

# SABARMATI RIVER FRONT DEVELOPMENT



Sabarmati River Front Development Corporation Limited

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## BID DOCUMENT

**GUNITING, GROUTING & STRENGTHENING FOR OLD DIAPHRAMGM WALLS STRUCTURES AT EAST & WEST BANK IN SABARMATI RIVER OF SABARMATI RIVERFRONT DEVELOPMENT PROJECT.**

**Contract Package: SRFDCL**

**VOLUME- 02**

**IV) Technical Specification**



**SECTION IV**  
**TECHNICAL SPECIFICATONS**



**TECHNICAL SPECIFICATION  
FOR  
CIVIL WORKS**



#### ITEM NO-01

**Providing form work of ordinary timber planking so as to give a rough finish including centering shuttering strutting and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4M. and removal of the same for in situ reinforced concrete and plain concrete work in.(A)Foundations Footings Bases of Columns etc. and Mass concrete.**

##### **Mode of Measurement and Payment**

The item shall be measured and paid in sqm..

#### ITEM NO-02

**Providing and applying external finish of average 2 to 2.5mm thick acrylic polymer based texture and pattern with standard tool and applicator as specified by manufacturer on exterior surfaces at all heights including scaffolding to give even shades including thoroughly brushing the surfaces free from mortar dropping and other foreign matter and sand paper smoothed etc. complete as per the manufacture specifications and up to the satisfaction of Engineer in-charge/ Architect. The rate includes making of grooves, pattas and finishing as directed by Architect/ EIC. Paint shall be measured and paid in separate tender item.**

##### Material

- 1.1 Textured Wall Finish
- 1.1.1 Texture shall be of approved make.
- 2.0 Workmanship
- 2.1 Relevant specifications shall be followed as per item No. 11.05 except texture finish average 2 to 2.5mm thick acrylic polymer textured of approved make shall be used and the paint shall be applied with standards tools and applicators as specified by the company and under close supervision of representatives of companies. Sample shall be got approved prior to application.
- 2.2 Rate will be inclusive of including thoroughly brushing the surfaces free from mortar dropping and other foreign matter and sand papered smooth.
- 3.0 Mode of Measurement and Payment
- 3.1 The item shall be measured and paid in sqm. No extra will be paid for the protective coat on textured wall finish. External paint shall be paid in relevant tender item.

#### ITEM No-03

**Providing, supplying and operating required vehicles/machineries on riverfront for diff. maintenance work including diesel, driver etc. all complete as directed by eng. In charge.**

- (A) JCB
- (B) Welding machine including welder
- (C) Electric Breaker with operator
- (D) TRACTOR
- (E) Rent of DG set per shift in (with diesel)

Measurement will be done in day work for dumper/tractor/ Tractor Breaker /JCB/JCB breaker/ Welding machine including welder/ Rent of DG set /Electric Breaker with operator for per day.

#### ITEM No-04

**Sealing of crack / porous concrete with Epoxy Grout by injection through nipples complete as per MORTH Clause 2803.1**

General The work of structural bonding of concrete using epoxy adhesive shall conform to these Specifications.



Section 2800 Repair of Structures 2803.2 The Contractor shall furnish a method statement giving details of methodology of construction, sources of supply of materials, tools, equipment, and appliances to be used on work, personnel and supervision.

2803.3 Personnel The Contractor's personnel shall be qualified and experienced in epoxy injection process.

2803.4 Material The material for injection shall be suitable two-component low viscosity epoxy resin, having the required characteristics of bonding with concrete and resistance to moisture penetration. Epoxy mortar or polysulphide resin may be used for sealing the surface. The material for epoxy injection shall conform to the following:

i) The resin and hardener shall be mixed by weight and the mixing ratio shall generally be between 1 pbw (parts by weight) to 50 pbw subject to manufacturer's recommendation.

ii) Neither the mixed epoxy adhesives nor their individual component shall contain solvents and thickeners.

iii) The components shall be free of lumps or foreign material. The viscosity of the individual components shall not change more than  $\pm 15$  percent kept in closed containers at 25°C after two weeks.

