TECHNICAL SPECIFICATION FOR CIVIL WORKS

1 Cable Trench:

Construction of cable trench (Three tier/ Four Tier) as per approved design & Drawing as per directives of Engineer-in-charge with required excavation as per site condition, Base concreting, Providing & laying of reinforcement as per design, concreting of M-20 grade for Pardi & Raft, Pre-cast RCC cover of 75mm thick, fabrication of cable tray as per design with one coat of red oxide and two coats of oil painting to structural steel, two coats of Waterproof cement paint to all inside, outside surfaces of cable trench with top cover. Work to be done as per drawing and PWD specifications. Detail description of major civil work activities involved are as under.

i. Excavation for foundation in Dense or Hard soil up to 1.5 M Depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 meter lead and filling excavated stuff in trenches & besides cable trench in layers not exceeding 20 cm in depth with consolidating/ watering etc. complete.
ii. Providing and laying cement concrete 1:4:8 (1 Cement : 4 coarse sand : 8 Machine crush metal aggregates 40 mm nominal size) and curing complete including cost of form work in Foundation etc. complete.
iii. Providing and laying control cement concrete M200 and curing complete including cost of form work and reinforcement for reinforced cement concrete work in.(A) Raft Foundations, Vertical pardi/wall etc. (Form work of steel sheets to be utilized)
iv. Providing & placing 75mm thick Precast RCC cover of size 1500 X 300mm, made in M-200 cement concrete with necessary reinforcement of 3 Nos. of 10mm TMT bars as main bar and 8mm TMT Distribution bars at 200mm c/c including providing 8mm TMT bars hook for lifting arrangement & curing, finishing all the surfaces etc complete incl. placing in position at site.
v. Providing & fabrication of structural Steel for cable tray incl. cutting, erecting, fixing in position and applying one coat of red oxide & two coats of oil painting in angles, flat and like section etc. complete.
vi. Expansion Joint: Providing & placing 12mm thick pre-moulded asphalt or bitumen cork board filler joint at every 50 Mtr length.
vii. Painting the inside, outside of Cable trench wall including precast cover with two coats of water proofing cement paint.

2 Precast RCC Cable Guard Block

Providing & placing precast RCC cable guard blocks for underground cable laying work as per approved drawing made in M-200 concrete for UG cable laying. 1.0 Rmt of cable guard consist of 3 nos. of RCC blocks, having size as stated below (A-type, B-Type, C-Type), including providing & laying of reinforcement steel as per drawing in all the three blocks including necessary form works of steel sheets, curing, finishing of all the surfaces & placing in the position at site as per drawing & as directed by engineer-in-charge.

A-Type	L x W x T = 1000 x 300 x 75 mm (For 01 no. of horizontal RCC block) L x W x T = 1000 x 300 x 75 mm (For 02 no. of vertical RCC block)

B-Type	L x W x T = 1000 x 450 x 75 mm (For 01 no. of horizontal RCC block) L x W x T = 1000 x 300 x 75 mm (For 02 no. of vertical RCC block)
C-Type	L x W x T = 1000 x 600 x 75 mm (For 01 no. of horizontal RCC block) L x W x T = 1000 x 300 x 75 mm (For 02 no. of vertical RCC block)

3 Cable Route Marker

Providing & fixing of route marker of pre-cast RCC block made in M-200 concrete of size 220 x 75 x 800 mm having top width round shape as per drawing, including providing & laying reinforcement steel of 1 no. of 10 mm dia tor steel main bar & 6 no of 8 mm dia tor steel distribution bars as per the drawing including necessary excavation, form works of steel sheets, curing, finishing of all surfaces & placing in position at site including fixing block by providing & laying 75 mm thick PCC (1:4:8) on all vertical sites & bottom of pre-cast RCC blocks as per drawings etc complete.

4 Detail Specification for Civil Work Items

<u>Item No. 1:</u>Excavation for foundation in trenches in ordinary, dense, hard soil, sand, clay, soft murrum up to 1.50 Mt. depth including strutting, shoring wherever necessary and throwing away the extra stuff with in the lead of 500 Mt. radius and its dressing etc. complete as directed by E. I. C.

a) General

Any soil which generally require close application of picks or jumpers or scarifies to loosen it, stiff clay, gravel and stone, etc. or organic soil, gravel silt, sand, turf, loam, clay, peat, etc. fall under this category.

b) Clearing the site

i. The site on which the structure is to be built shall be cleared, and all obstructions loose stone, materials, and rubbish of all kind, bush wood and trees shall be removal as directed. The materials so obtained shall be property of the Government and shall be conveyed and stacked as directed within 50 m. lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt.

ii. The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

c) Setting out

After clearing the site, the centre lines will be given, by the Engineer-in-Charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labours materials, etc., required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

d) Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transferal as directed by

removing and watering as required. No earth filling will be allowed for bringing it to level. If by mistake or any excavation is made deeper or wider than that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m depth shall be measured under this item.

e) Disposal of the excavated stuff

i. The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering etc.

ii. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 500 M. and all lift.

