

## ITEM WISE SPECIFICATIONS

**ITEM NO. 1 :- Dewatering the foundation trenches during excavation, laying foundation concrete, masonry etc. till completion and diversion of surface and subsurface water etc. complete as directed**

### **GENERAL : SCOPE OF WORK : WORKMANSHIP :**

The scope of work includes dewatering for head works and allied works foundation Area/pits/trenches by deploying water pumps. The foundation area/pits/trenches shall be kept dry by deploying required capacity and numbers of water pumps, diesel engine or electric motors. Contractor has to make his own assessment for quantum of dewatering i.e. impounding water and water coming through seepage from surrounding as well as ground water condition etc. And contractor should deploy pumping capacity accordingly. The department will not be responsible for any variation in quantum of water and inflow of water in any. Department will not be responsible for any variation in quantum of water and inflow of water if any. Department will not be responsible for providing electricity at site of work. So contractor has to make his own arrangement for electric power, if he wants to use electric motors. The work area shall be kept dry by continuous dewatering if required. The works includes providing & operating pumping machinery with driving force, pipe lines and other accessories, labours and mechanics and other materials with all leads and lift. A record shall be maintained by the department for HP power deployed and actual run on site and Hours of machineries actually run on site. And it shall be consider final for the payment, measurement is on hp per hour. Contractor has to make arrangement for stand by machineries for continuous dewatering in case of failure.

### **Mode of Measurement and Payment:-**

The measurement of the item shall be on HP per hours basis of completed works.

**ITEM NO.2:- Dismantling the R.C.C. work and disposing off the stuff including stacking of the useful materials etc. complete as directed. a) Light Weight Reinforcement ( Main bar upto 16 mm. dia. )**

The work of dismantling the reinforced concrete shall be carried out very carefully and true to line. The damages due to additional dismantling done to any adjoining work by contractor shall have to be made good at the cost of the contractor and to the entire satisfaction of the Engineer-in-charge. The dismantling shall be done by chipping, Chiseling & Hammering, and if required controlled blasting shall be carried out under the supervision of Engineer-in-charge. Due care shall be taken to prevent any damage to adjoining canal section.

The dismantled materials shall be sorted out and neatly stacked as & where directed by the Engineer- in-Charge. The R.C.C. With steel having reinforcement main bar of diameter less than 16 mm shall considered as light reinforcement Steel and with main bars of having dia. more 16 mm. shall be considered as heavy reinforcement steel obtained shall be handed over fully to the Department immediately and for any pilferage or loss, the contractor shall be responsible and recovery at the market rate shall be made from the contractor.

**ITEM NO. 3 :- Dismantling the existing R.C.C. pipes including sorting out and stacking the useful material of the following diameter including refilling the trenches etc. complete as directed. NP 2 Pipes. 650 to 900 mm**

The work of dismantling the existing R.C.C. pipes shall be carried out very carefully. The contractor will if ordered by the Executive Engineer. Make good any walls or roads etc. damaged

during demolition and will protect. As far as possible all trees, shrubs etc. near the work. The additional dismantling work shall not be paid for. For any damages to pipes and collars due to negligence on the part of contractor. He shall be liable for recovery of cost of pipes and collars at market rate.

If drain pipes are to be removed the contractor must at once remove all foul matter, but the rates unless otherwise mentioned in the contract are exclusive of any excavation that may be necessary. This will be separately paid for as such unless specially stated in the contract no allowance will be made for shoring or underpinning.

The dismantled materials shall be stacked as and where directed by the Engineer-in-charge at a safer place within a lead of 100 m. and pipes shall be handed over to the department. Any damage caused at stacks shall be the responsibility of the contractor till the pipes and collars are handed over to the department.

#### **Mode of Measurement and Payment:-**

The measurement and payment shall be made on running meter basis for the quantity actually required to be dismantled including refilling the trenches etc. complete

#### **Item No.4 - Excavation for foundation in all sorts of soil including yellow sandy gravelly soils, soft & hard murrum etc. in dry condition including depositing the excavated stuff in uniform layers in banks or as and where directed etc. complete for lead upto 500 m and all lift. (BY MACHINERY) (Excluding Dewatering).**

The site shall be cleared of all loose materials, vegetation, rubbish etc. & roots shall be rubbed out. The excavation of trenches shall be for exact depths and dimensions as shown in drawing or as directed by Engineer in charge or his agent. The trenches shall be left plumb where the nature of soil admits to it and be strutted and shored carefully and adequately where the sides are liable to fall in. In case of deep cuttings necessary batters to the sides of the trenches shall be given as required as per the nature of soil as provided in the sanctioned plans without any extra payment. The work shall conform to the true line & levels and shall be carried out uniformly to the approved sections.