iv) Consistency of mixed adhesive shall satisfy the requirements given in Table 2800-1. Table 2800-1: Consistency of Adhesive Standard Version Low Viscosity (cps) Version (cps) Viscosity of Mixed Adhesive at 25° C (200-300) (100-190) Pot Life of mixed adhesive at 25° C 1 hour  $\pm$  15 minutes\* Set time of mixed adhesive at 25°C 3- 6 hours \* In the case of two component injection system where resin and hardener get mixed at point of injection pot life at 25°C shall be not greater than 15 minutes  $\pm$  10 minutes, 2803.5

Equipment for Injection The equipment shall be portable positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at nozzle. The pumps shall be generally electrically powered and shall provide in-time metering and mixing. The tolerance \ Repair of Structures Section 2800 on mix ratio shall be 5 percent by volume. The injection equipment shall have automatic pressure control capable of discharging mixed adhesive at any pre-set pressure within the prescribed limits and shall be additionally equipped with a manual pressure control. The injection equipment shall be equipped with sensors on both the components A and B reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head. If considered appropriate, suitable compressed air operated epoxy injection gun can be used with prior approval of the Engineer for manual injection of mix when resin and hardener had been mixed in a separate unit.

2803-6 Preparation Surfaces adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil efflorescence or other foreign matter by brushing/water jetting/sand blasting. Acids and corrosives shall not be permitted for cleaning. Entry ports shall be provided along the crack at intervals of not more than the thickness of concrete at the location. Surface seal shall be applied to the face of the



crack between the entry ports. For through cracks, surface seal shall be applied to both faces. Before proceeding with the injection, it shall be ensured that the surface seal has gained adequate strength corresponding to concrete strength of the member and to withstand the injection pressure.

2803.7 Epoxy Injection Injection of epoxy adhesive shall begin at the lowest entry port and continue until the epoxy adhesive appears at the next adjacent entry port. The injection shall then be discontinued at the first entry port which shall be sealed. Thereafter, epoxy injection shall be carried out from the next adjacent port and continued successively from each port until the crack is completely filled. If travel of epoxy adhesive from one port to the next does not occur, the work shall be stopped immediately. In case the volume of the injected material exceeds 2 litres for a particular entry port, the work shall be stopped and the specifications may be reviewed. Section 2800 Repair of Structures.

2803.8 Precautions for Application 2803.9 2803.9.1

a) Temperature of components A and B, i.e., resin and hardener shall be between 10°C and 35°C at the time of mixing unless otherwise specified.

b) Temperature of structural member during epoxy injection shall be between 10°C and 35°C unless otherwise specified.

c) Immediately prior to use, each component shall be thoroughly mixed with a clean paddle. The paddle shall be of a type that does not propel air into the material. Separate clean paddle shall be used for each component.

d) Any heating of the adhesive components shall be done by application of indirect heat; in case the work is to be done in cold climate.

e) Just before use, the two components shall be thoroughly mixed in the ratios specified by the manufacturer. The mixing time shall be strictly in accordance with manufacturer's recommendations. When adhesives with different coloured components are mixed, the mixture shall have a uniform colour without streaks.

f) The use of solvents and thinners shall not be permitted except for cleaning of equipment. Testing Material Testing Prior to approval of material, the following tests shall be carried out by the Contractor at site or in an authorised laboratory for each batch of resin and hardener and each combination. i) Viscosity test for resin and hardener and the mix: three specimens each. ii) Pot life test: three specimens each. iii) Bond test: three specimens each. iv) Shear test: six specimens each, 3 after 24 hours and the other three after 72 hours of curing. Subsequent tests shall be carried out as directed by the Engineer. Procedure for tests shall be as below: i) Pot Life Test a) 500 gm of resin formulation shall be prepared by thoroughly mixing the resin and hardener/ accelerator/ catalyst component in proposed proportion in a 1 kg capacity hemispheric Repair of Structures Section 2800 porcelain bowl by means of a spatula or any other agitating device and the ambient temperature noted. b) The resin formulation shall be applied with a clean dry 25 mm size painter's brush, on a clean dry surface such as cement concrete over 150 mm - 200 mm length, starting immediately after mixing the formulation and repeating the operation every five