Item No. 2: Filling available excavated earth (Excluding rock) in trenches, plinth sides of foundation etc. in layers not exceeding 20 CM in depth, consolidating each deposited layers by ramming and watering.

a) Workmanship

i. The earth to be used for filling shall be free from salts, organic or other foreign matter. All clots of earth shall be broken.

ii. As soon as the work in foundation has been completed and measured the site of foundation shall cleared of all debris, brick bats, mortar dropping etc., and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The earth shall be rammed with iron rammers where feasible and with the butt ends of crow bars, where rammer cannot be used.

iii. The plinth shall be similarly filled with earth in layers not exceeding 20 cms. adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

iv. The finished level of filling shall be kept to shape intended to be given to floor.

v. In case of large heavy duty flooring like factory flooring, the consolidation may be done by power rollers, where so specified. The extent of consolidation required shall also be as specified.

vi. The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling in the plinth.

Item No. 3: Filling in foundation and plinth with murrum or selected soil in layers of 20 CM thickness including watering, ramming and consolidation etc. complete (Yellow earth should be brought by contractor from outside)

a) Materials

Murrum shall be clean, of good binding quality, and of approved quality obtained from approved pots / quarries of disintegrated rocks which contain silicon materials and natural mixture of clay of calcareous origin. The size of murrum shall not be more than 20mm.

b) Workmanship

The relevant specifications of item No. 2 shall be followed except that murrum or selected soil shall be filled in foundation and plinth in 20 cms. Layers including consolidating, ramming, watering, dressing, etc complete.

Item No. 4: Filling in plinth with sand under floors including watering, ramming consolidating and dressing etc. complete.

a) Materials

Sand shall conform to M-3.

b) Workmanship

The relevant specifications of item No. 2 shall be followed except that sand shall be filled in under floors, including watering, ramming, consolidating and dressing etc. complete.

Item No. 5: Brick work using common fly ash / concrete blocks / building bricks having crushing strength not less 35 kg. / sq. cm. in foundation and plinth in cement mortar 1:6 (1 Cement: 6 - Fine sand)

a) Materials

Water shall conform to M-1. Cement shall conform to M-2. Sand shall conform to M-3. Cement mortar shall conform to M-5. Brick shall conform to M-8.

b) Workmanship

- **Proportion:** The proportion of the cement mortar shall be 1:6 (1 Cement: 6 fine sand) by volume.
- **Wetting of bricks:** The bricks required for masonry shall be thoroughly wetted with clean water for about two hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is an indication of thorough wetting of bricks.
- **Laying:**

i. Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete to bond, closers in such case shall be cut to the required size and used near the ends of walls.

i. A layer of mortar shall be spread on full width for suitable length of the lower course. Each brick shall first be properly bedded and set home by gently tapping with the handle of trowel or wooden mallet. It side face shall be flushed with mortar before the next brick is laid and pressed against it. On completion of course, the vertical joint shall be fully filled from the top with mortar.

ii. The wall shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of the brick course shall be kept uniform.

iii. The bricks shall be laid with frog upwards. A set of tools comprising of wooden straight edges, mason's spirit level, square half meter rub, and pins, string and plumb shall be kept on the site of the work for frequent checking during the progress of work.

iv. Both the faces of the walls of thickness greater than 23 cms shall be kept in proper place. All the connected brickwork shall be kept not more than one meter over the rest of the work. Where this is not possible the work shall be raked back according to bond (and not left toothed) at an angle not steeper than 45 degrees.

v. All fixtures, pipes, outlets of water, holdfasts of doors and windows, etc. which are required to be built in wall shall be embedded in the cement mortar.

- **Joints**

i. Bricks shall be so laid that all joints are quite flush with mortar. Thickness of the joint shall not exceed 12mm. The face joints shall be raked out as directed by raking tool daily during

the progress of work, when the mortar is still green so as to provide key for plaster or pointing to be done.

ii. The face of the brick shall be cleaned the very day on which the brick work is laid and all mortar dropping removed.

- **Curing**

  Green work shall be protected from the rain suitable. Masonry work shall be kept moist on all the faces for a period of seven days. The top of the masonry work shall be kept well wetted at the close of the day.