All foundation trenches shall be back filled around masonry or concrete as the case may be to the original surface of the ground as directed and shall be in 15 to 23 cm. layers. Without any extra payment in this case. The measurement shall be paid of the exact requirement as per site. Any excavation carried out beyond the approved section shall not be paid for. Excavation carried out to depth greater than the exact foundation.

level shall have to be filled back by 1:5:10 cement concrete with brickbats or aggregates and contractor shall not be paid for this unless if instructed as required. The rate provided for excavation for foundation shall include all sorts of soil including black cotton soil mixed with kankar, soft and hard murrum, gravel etc. but excepting soft and hard rock. No extra payment shall be made for the required shoring and strutting except the stated in such cases as per requirement. The rate including refilling the sides of trenches excavated for foundation of walls, head walls, wing walls, abutments and C.R. walls etc. complete.

The contractor shall provide at his cost line pegs, nails, string, line powder and skilled and unskilled labours and other material and equipment for lining out of the work.

#### **Mode of measurement and Payment:-**

The measurement and payment shall be made on cubic meter basis and on the quantity actually excavated as per the measurement for the foundation.

**ITEM NO:-5 Providing & Laying in position "NOMINAL MIX" cement concrete using cement, sand and crushed aggregate by mass and machine mix for C.C./R.C.C work incl. necessary formworks centering, scaffolding, compaction by vibrator, curing as directed with all lead & lift etc complete Without Dewatering and excluding cost of steel reinforcement.**

**WORKMANSHIP :**

The cement concrete shall be in controlled for the components as shown in drawings including necessary form work, centering, mixing, laying, vibrating, finishing, curing, scaffolding, etc. complete including cost of all materials, tools, plants, equipments, transportation of all materials, labors etc. for execution of this item for all lifts & leads. The foundation bed shall be clean by removing all foreign materials. The bed shall be watered before laying the concrete. The concrete shall be compacted by tamping. The concrete laid shall be finished smooth by float to the exact curve lines and levels shown in the drawings or as directed.

Necessary recesses and blackouts as directed by the Engineer shall be kept and concrete filled subsequently in the recesses and blackouts. No extra payment shall be made for this subsequent work. All concrete work and exposed surface shall be kept clean of the mortar/ concrete spoils by removing it when same is green.

**SCOPE OF THE WORK:**

The work covered by this section consists of furnishing all materials, equipments and labor for transporting, placing, vibrating, finishing and curing of concrete includes in these specifications and performing all the functions necessary and ancillary there to. The item of concrete has been split in to several items according to the grade of concrete to be used and its location and shall be measured and paid for accordingly. The general specification described there in after shall however in relevance apply to all concrete item.

**COMPOSITION OF CONCRETE:**

Concrete shall be composed of ordinary Portland cement, fine aggregate (natural sand), coarse aggregate (Metal and/ kapchi as per relevant item) and water, all well mixed in proper proportion and brought to the proper consistency. In general, the proportion shall be adjusted to produce a durable plastic and workable concrete suitable for the specific conditions of placement and strength. Ordinary Portland cement shall be used for all concrete works.

**GRADATIONS OF CONCRETE:**

The gradation of concrete to be adopted for different locations where concrete is to be laid is given in the table given below. It also indicates the maximum size of coarse aggregate to be used for structure are shown in table No.1

TABLE NO.1

SSr. No.	Class of concrete (grade of concrete)	Requirement of cement in kg/m <sup>3</sup> of concrete (tentative only)	Coarse aggregate	Maximum size coarse aggregate	Components of structure
1	2	3	4	5	6
1.	M-10	220 kg	Metal	25 to 40 mm	Foundation
2.	M-15	300 kg	Metal / kapchi	12 to 25 mm	Lining, Headwall, Coping

**NOTE:**

In the designation of a concrete mix letter 'M' refers to the mix and the special characteristic, compressive strength of 15 cm \* 15 cm\* 15 cm cube at 28 days expressed in N/mm<sup>2</sup> (where 1 N/mm<sup>2</sup> = 10 kg/cm<sup>2</sup>). The concrete in the work shall have strength corresponding to grade of M-10, M-15, M-20 and M-25 as per I.S. 456-2000 or its latest version as mentioned under Table No.2.

**GRADING:**

Coarse aggregate shall be of such a size that it shall retained on mesh 3/16" square. The gradation shall give a dense concrete of the specified strength and consistency that will work readily into position without segregation and without the use of excessive water content.

The gradation shall conform to I.S. 383-1999 or its latest version.

The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, One bag of cement is considered to weigh 50 kg. While measuring aggregate by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is damp, allowance for "bulking" shall be made as per I.S. 2386 (part-iii) For heavily reinforced concrete members as in the case of main beams nominal maximum size of aggregate shall usually be restricted to 5 mm less than the minimum lateral clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement, whichever is the smaller. Coarse aggregate shall be of machine crushed.