minutes. When it becomes just difficult to spread the resin properly with the brush, the time is noted. The time elapsed since completion of mixing of resin formulation, is taken as its pot life. c) One pot life test shall be performed on commencement of work and the same shall be repeated every four hours. d) In case the material fails to satisfy the pot life test, it shall not be used for injection. Where the resin and hardener get mixed at point of injection, the pot life is not important and no tests may be required. ii) Bond Test A standard 150 mm diameter and 300 mm long concrete cylinder shall be cast in 2 pieces by providing a separating medium at an axis of 45 degrees to the longer axis of the cylinder as shown in Fig. 1 of Appendix 2800/1. Three such split cylinders shall be prepared. Two pieces of each cylinder shall be joined with epoxy mortar at four points to give a clear gap of about 0.2 mm, which will be injected with epoxy resin at site. After epoxy has been cured, load test shall be carried out on the cylinder. The failure shall not take place at the joint injected with epoxy resin. Also the strength of cylinder at failure shall not be less than 80 percent of the 28 days' cube strength of the concrete mix. iii) Shear Tests Two steel plates, minimum 3 mm thick, shall be bonded with epoxy at site using the same resin mix as used/proposed to be used for injection. The assembly shall be kept in mechanical clamp till epoxy is cured. A total of six specimens shall be prepared for each batch of materials. Three test specimens shall then be subjected to a shear force along the axis after 24 hours and the minimum shear strength before failure shall not be less than 1 MPa (Refer Fig. 2 of Appendix 2800/1). The remaining test specimens shall be similarly tested after 72 hours of curing. The shear strength before failure shall not be less than 2.5 MPa. Section 2800 Repair of Structures 2803.9.2 Core Test If directed by the Engineer, cores shall be tested for the acceptance of the work. The selection of the location of cores shall be as directed by the Engineer in such a way that damage in critical/stressed areas of the structure is avoided. The Contractor shall obtain 50 mm diameter initial core samples in the first 50 linear metres. Thereafter, frequency of core sampling shall be as specified or as agreed by the Engineer. The depth of the core shall normally be less than 200 mm. Tests and Acceptance Criteria shall be as follows: a) Penetration- Visual examination of the core should show epoxy adhesive filling a minimum of 90 percent of the crack.

b) Bond Strength- When tested for bond, concrete failure should occur before adhesive failure. Also, minimum bond strength of 40 MPa should be developed with no failure of either concrete or adhesive. If the cores taken in first 50 m length pass tests as specified above, epoxy adhesive injection work at area represented by cores will be accepted. If cores fail either by lack of penetration or bond strength, work shall not proceed further until the areas represented by the cores are re-injected and re-tested for acceptance. Filling of Core Holes Two-component bonding agent shall be applied to surfaces of cored holes followed by filling of non-shrink cement grout mix placed by hand trowel, thoroughly rodded and tamped in place. The surface shall be finished to match the finish and texture of existing concrete to the satisfaction of the Engineer. Materials to be used and procedures for filling core holes shall be got approved by the Engineer before proceeding with work.

2803.9.3 Test for Injection Equipment At all times during the course of the work, the Contractor shall keep complete and accurate records and make available to the Engineer, the results of the pressure and



ratio tests specified below so that the efficacy and accuracy of the injection equipment is verified. The Engineer at any time may direct the Contractor to conduct additional tests in his presence.

**Pressure Test** The mixing head of the injection equipment shall be disconnected and the two adhesive component delivery lines shall be attached to Repair of Structures Section 2800 the pressure check device, which shall consist of two independent valved nozzles capable of sensing the pressure. The check device shall be closed and equipment operated until the gauge pressure in each line reads 5 MPa. The pumps shall be stopped and the gauge pressure shall not drop below 4 MPa within 2 minutes. The pressure test shall be run for each injection unit at the beginning and after break of every shift.