- **Preparation of the foundation bed**

  If the foundation is to be laid directly on the excavated bed, the bed shall be leveled, cleaned of all the loose materials, cleaned and wetted before starting masonry. If masonry is to be laid on concrete footing, the top of the concrete shall be cleaned and moistened. The contractor shall obtain the engineer's approval for the foundation bed, before foundation masonry is started. When pucca flooring is to be provided flush with the top to plinth, the inside plinth offset shall be kept lower than the outside plinth top by the thickness of the flooring.

c) Mode of measurement

i. The measurements of this item shall be taken for the brick masonry fully completed in foundation up to plinth. The limiting dimensions not exceeding those shown on the plans or as directed shall be final. Battered, tapered and curved portion shall be measured net.

ii. No deduction shall be made from the quantity of brick work, nor any extra payment made for embedding in masonry or making holes in respect of following items.
   - End of joints, beams, posts, girders, rafters, purlins, trusses, corbel, steps, etc. where cross section area does not exceed 500 sq cm.
   - Opening not exceeding 1000 sq cm.
   - Wall plates and bed plates, bearing of slabs, and the like whose thickness does not exceed 10 cm and the bearing does not extended to the full thickness of the wall.
   - Drainage holes and recesses fro cement concrete blocks to embed hold fasts for doors, windows etc.
   - Iron fixtures, pipes up to 300mm dia, hold fasts and doors and windows built into masonry and pipes, etc. for concealed wiring.
   - Forming chases of section not exceeding 350 sq. cm. in masonry.

iii. Apertures for fire places shall not be deducted nor shall extra labour required to make splaying of jambs, throttling and making arches over the apertures be paid for separately.

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

Item No. 6: Providing & laying controlled cement concrete M-200 curing complete for reinforced concrete work in

a) Foundation, footings, Bases of columns etc. and Mass concrete,

b) Slabs, Landings, shelves, Balconies, Lintels, Beams, Girders, wall and cantilever up to floor two level,

a) Materials

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8. Graded stone aggregate 20mm nominal size shall conform to M-12.

b) General

i. The concrete mix shall be designed by preliminary tests, the proportioning of cement and aggregates shall be done by weight and necessary precautions shall be taken in the production to ensure that the required work cube strength is attained and maintained. The controlled concrete shall be in grade of M-200 with prefix controlled added to it. The letter 'M' refers to mix and numbers specify 28 days works cube compressive strength of 150mm cubes of the mix expressed in Kg/ Cm2

ii. The proportion of cement, sand and coarse aggregates shall be determined by weight. The weigh batching machine shall be used for maintaining proper control over the proportion of aggregates as per mix design.

The strength requirements of different grades of concrete shall be as under:

Grade of concrete	Compressive strength of 15 cms. cubes in Kg / Cm^2 at 28 days, conducted in accordance with IS 516 – 1959.	
	Preliminary test (min)	Work test (min)
M-150	200	150
M-200	260	200
M-250	320	250
M-300	380	300
M-350	440	350
M-400	500	400

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

iii. Admixture may be used in concrete only with approval of Engineer – in – Charge based upon the evidence that with the passage of time neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaired by the use of such admixture.

c) Workmanship

i. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with means available except where it can be shown to the satisfaction of the Engineer – in – Charge, that 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 aggregates, in different sizes and being in 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.

ii. 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 the 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 equipments shall be maintained in clean, and serviceable condition. Their accuracy shall be periodically checked.

iii. It is most important to keep the specified water cement ratio constant and at its correct value. To this end, 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 2389 (Part III) shall be referred to. Suitable adjustments shall also be made in the weights of coarse aggregates due to variation in the moisture content. Minimum quantity of cement to be used in concrete shall not be less than 320 Kg / Cmt.

iv. Mixing

- For all work, concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Measured quantity of aggregate, sand, cement required for each batch shall be poured into the drum of the mechanical mixer while it is continuously running. After about half a minute of dry mixing measured quantity of water required for each batch of concrete mix shall be added gradually and mixing continued for another one and half a minute. Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than two minutes after all ingredients have been put into the mixer.
- Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer – in – Charge the first batch of concrete from the mixture shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

v. Consistency

The degree of consistency which shall depend upon the nature of the work and methods of vibration of concrete shall be determined by regular slump tests in accordance with IS 1199 – 1959. The slump of 10 mm to 25 mm shall be adopted when vibrators are used and 80 mm when vibrators are not used.

vi. Inspection

- Contractor shall give the Engineer – in – Charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness but such inspection shall not reliever the contractor of his responsibility for the safety of men, machinery, materials and for results obtained. Immediately before concreting, all forms shall be thoroughly cleaned.
- Centering design and its erection shall be got approved from the Engineer – in – Charge. One carpenter with helper shall invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited for reinforcement laid in position. For access to different parts, suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper

cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose.