The proportion of the concrete shall be such as that it attains the strength for the class of the concrete grade specified.

**MIXING OF CONCRETE:**

The concrete ingredient shall be fed into the mixer simultaneously. A portion of water (5 to 10%) shall proceed and equal quantity shall follow the introduction of material. The remaining quantity of water shall be added uniformly and simultaneously with the other materials. Mixer shall not be loaded in excess of its rated capacity. The concrete ingredients shall be mixed in a batch mixer, for not less than ½ to 3 minutes according to capacity and efficiency of mixer, after all of the ingredients, except the full amount of water are feed in the mixer. Mixer shall however have to be continued for longer periods if proper mixing does not result with timing indicated above. Mixer shall be examined daily for changes in conditions due to accumulation of hard concrete of mortar or to wear – bass blades. No mixer shall be charged in excess of its rated capacity for mixing or agitating. However, if any mixer can not produce concrete meeting the requirements here to for specified when mixing at rated capacity, within the specified limitation on the conforming on the number of revolutions of the mixing drum at mixing speed, the size of batch mixed batch conforming to the performance test as provided here in after is obtained. Hand missing shall not be permitted under any circumstances.

Whenever mixing is done at higher elevations, chutes formed on plain G.I sheets, shall be provided indication of the chute should be so adjusted that segregation does not take place. The chutes shall be washed clean as and when necessary. The first batch of concrete at the commencement of work shall be made richer by adding 10 percent of cement extra without claim over and above the required for the particular mix. Concrete from chute should be deposited on non absorbent platform at lower level after that concrete should be remixed property with hand shovel before placed in position.

**CONVEYING CONCRETE TO PLACE OF CASTING :**

Concrete shall be conveyed from mixer into the forms as rapidly as practicable by methods which will prevent segregation and or loss of gradients in case such separation occurs in advertently concrete shall be remixed before being laid in place. The distance between the mixer and place of concreting and also mode of transport of concrete shall be subject to the prior approval of the Engineer. It shall be deposited in its final position as early as practicable but always within a period of 30 minutes after mixing. When the initial set has taken place in a batch of concrete before it is

placed in position such concrete shall be rejected and taken away from the site to a distance and disposed off as ordered by the Engineer. No claim in this respect shall be entertained.

Method of conveying concrete to any part of the structure where in concrete is loaded into chute, belt conveyer or other similar equipment and carried and carried in a thin continuously expect for very limited or isolated section of the work and only when approved in writing by the Engineer.

#### **PLANING CONCRETE:**

Concrete shall be placed only in location where authorized and no concrete or mortar shall be placed until form work, installation of embedded parts, preparation of surface or necessary clearing up has been done and approved. While placing concrete over rock the surface. If dry shall be moistened and coated with rich cement mortar 1:3 proportion to ensure good adhesion. Nothing extra should be paid for this work, before starting placing of concrete it should be made certain that the transporting and placing equipment is clean and improper repair and the equipment along with the operating staff is arranged to deliver the concrete in the final position without under delays and objectionable segregation. If concrete is to be placed at night adequate lighting arrangement as may be directed by the Engineer-in-charge shall be made. The method and the equipment used for transporting and placing concrete shall be such as will permit the delivery of concrete of the required consistency into the work without objectionable segregation or excessive loss workability. All concrete shall be placed directly in its final position within 30 minutes since it is mixed. Any concrete which has become so stiff that proper placing can not be assured without re tempering shall be wetted excessive segregation from wherever cause shall be minimized in handling and placing operation by avoiding or controlling internal movements of the concrete to flow, concrete shall not be dropped from excessive heights and the free fall should be kept a minimum. All surface of forms and metal work including reinforcement bars that have become rusted with direct mortar or grout from concrete previously placed shall be cleaned off all such mortar or grout before surrounding or adjacent concrete is placed. Concrete shall be deposited in continuous horizontal layers in thickness from approximately 30 cm. In ordinary to 45 cm for mass concrete except that not here in shall be constructed to permit placement of the additional layers of mass concrete before prior permission of the Engineer-in-charge.

#### **FORMS :**

The forms for concrete work shall have sufficient and rigidity to hold and withstand the pressure of fresh green concrete during casting and compaction of concrete including live load and shall be to the require line with in the tolerance specified. The tolerance specified are for finished concrete and not for the from.