**Ratio Test** The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously through the ratio check device, which shall consist of two independent valved nozzles. There shall be a pressure gauge capable of controlling back pressure by opening or closing valved nozzles capable of sensing the back pressure behind each valve. The discharge pressure shall be adjusted to read 5 bar for both adhesive components, which shall be simultaneously discharged into separate calibrated containers during the same time period. The amounts thus discharged shall be compared to determine whether the volume/discharge conforms to the manufacturer's recommended ratio for applicable material.

159 Mode of Measurement: Measurement for sealing of cracks and injection shall be made by weight of epoxy consumed in kg for epoxy grouting. The rate includes all materials, labour, and everything required to execute this item. Note: Item rate is inclusive of total no. of nozzles or nipples (calculation for number of nozzle or nipple =  $\text{grout kg}/3.625=7975/3.625=2200$ ).

#### **ITEM No-05**

Providing Surface preparation for the damaged concrete members by removing loose, cracked and unsound concrete to expose steel reinforcement completely using heavy duty mechanical breakers with the depth of cutting extended beyond 10mm of main reinforcement followed by cleaning the surface using High-pressure water jet at suitable pressure to remove all loose particles, organic matter, marine growth and impurities from the concrete surface making it suitable for repair inclusive all Manpower, Material and Equipment.

Removal of existing affected, distressed, loose cover concrete including loose damaged concrete from all structural members up to beyond the corroded steel reinforcements to a depth of 10 mm minimum behind the reinforcement only at affected concrete (Good & sound concrete should not be chipped / damaged) by chipping / hacking with chisel and hammer or by mechanical means like light weight chisel hammer, etc. for all height as per Technical Specification without causing detrimental effect to any part of the bridge structure and removal and disposal of debris at designated location including all material, labour, tools, plant and machineries, lead & lifts etc Complete as directed by Engineer-in-charge and/or Consultant.  
Application Procedure:

1. Provide props & other suitable arrangements to relieve the structural members stress and strains wherever feasible.
2. Scaffolding/ working platforms of suspended / suitable type shall be erected as per therequirement.
3. Provide the protective screen or suitable arrangements to minimize falling of debris on serviceroad below / river in any case.
4. Mark all the loose areas of damaged concrete after basic inspection.
5. Making dents using electrical / manual equipment's and remove the damaged part as required by engineer in charge.
6. Clearing the surface after chipping with wire brush or buffing machine.



Mode of Measurement: The rate includes labour, material, equipment etc. The measurement & mode of payment shall be in sq.mt basis.

#### ITEM No-06

Providing and laying of polymer modified micro concrete like Renderoc RG (L) of Fosroc / Master emaco S346 / T 288 of BASF / or SIKA equivalent with washed saturated surface dry (SSD), graded, low absorption, high density, aggregates of size 5 mm to 10 mm at 30 % minimum by weight of micro concrete and water at 4 lit. per 25 kg bag and pouring into the form work using suitable arrangement or if required using pumping device for uniform flow of micro concrete. The side shuttering can be removed after 3 days and bottom shuttering after 7 days ensuring proper bond between the micro concrete and the existing concrete sub strate. Item rate is inclusive of the materials all labor, supervision, tools and tackles and transportation including shuttering etc. complete as per specification and as directed by EIC. (Considering Avg. Thickness of 150 mm)

MORT&H specifications (5 th Revision) shall be followed in connection with this item. All relevant provisions as have been included in the respective IRC and IS a specification are also applicable.

The measurement shall be in cum. The rate includes all materials, labour, and everything required to execute this item.

#### ITEM No-07

Grouting done by inject process in RCC/PCC irrigation structure's components through Nipples with pressure 3 to 7 kg/cm<sup>2</sup> and as per instruction, with materials

(1 bag cement of 50kg of 53 grade with Sika latex of FBR of equivalent quality 2Lit + Sika 4A or equivalent quantity 1 Lit + FL 40 or equivalent quantity 8kg + Fair add or intra plast or equivalent quantity 400 grams with sufficient water for easy grout )

The rate includes cost of materials ,labours scaffolding ,equipment etc. and materials to be used of BIS quality only.

The measurement shall be in Smt. The rate includes all materials, labour, and everything required to execute this item.