vii. Transporting and laying

- The method of transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of Engineer – in – Charge has been obtained.
- Concreting shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer. Except where otherwise agreed to by the Engineer – in – Charge concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 metre when internal vibrators are used and not exceeding 0.30 meter in all other cases.
- Unless otherwise agreed to by the Engineer – in – Charge, concrete shall not be dropped into place from a height exceeding 2 meters. When trucking or chutes are used they shall be kept close and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a 13mm thick layer of mortar composed of cement and sand in same ratio as in the concrete mix itself. This 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. When concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150mm in thickness and shall be well rammed against old work, particular attention being given to corners and close spots.
- All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless, otherwise permitted by the Engineer – in – Charge for exceptional cases, such as concreting under water, where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of breakdowns.

  Concrete shall be judged to be compacted when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an ever surface. Compaction shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to dry mixture. During compaction, it shall be observed that needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

viii. Curing

Immediately after compaction, concrete shall be protected from weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and drying out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved, soon after the initial set and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over foundation concrete may be

started after 48 hours of its laying but curing of concrete shall be continued for a minimum period of 14 days.

ix. Sampling and testing of concrete

- Samples from fresh concrete shall be taken as per IS 1199 – 1959 and cubes shall be made, cured and tested at 7 days or 28 days as per requirements in accordance with IS 516 – 1959. A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all mixing units. The minimum frequency of sampling of concrete of each grade shall be in accordance with following:

Quantity of concrete in the work	No. of samples	Quantity of concrete in the work	No. of samples
1 – 5 Cmt.	1	31 - 50 Cmt.	4
6 – 15 Cmt.	2	51 and above	4 + one additional for e additional 50 m. or part thereof.
16–30 Cmt.	3		

NOTE: At least one sample shall be taken from each shift. Ten test specimens shall be made from each sample, five for testing at 7 days and the remaining five at 28 days. The samples of concrete shall be taken on each day of concreting as per above frequency. The number of specimens may be suitably increased as deemed necessary by the Engineer – in – Charge when procedure of tests given above reveals a poor quality of concrete and in other special cases.

- The average strength of the group of cubes cast for each day shall not be less than the specified cube strength of respective concrete grade at 28 days. 20 % of the cubes cast for each day may have value less than the specified strength provided the lowest value is not less than 85% of the specified strength. If the concrete made in accordance with the proportions given for a particular grade, does not yield the specified strength, such concrete shall be classified as belonging to the appropriate lower grade. Concrete made in accordance with the proportions given for a particular grade shall not, however, be placed in a higher grade on the ground that the test strength are higher than the minimum specified.

d) Stripping

x. The Engineer – in – Charge shall be informed in advance by the contractor of his intention to strike the form work. While fixing the time for removal of form work, due consideration shall be given to local conditions, character of the structure, the weather and other condition that influence the setting of concrete and of the materials used in the mix. In normal circumstances (generally where temperatures are above 20° C and where ordinary concrete is used, forms may be struck after expiry of periods specified in item for respective item of form work.

xi. All form work shall be removed without causing any shock or vibration as would damage the concrete. Before the soffit and struts are removed, the concrete surface shall be exposed, where necessary in order to ascertain that the concrete has sufficiently hardened. Centering

shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stress due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm cover to the finished concrete surface. Where it is intended to re-use the form work, it shall be cleaned and made good to the satisfaction of the Engineer – in – Charge. After removal of form work and shuttering, the Executive Engineer shall inspect the work and satisfy by random checks that concrete produced is of good quality.

xii. Immediately after the removal of forms, all exposed bolts etc., passing through the cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All line caused by form joint, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in proportions used in the grade of concrete that is being finished and of as dry consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which are pointed shall be kept moist for a period of 24 hours.

If rock pockets / honeycombs in the opinion of the Engineer – in – Charge are of such and extent or character as to effect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure effected.

Item No. 7: Providing and laying Thermo Mechanically Treated (TMT bars) steel reinforcement conforming to grade Fe 415 IS : 1786 for RCC work including cutting, bending, hooking and binding the reinforcement with approved quality of binging wire etc., completed as per design.

All reinforcement TMT bar specified in item shall confirm to relevant IS standard 1786 for thermo mechanical Tested bars, wherever tested brands to be used, certificate for the same from manufacture shall be submitted.

