ribs are cut by automated milling machines which produce uniform and concrete ribs.

12.6.2.2 While the specification stipulates that bond strength should be 40% higher than that of Mild Steel plain bars.

12.6.3 Standard Sizes and Useful Data

Section (mm)	Nominal Weight (kg/meter)
8	0.395

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10	0.617
12	0.888
16	1.58
20	2.47
25	3.85
28	4.83
32	6.31
36	7.99
40	9.85

13. M-13 MILD STEEL BINDING WIRE:

13.1 The mild steel wire shall be of 1.63 mm or 1.22 mm (16 or 18 gauge) diameter and shall conform to IS-280 or as revised from time to time.

13.2 The use of black wire will be permitted for binding reinforcement bars. It shall be free from dust, oil paint, grease, loose mill scale or any other undesirable coating, which may prevent adhesion of cement mortar.

13.3 Storage:

13.3.1 The wire coils shall be stored such as to avoid deterioration.

13.4 Measurement:

13.4.1 No measurement will be taken of the wire used for tying reinforcement bars. The rate for reinforcement steel and its fabrication shall include the cost of binding wire.

14 . M-14 STRUCTURAL STEEL:

14.1 All structural steel shall conform to IS-226 and IS-800 or as revised from time to time. The steel shall be free from the defects mentioned in IS. 226 and shall have a smooth finish. The Material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall be conforming to IS-1148.

14.2 Structural steel shall be stored such as to avoid distortion of section of long length and shall be protected as far as practicable from surface deterioration. It should be so stored and handled that material will not be subjected to excessive stress and damages. All deformed structural material will be properly straightened by methods, which are not injurious prior or being, and off, punched or otherwise worked in the shop. Sharp kinks and bends shall be caused for rejection.

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- 14.3 When the steel is supplied by the Contractor test certificate of the manufactures shall be produced, if so required by the Engineer-In-Charge. If further test be necessary, they will be done according to IS-226 and IS-23 or as revised from time to time.

15 M-15 SHUTTERING:

- 15.1 The shuttering shall be either of wooden planking of 30mm minimum thickness with or without steel sheet lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical bellies properly cross braced together so as to make the form work rigid.
- 15.2 The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.
- 15.3 If at any stage of work during or after placing concrete in the structure the form work sags or budes out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequate rigid form work. The complete formwork shall be got inspected by and approved from the Engineer-In-Charge before the reinforcement bars are placed in position.
- 15.4 If wooden props are used, the props shall consist of bellies having 100 mm minimum diameter measured at mid length and 80 mm at thin end and shall be placed at 1 to 1.20m spacing. These shall rest squarely on wooden sole places 40 mm thick and minimum bearing area of 0.10 sq.m. Lay on sufficiently hard base.
- 15.5 Double wedges shall further be provide between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.
- 15.6 The timber used in shuttering shall not be so dry as to absorb water from concrete and swell budge nor so green or wet as to shrink after erection. The timber shall be properly swan and planned on the sides and the surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel shall be permitted.
- 15.7 As far as practicable clamp shall be used to hold the forms together and use of nails and spikes avoided.
- 15.8 The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface.
- 15.9 The shuttering for beams and slabs shall have camber of 4 mm per meter (1 in 250) or as directed by the Engineer-In-Charge so as to offset the subsequent deflection. For cantilever

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the camber at free end shall be $\frac{1}{50}$ of the projected length or as directed by the Engineer-In-Charge.

15.10 The period that shall elapse after the concrete has been laid before easing and removal of centering and shuttering as under taken shall be as follows.

PART OF STRUCTURE	PERIOD
1. Sides of Foundation, Columns beams & walls.	24 to 48 hours.
2. Undersides of slabs up to 4.5 m span.	7 days.
3. -do- above 4.50 m and underside of Beams and arches up to 6 m span.	14 days.
4. -do- above 6 m span & up to 9 m. span	21 days.
5. Inner sides of beams and arches over 9 m span.	28 days.
6. Domes, shell & other structures of Special nature.	as per instruction

15.11 Work damaged through premature or careless removal of forms shall be reconstructed.

15.12 The period for striking the form work shall be 0.5 times more in case of Pozzolana Cement if used than that of the ordinary Portland cement and the contractor shall not entitle for any extra claim for the same.