#### ITEM No-08

Providing and laying of cement concrete of R.C.C.M25 grade as per the specifications for base slab and key of RCC retaining wall, any other structure for encasing of underground services as per drawing and as directed by the Engineer in Charge. Rate shall include cost of formwork but exclude cost of reinforcement.

2.12.2 Including the cost of centering, shuttering (as per specification), but excluding the cost of reinforcement

2.12.2.1 Upto Plinth level

2.12.2.1.1 M10

2.12.2.1.2 M15

2.12.2.1.3 M20

2.12.2.1.4 M25

2.12.2.2 Above Plinth level

2.12.2.2.1 M10

2.12.2.2.2 M15

2.12.2.2.3 M20





	At 7 days	At 28 days	Max size of agg. In mm
M-10	7	10	20
M-15	10	15	20
M-20	13.5	20	20
M-25	17	25	20
M-30	21	30	20
M-35	24	35	20
M-40	28	40	20

In all cases, the 28 days compressive strength specified in above table be the criteria for acceptance or rejection of the concrete.

2.6 Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for all purposes as concrete belonging to the lower of the two grades between which its strength lies.

2.7 The Contractor shall take necessary care to avoid sand streaks, air holes, honey combining etc., on finished concrete surface.

## 2.8 Proportioning

2.8.1 The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work and the supply of properly graded aggregate of uniform quality can be maintained till the completion of work. Grading of aggregate shall be controlled by obtaining the coarse aggregate, in different sizes and blending them in the right proportions as required. Aggregate of different sizes shall be stocked in separate stock piles. The required quantity of material shall be stock piled several hours, preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading, as approved for samples used in the preliminary tests.

2.8.2 In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag a reasonable number of bags shall be weighed separately, to check the net weight, where cement is weighed from bulk stocks at site and not by bags. It shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in clean and serviceable condition. Their accuracy shall be periodically checked and calibrated in standard laboratory.

2.8.3 It is most important to keep the specified water cement ratio constant and at its correct value. Moisture content in both fine and coarse aggregates shall be determined by the engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates IS : 2386 (Part III) shall be referred. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content.

2.8.4 The minimum cement content for the various mixes shall be as per IS: 456-2000.



2.8.5 All RCC works shall be carried out as per the detailed drawings and direction of Architects and Engineer-in-charge. The concrete shall be placed at all heights, levels and for all shapes.

3.0 Mode of Measurement and Payment

3.1 The relevant specifications of item no. 5.4.11.1, 5.4.11.4, 5.4.11.5, 5.4.12, 5.4.13 shall be followed. The rate shall be included or exclude the cost of centering and shuttering will be as specified in the item.

3.2 The rate shall be for a unit of one cum.

The rate shall be inclusive of chemical admixture like plasticizer etc. as directed by the engineer-in-charge. No extra payment shall be paid for.

**ITEM No-09**

**Cutting and making of groove up to depth of 25 to 50 mm, 100 to 125 mm for repairing of cracks in RCC floors with cutter machine and operator etc. complete as directed by engineer in charge.**

This item includes Cutting and making of groove up to depth of 100 to 125 mm for repairing of cracks in RCC floors with cutter machine and operator etc. complete as directed by engineer in charge.

The Mode of measurement and rate shall be given as per Running meter basis.

**ITEM No-10**

**Dismantling of structure. The contractor rate includes all necessary machinery, labour for dismantling, constructing of ring bund, shoring, strutting, dewatering, finishing the broken edges, etc. complete as instructed by engineer In charge including disposing of dismantled material with all lead and lift.**

**a) PCC/DLC & RCC.**

**1.0 Workmanship**

1.1 The relevant specifications of items no. 13.01.a shall be followed except that demolition of RCC Work is to be done.

1.2 Where ever necessary while breaking concrete for RCC slabs, a complete centering should be done below, as if a new slab is to be cast. Breaking is being done from upper level. The centering should be strong to withstand impact and vibration while working with breaker. Sometimes there is a temptation to work from one edge and proceed towards the other edge, working on the reinforcement jail, this would results into avoidance of centering with another objective of dropping the debris to the lower level without involving extra labour. In the distressed structure, it cannot be relyed on reinforcement to carry load of men and machinery. Corroded steel might give way any time. If fresh slab is not to be cast at the same location, reinforcement is cut off after removal of concrete.