Bars shall be bent as per bar bending schedule supplied with drawing. If bar bending schedule is not supplied contractor shall prepare it and get it approved at the site before cutting for fabrication. Bars shall be clean, free form rust, dust, mud etc. if coils are there, they shall be first straightened. Bars shall be cut according to the cutting length specified/approved by department. Bars shall be bent gradually. Bars having crack or spits shall be rejected. Bars shall be bent cold, unless otherwise specified in case of higher diameter bars. If bar is bend wrongly, it should be straightened and recent such that it do not injure the materials.

Laps and splices shall be got approved. They shall be staggered and shall be at location shown / approved. Lapping shall be avoided when full length bars are available. All laps, hooks, bends etc. shall be provided as per IS standards. Reinforcement bars shall be place in position as per drawing or details given. It shall be tied with annealed black wire/G.I. wire of 18 gauge. Blocks, spacers, chairs etc., shall be provided as per IS. 2502 at places instructed.

Bars shall be provided with clear cover as shown in drawing or as instructed on site. Cover shall be provided with cement mortar cover block prepared of specified thickness with binding

wire embedded to fix cover in position and tie with the reinforcement so that it may not get disturbed. Minimum clear cover shall be less than 13 mm or diameter of bars for slabs. For beam and columns depending on size it shall be 20mm to 25mm. Cover shall be provided depending on structure, weather condition, location of structure etc., as per ISI.

After the reinforcement is tied and checked by contractor himself it shall be got checked by client authorized representative and okayed for pouring of concrete. Quantity of reinforcement bars in M.T. embedded in concrete shall be paid. Weight shall be computed on cutting length approved or given multiplied by standard weight of particular diameter of bars as per IS standards. Work shall to be carried out at all levels. "Rate quoted shall inclusive of wastages, cost of binding wire etc., No separate payment will be made for binding wire. However, laps, dowels etc shall be paid as per drawing or as approved.

For the purpose of payment, the bar shall be measured correct up to 100 mm length and weight payable worked out at the rate specified below:

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

Item No. 8: Providing 15 mm. thick cement plaster in single coat in C. M. (1:3) on fair side brick / concrete wall for interior plastering of floor two level including finishing the surfaces with smooth cement finishing, necessary drip moulding, scaffolding, curing with three coats of the white wash or colour wash as directed by E. I. C.

a) Materials

Water shall confirm to M-1. The cement mortar of proportion 1:3 shall conform to M-5.

b) Workmanship

i. Scaffolding: Wooden ballies, bamboos, planks, trestles and other scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster which shall be independent of the walls.

ii. Preparation of back ground:

- The surface shall be cleaned of all dust, loose mortar droppings, traces, of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be roughened by wire brushing if it is not hard and by racking if it is hard. In case of concrete surface, if a chemical retardant has been applied to the hard and by racking if it is hard. In case of concrete surface, if a chemical retardant has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retardant is left on the surface. Trimming of projections on brick / concrete surface where necessary shall be carried out to get an even surface.
- Raking of joints in case of masonry where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.
- The work shall not be soaked but only damped evenly before applying the plaster. If the surface becomes dry such area shall be moistened again.

- For external plaster, the plastering operation shall be started from top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supporting ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

c) Applications of plaster:

i. The plaster about 15 x 15 cms shall be first applied horizontally and vertically at not more than 2 metre intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movement at a time. Finally, the surface shall be finished off true with a trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive trowelling or overworking the float according as a smooth or a sandy granular texture is required. Excessive trowelling or overworking the float shall be avoided. All corners, arises, angles and junctions be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arises, junctions etc. shall be carried out with proper templates to the size required.

ii. Cement plaster shall be used within half an hour after addition of water. Any mortar or plaster which is partially set shall be rejected and removed forthwith from the site.

iii. In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically. When recommencing the plaster, the edges of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15cms to any corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.

iv. Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging matting or gunny bags on the outside of the plaster and keeping them wet.

Item No. 9: Providing fabricating & erecting in position M. S. Angle, channels girders etc., for purlins rafters, columns etc., including welding the section as per instruction & drawing making holes & 3 coats of oil painting of approved shade & make etc. complete.

General specification of fabrication shall be applicable. Cutting schedule of the various members shall be prepared as per drawing and got approved.

The rate quoted shall be for supplying steel, confirming I. S. Standards, fabricating erecting and painting the structure.

Item No. 10: Expansion Joints – Premoulded filter

The item provides for expansion joints in RCC frame structures for internal joints as well as exposed joints, with the use of premoulded bituminous joint filler. Premoulded bituminious

joint filler, i.e. performed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected. Thickness of Premoulded joint filler shall be 25mm unless otherwise specified. Premoulded Bituminous joint filler shall confirm to IS 1838-1961.