1.3 While breaking concrete for RCC beams, care should be taken to support slabs on both sides of the beam. If beam is to be retrofitted after partial removal of concrete, all superimposed loads should be relieved and adequate props be placed at selected locations below the beam too. In case of partial precise demolition of beams, manual breaking might be advantageous.



1.4 Column demolition is normally partial only. Before executing demolition of column, adequate props have to be provided to transfer of loads from the uppermost level up to the working level. Damaged concrete should be removed all round including the one behind the corroded bars, very carefully, preferably manually.

2.0 Mode of Measurement and payment

2.1 The relevant specifications of items No. 13.01.a shall be followed except that the demolition of reinforced concrete structure. The unserviceable materials shall be disposed of all leads and lifts. The rate excludes scraping straightening of reinforcement but includes cutting of reinforcement.

2.2 The rate shall be for a unit of one cubic meter.

Dismantling steel work

1.0 Materials

1.1 The relevant specifications of item no. 13.01.a shall be followed except that the dismantling of steel works shall be carried out.

2.0 Mode of measurement and payment

2.1 The relevant specifications of item No. 13.01.a shall be followed.

2.2 The weight of the member shall be computed from standard tables unless the actual weight can be readily determined.

2.3 Riveted works where rivets are required to be cut, the same shall be carried out under this item and nothing extra shall be paid.

2.4 In farmed steel gate, the weight of any covering materials of filling such as iron sheets and expanded metal shall be added to the weight of the main articles if such covering is not ordered to be taken out separately.

2.5 The rate includes stacking the materials as and where directed with all leads and lifts.

2.6 The rate shall be for a unit of one kg.

#### ITEM No-11

Supplying, erecting, placing, lowering in position by suitable method HYSD (TMT) Fe 500 Reinforcement conforming to IS 1786 of all categories of RCC works as per design at all levels including transporting steel to the work site, handling, decoiling, cutting, bending, cranking, fabricating to required shape, placing in position and tying / binding the system with 18 gauge annealed (with two strands) wires, welding if necessary etc. complete as per specifications and as directions by the Engineer-in-charge. Measurement will be made on the length basis and converted into weight by using standard co-efficient (rolling margin's and wastage shall not be paid). The quoted rate should be inclusive the cost of Binding wire, laps, chairs, hooks for lifting, spacers etc and the same will not be measured and paid separately.

2.17.a1 Mild steel reinforcement, yield stress not less than 250 N/mm<sup>2</sup>

2.17.a2 High yield deform steel bars Fe-415, yield stress not less than 415 N/mm<sup>2</sup>

2.17.a3 TMT bars- Fe-415, yield stress not less than 415 N/mm<sup>2</sup>

2.17.a4 TMT bars Fe- 500, yield stress not less than 500 N/mm<sup>2</sup>

2.17.a5 TMT bars Fe- 550, yield stress not less than 550 N/mm<sup>2</sup>



2.17.a6 TMT bars- CRS Fe- 500, yield stress not less than 500 N/mm<sup>2</sup>

2.17.a7 TMT bars- CRS Fe-550, yield stress not less than 550 N/mm<sup>2</sup>

1. Material

1.1 Reinforcement

1.1 Reinforcement shall conform to M-17.

1.2 Binding Wire

1.2 Binding Wire shall conform to M-18.

2. Workmanship

2.1 CPWD Technical specifications clause no. 5.3.1 and 5.3.2 is to be followed.

2.2 The type of reinforcement shall be as per the item description. The contractor shall submit the test certificate from steel manufacturer as and when required. The test results shall be verified, if required in any reputed laboratory.

2.3 Bar bending schedule shall be made by the contractor before starting the work. The payment shall be done based on quantity worked out in bar bending schedule. The bar bending schedule shall be prepared as per SP 34.