Item No. 11: Providing form work of sheeting of steel sheets so as to give fair finish including centering, shuttering strutting and propping etc., height of propping and centering below supporting floor to ceiling not exceeding 4 M. and removal of the same for in situ reinforced concrete and plain concrete work in

a) Materials

The shuttering to be provided shall be using sheathing of steel sheets and plates of steel or Plywood as approved by E-I-C.

b) Workmanship

i. The form work shall conform to the shape, lines and dimension as shown on the plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor to safe-guard against any settlement of the form work during the course of concreting and after concreting. The form work of shuttering, centering, scaffolding, bracing, etc. shall be as per design.

ii. Cleaning and Treatment of forms

All rubbish, particularly chippings, shaving and saw dust shall be removed from the interior of the form before the concrete is placed and the form work in contact with concrete shall be cleaned and thoroughly wetted or treated. The surface shall be then coated with soap solution applied before concreting is done. Soap solution for the purpose shall be prepared by dissolving yellow soap in water to get consistency of paint. Alternatively, a coat of raw linseed oil or form oil of approved manufacture may be applied in case steel shuttering is used. Soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Care shall be taken that the coating does not get on construction joint surface and reinforcement bars.

iii. Stripping time

In normal circumstances and where ordinary cement is used, forms may be struck after expiry of following periods.

(a)	Sides of walls, columns, and vertical faces of beam	24 to 48 hours.
(b)	Beam soffits. (Props left under)	7 days.
(c)	Removal of props slabs	
	(i) Slabs spanning upto 4.5 m	7 days.
	(ii) Spanning over 4.5 m	14 days.
(d)	Removal of props to beams and Arches	
	(i) Spanning up to 6 m	14 days
	(ii) Spanning over 6 m	21 days

iv. Procedure when removing the form work

All form work shall be removed without such shock or vibrations as would damage the reinforced concrete surface. Before the soffit form work and struts are removed, the soffits and the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened.

v. Centering

- The centering to be provided shall be got approved. It shall between sufficiently strong to ensure absolute safety of the form work and concrete work before, during and after pouring concrete. Watch should be kept to see that behaviour of centering and form work is satisfactory during concreting. Erection should also be such that it would allow removal of forms in proper sequence without damaging either the concrete or the forms to be removed.
- The props of centering shall be provided on firm foundation or base of sufficient strength to carry the loads without any settlement.
- The centering and form work shall be inspected and approved by the Engineer - in - Charge before concreting. But this will not relieve the contractor of his responsibility for strength, adequacy and safety of form work and centering. If there is a failure of form work or centering, contractor shall be responsible for the damages to the work, injury to life and damage to property.

vi. Scaffolding

- All scaffolding, hoisting arrangement and ladders, etc. required for the facilitating of concreting shall be provided and removed on completion of work by contractor at his own expense. The scaffolding, hoisting arrangements and ladders etc. shall be strong enough to withstand all live, dead and impact loads expected to act and shall be subject to the approval of the Engineer - in – Charge. However, contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workman etc.
- The scaffolding, hoisting arrangements and ladders shall allow easy approach to the work spot and afford easy inspection.
- The rate is applicable to all conditions of working and any height. The rate shall include the cost of materials and labour for various operations involved such as:
  (a) Splayed edges, notching allowance for over laps and passing at angles, battens centering, shuttering, strutting, propping, bolting, nailing, wedging, easing, striking and removal.
  (b) Filleting to form stop chamfered edges or splayed external angles not exceeding 20mm width to beams, columns and the like.
  (c) Temporary openings in the forms for pouring concrete, if required, removing rubbish etc.
  (d) Dressing with oil to prevent adhesion of concrete with shuttering, and
  (e) Raking or circular cutting.

vii. Re-use

Before re-use, all forms shall be inspected by the Engineer - in - Charge and their suitability ascertained. The forms shall be scarred, cleaned, and joints gone over, repaired where required. Inside surface shall be retreated adhesion of concrete.

Item No. 12: Providing & applying 2 coats of water proof cement paint of approved brand & manufacture on wall & cable trench cover surfaces after thoroughly brushing the surface to remove all dirt and remains of loose materials. The work should be carried out strictly as per manufacturer's specifications and requirement etc. complete as directed by E. I. C.

a) Materials

The water shall confirm to M-1. Cement water proofing shall confirm to IS 5410-1969.

b) Workmanship

i. Scaffolding

Where scaffolding is required, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured and well tied suspended platform (Joola) may be used for distempering. Where ladders are used, pieces of old gunny bags" shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

ii. Preparation of surface:

The undecorated surface to be water proofing cement painted shall be thoroughly brushed from dust, dirt, grease, mortar dropping and other foreign matter and sand papered smooth. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

iii. Preparation of paint:

Portland cement shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brushable consistency. Generally equal volumes of paint powder and water make a satisfactory paint. In all cases manufacturer's instructions shall be followed. The paint shall be mixed in such quantities as can used up within an hour of mixing as otherwise the mixture will set and thickness, affecting flowing and finish. The libs of cement paint drums shall be kept tightly when not in use.

iv. Application of Paint:

- No painting shall be done when the paint is likely to be exposed to a temperature of below 7° C within 48 hours after application.
- When weather conditions are such as to cause damage the work shall be carried out "in the shadow" as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.
- To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.
- For undercoated surfaces, the surfaces shall be treated with minimum two coats of water proof cement paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the preceding coat shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In not dry weather, the preceding coat shall be allowed between two coats. Next coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be slightly moistened before applying the subsequent coat.
- The finished surface shall be even and uniform in shade, without patches, brush masks, paint drops etc.
- The cement paint shall be applied with a brush with relatively short stiff hog or fiber bristles. The paint shall be brushed in uniform thickness and shall be free from excessive heavy brush marks. The lamps shall be well brushed out.
- Water proof cement paint shall not be applied on surfaces already treated with white wash color wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

v. Curing:

Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water say about 12 hours after the application.

Item No. 13: Methods for Laying of Cable

The cables shall be laid direct in ground, pipe, closed or open ducts, on cable trays or on surface of wall etc. The method(s) of laying required shall be specified in the Bill of Quantity.

i. Laying direct in ground

- **General**

This method shall be adopted where the cable route is through open ground, along roads/lanes, etc. and where no frequent excavations are likely to be encountered and where re-excavation is easily possible without affecting other services.

- **Trenching**

a) Width of trench

The width of the trench shall first be determined on the following basis

- The minimum width of the trench for laying a single cable shall be 35cm
- Where more than one cable is to be laid in the same trench in horizontal formation, the width of the trench shall be increased such that the inter-axial spacing between the cables, except where otherwise specified, shall be at least 20cm.
- There shall be a clearance of at least 15cm between axis of the end cables and the sides of the trench.

b) Depth of trench

The depth of the trench shall be determined on the following basis: -

- Where the cables are laid in a single tier formation, the total depth oftrench shall not be less than 75cm for cables upto 1.1KV and 1.2m for cables above1.1KV.
- When more than one tier of cables is unavoidable and vertical formationof laying is adopted, the depth of the trench in (b) as above shall be increased by 30cm foreach additional tier to be formed.

c) Excavation of trenches

- The trenches shall be excavated in reasonably straight lines. Wherever there is a change in the direction, a suitable curvature shall be adopted.
- Where gradients and changes in depth are unavoidable, these shall be gradual.
- The bottom of the trench shall be level and free from stones, brick bats etc.
- The excavation should be done by suitable means-manual or mechanical. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.
- Adequate precautions should be taken not to damage any existing cable(s), pipes or any other such installations in the route during excavation. Wherever trickd, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-Charge.
- Existing property, if any, exposed during trenching shall be temporarily supported adequately as directed by the Engineer-in-Charge. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein.

- It there is any danger of a trench collapsing or endangering adjacent structures, the sides may be left in place when back filling the trench.
- Excavation through lawns shall be done in consultation with the Department concerned.

ii. Laying of cable in trench

- **Sand cushioning**
  a) The trench shall then be provided with a layer of clean, dry sand cushionof not less than 8cm in depth, before laying the cables therein.
  b) However, sand cushioning as per (a) above need not be provided for MVcables, where there is no possibility of any mechanical damage to the cables due to heavyor shock loading on the soil above.
  c) Sand cushioning as per (a) above shall however be invariably provided inthe case of HV cables.
- **Testing before laying**
  All the time of issue of cables for laying, the cables shall be tested for continuityand insulation resistance test.
- **Testing before covering**
  The cables shall be tested for continuity of cores and insulation resistance and the cable length shall be measured, before closing the trench. The cable end shall be sealed /covered.
- **Sand covering**
  Cables laid in trenches in a single tier formation shall have a covering of dry sand of not less than 17cm above the base cushion of sand before the protective cover is laid.
  In the case of vertical multi-tier formation, after the first cable has been laid, a sand cushion of 30cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30cm as stated above. Cables in the top most tiers shall have final sand covering not less than 17cm before the protective cover is laid.
- **Extra loop cable**
  a) At the time of original installation, approximately 3m of surplus cable shall be left on each terminal end of the cable and on each side of the underground joints. The surplus cable shall be left in the form of a loop. Where there are long runs of cables such loose cable may be left at suitable intervals as specified by the Engineer-in-Charge.
  b) Where it may not be practically possible to provide separation between cables when forming loops of a number of cables as in the case of cables emanating from a substation, measurement shall be made only to the extent of actual volume of excavation, sand filling etc. and paid for accordingly.
- **Mechanical protection over the covering**
  a) Mechanical protection to cables shall be laid over the covering in accordance with (b) and (c) below to provide warning to future excavators of the presence of the cable and also to protect the cable against accidental mechanical damage by pick-axe blows etc.
  b) Unless otherwise specified, the cables shall be protected by second class brick ofnominal size 22cmX11.4cmX7 cm or locally available size, placed on top of the sand (or, soil as the case may be). The bricks shall be placed breadth-wise for the full length of the cable. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and project at least 5cm over the sides of the end cables.