2.4 All the reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position with 18 gauge MS binding wire as approved by Engineer-in charge. The rebars shall be placed with stay blocks or metal chair spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars shall not be allowed to sag between supports nor displaced during concreting or any other operations of the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports shall not extend to the surface of concrete, except where shown on drawing. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall not allowed. Pieces of broken stone or brick and wooden blocks shall not be used. Layers of bars shall be separated by spacer bars at 1m c/c , Precast cover blocks in cement mortar 1:2 ( 1cement : 2 coarse sand) about 4 X 4 cm square section or 4 cm dia round section or PVC cover blocks shall be used to maintain the cover of the concrete members as directed by Engineer In charge or Architect. 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 prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawing. All the bars projecting from concrete and to which other bars are to be spliced and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout.

2.5 Bars crossing each other where required shall be secured by 18 gauge GI binding wires (annealed) of size not less than 1 mm., in such manner than they do not slip over each other at the time of fixing and concreting.

1.1 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. Where directed and practicable overlapping bars shall not touch each other, but be kept apart by 25 mm. or 1.25 times the maximum size of the coarse aggregate, whichever is greater by concrete between them. Where not feasible, overlapping bars shall be bound with annealed wires not less than 1 mm. thick, twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending movement is maximum in beam and slab.

1.2 Whenever indicated on the drawings or desired by the Architect and Engineer-in-charge, bars shall be joined by couplings which shall have a cross section sufficient to transmit the full stresses of bars. The



ends of the bars that are joined by coupling shall be upset for sufficient length so that the effective cross sectional the base of threads is not less than normal cross section of the bar. Threads shall be standard threads. Steel coupling shall conform to IS : 226.

- 1.3 When permitted or specified on the drawings, joints of reinforcement bars shall be welded with appropriate welding rod as per the instructions given by Structural Engineer. The type of welding, size of fillet etc shall be as approved by Structural Engineer. Welded joints shall preferably be located at points when steel will not be subject to more than 75 % of the maximum permissible stresses and welds so staggered that any one section not more than 20 % of the rods are welded. Only electric arc welding using a process which excludes air from the molten metal and conforms to any or all other special provisions for the work shall be accepted. Suitable means shall be provided for holding bars securely in position during welding. It shall 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. The M.S electrodes used for welding shall conform to IS: 814. Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed. Welding shall be done by electric arc process as per IS : 816 and IS : 823.
- 1.4 At the time of concreting, a bar fitter shall remain at site to keep the reinforcement in position.
- 2.10 Rolling margin shall be checked for each lot of steel received at site. This rolling margin shall be considered for reconciliation of steel at the end of the project or after the end of each month as per the decision of engineer -in charge.
- 3.0 Mode of Measurement and Payment
- 3.1 Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Where welding or coupling is resorted to in place of lap joints, such joints shall be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in tones by using standard IS co-efficient. Length shall include hooks at the ends. The wastage of steel and binding wires shall not be measured and paid extra. The rolling margin of steel shall not be paid extra.
- 3.2 The rate for reinforcement shall include the cost of labour and material required for all operations described above like cleaning of reinforcement bars, straightening, cutting, hooking, bending, binding, welding placing in position etc. as per the drawing or directed by the Architect or engineer-in-charge Rate shall also include the cost of GI binding wires of 16 to 18 gauge, devices like chairs, pins, spacer bars, cover blocks of PVC or cement mortar etc. for keeping reinforcement in position. The rate shall for an unit of MT.

#### ITEM No-12

##### **Providing and supplying departmental labour for all type of work including all tools and tackles.**

This item includes providing and supplying departmental labour for all type of work including all tools and tackles as directed by engineer in charge.

The rate per No. for day work with 8 hour working shift/day.

#### ITEM No-13

##### **Providing and supplying departmental mason/carpenter/fabricator/Plumber for all type of work including all tools and tackles.**



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This item includes providing and supplying departmental mason/carpenter/fabricator/Plumber for all type of work including all tools and tackles as directed by engineer in charge.

The rate per No. for day work with 8 hour working shift/day.