c) Where bricks are not easily available, or are comparatively costly, there is no objection to use locally available material such as tiles or slates or stone/cement concrete slabs.

- **Back filling**

a) The trenches shall be then back-filled with excavated earth, free fromstones or other sharp ended debris and shall be rammed and watered, if necessary insuccessive layers not exceeding 30cm depth.

b) Unless otherwise specified, a crown of earth not less than 50mm and notexceeding 100mm in the center and tapering towards the sides of the trench shall be leftto allow for subsidence. The crown of the earth however, should not exceed 10 Cms so asnot to be a hazard to vehicular traffic.

c) The temporary re-statements of roadways should be inspected at regularintervals, particularly during wet weather and settlements should be made good by furtherfilling as may be required.

d) After the subsidence has ceased, trenches cut through roadways or otherpaved areas shall be restored to the same density and materials as the surrounding areaand –re-paved in accordance with the relevant building specifications to the satisfactionof the Engineer-in-Charge.

e) Where road beams or lawns have been cut out of necessity, or kerb stonesdisplaced, the same shall be repaired and made good, except for turfing /asphalting, to thesatisfaction of the Engineer-in-Charge and all the surplus earth or rock shall be removedto places as specified.

iii. Laying in pipes / closed ducts

a) In locations such as road crossing, entry in to buildings, paved areas etc. cables shall be laid in pipes or closed ducts. Metallic pipe shall be used as protection pipe for cables fixed on poles of overhead lines.

b) Stone ware pipes, GI, CI or spun reinforced concrete pipes shall be used forcables in general; however only GI pipe shall be used as protection pipe on poles.

c) The size of the pipe shall not be less than 10cm in diameter for a single cable andnot less than 15cm for more than one cable.

d) In the case of new construction, pipes as required (including for anticipated future requirements) shall be laid along with the civil works and jointed according to the CPWD Building Specifications.

e) Pipes shall be continuous and clear of debris or concrete before cables are drawn. Sharp edges if any, at ends shall be smoothened to prevent damage to cable sheathing.

f) These pipes shall be laid directly in ground without any special bed except for SW pipe which shall be laid over 10cm thick cement concrete 1:5:10 (1 cemtnt:5coarsesand:10 graded stone aggregate of 40mm nominal size) bed. No sand cushioning or tiles need be used in such situations.

iv. Road crossings

a) The top surface of pipes shall be at a minimum depth of 1m from the pavement level when laid under roads, pavements etc.

b) The pipes shall be laid preferably askew to reduce the angle of bend as the cable enters and leaves the crossing. This is particularly important for HV cables.

c) When pipes are laid cutting an existing road, care shall be taken so that the soil filled up after laying the pipes is rammed well in layers with watering as required to ensure proper compaction. A crown of earth not exceeding 10cm should be left at the top.

d) The temporary re-instatements of roadways should be inspected at regular intervals, particularly after a rain, and any settlement should be made good by further filling as may be required.
e) After the subsidence has ceases, the top of the filled up trenches in roadways or other paved areas shall be restored to the same density and material as the surrounding area in accordance with the relevant CPWD Building Specifications to the satisfaction of the Engineer-in-Charge.
f) Manholes shall be provided to facilitate feeding/drawing in of cables with sufficient working space for the purpose. They shall be covered by suitable manhole covers. Sizes and other details shall be indicated in the Schedule of work.

v. Cable entry into the building

a) Pipes for cable entries to the building shall slope downwards from the building. The pipe sat the building end shall be suitably sealed to avoid entry of water, after the cables are laid.
b) Cable-grip / draw-wires, winches etc. may be employed for drawing cables through pipes / closed ducts.
c) Measurement for drawing/ laying cables in pipes/ closed duct shall be on the basis of the actual length of the pipe / duct for each run of the cable, irrespective of the length of cable drawn through.

All other specification which are not mention here under are as per PWD specifications.