Forms shall be fabricated from steel materials. The surface all forms in concrete with the concrete shall clean smooth, rigid and tight. From shall be designed and fabricated so as to permit easy removal without injury to the concrete. Suitable device shall be used to hold comers adjacent ands of panels of other means. The forms and their joint shall be tight compaction of concrete by vibration or other means. The forms and their joint shall be tight enough to prevent loss or mortar or common land water from concrete while vibration the concrete. forms to be used more then once shall designed and fabricated so that they will not warp or swell during erection or placing of concrete. The contractor shall provide suitable formwork as directed buy the Engineer-in-charge. If any modifications are made due to change size. shape and quantum the formwork shall be modified accordingly.

#### **REMOVAL OF FORMS :**

Determination of the time of form removal shall be based on the hardening of concrete and depends upon a number of condition such as air, temperature, hardening properties of cement, type and length of member, condition of loading and type of stresses induce. Strength attained by representative samples of concrete placed inside the structure determined by testing shall be taken as a guide for safe removal of various of forms.

All forms shall be removed in a careful workman like manner without causing deflections, distortion and damage to the concrete surface due to either removal of support or due to the stripping operation. supporting forms and shoring shall not be removed from beams, floors and walls until the concrete placed attain sufficient strength to carry its own weight and any superimposed load. forms should be removed at the earliest practicable time to facilitate curing the formed surfaced without much delay and repair under most favorable conditions for good bond.

### **compressive strength:**

the compressive strength test of concrete shall be conducted on 150 x 150 x 150 mm. cubes. and will be cast and tested for strength at 28 days. these strengths are deemed as the standard strengths. the strengths of test specimens should be not less than 80% at the respective standard strength as mentioned. the testing of cubes shall be carried out as per I.S. specification 456-2000.

80% of the test specimens shall fulfill the above stipulation. in addition. coefficient of variation shall not be more than 20%

### **Test specimen :**

Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purpose such as to determine the strength of concrete at 7 days at may time of striking the formwork or to determine the duration of curing or to check the testing error. additional cubes may also be required for testing cube by accelerated methods as described in L.S. 9013-1978 or its latest version.

The test strength of the sample shall be the average as per L.S. 456 –2000 or its latest version.

Table no.2-

grade of concrete	compressive strength of : 15 cm cubes at 28 days after mixing conducted in accordance with.	compressive strength on 15 cm cubes.
	work test. minimum strength on field in n/mm2	minimum at 7 days n/mm2
M-10	10	7
M-15	15	10
M-20	20	13.5

### **Note:**

In order to get a relatively quicker idea of the quality of concrete optional test on cubes of size 15 cm x15xcmx15 cm. for compressive strength test at 7 days may be carried out in addition to 28 days compressive strength test. for this purpose the value given in table below may be taken for general guidance. in all case the 28 days compressive strength shall along be the criteria for acceptance or rejection of concrete. if the test results show that the concrete cubes give result below the specified standard then such substandard quality of concrete shall be removed and redone by the contractor at his cost. incase of doubtful work if possible cubes shall be taken and tested by the department, in presence of the contractor or his

Sr. No.	materials	Type of Test (compressive test)	testing frequency for lot	Remarks
1	c.c cubes	Qty of concrete work in cum.	No. of samples	
		1-5	1	
		6-15	2	
		16-30	3	

		31-50	4	
		51 and above	4 plus more additional sample for each additional 50 m3 or part thereof.	

#### PLACING :

The contractor shall keep the Engineer informed in advance as to when placing of concrete will be performed. Unless inspection is waived in each specified case by a direction in writing from the Engineer placing of concrete shall be performed only in the presence of an authorized representative of the Engineer. The surface against which concrete is to be placed shall be thoroughly cleaned and dried. After the surface are prepared satisfactory. All approximately horizontal subtraction joints shall be conversed with a layer of cement mortar approximately 3/8 of in inch thick. The mortar shall leave the same peroration of water cement and sand as the regular concrete mixture, unless otherwise directed. The water cement ration of the mortar in place shall not exceed the of the concrete to be placing upon it and the consistency of the mortar shall be suitable for placing and to the working in the manner here in after specified. The mortar shall be spread and shall be worked thoroughly in to all irregularities of the specified. Concrete shall be placed immediately upon the fresh mortar.

In placing concrete against formed construction joints, the surface of the joints where accessible, shall be coated thoroughly with brooms dipped in the wet mortar. it is impracticable to apply such a mortar, special precaution shall be taken to ensure that the new concrete is brought in to intimate contact with the surface of the joints by careful puddling and spading with the aid of suitable tools.

Tempering of concrete will not be permitted. Any concrete, witch has become so stuff that proper placing can not be assured shall be wasted. In all case concrete shall be deposited as nearly as practicable directly in its final position and shall not be caused to flow such that the lateral, movement will permit or cause segregation of the coarse aggregate from shall be such as will not result in concrete mass, methods and equipments employed in depositing concrete in forms shall be such as will not result in cluster or groups of coarse aggregate particles being separated from the concrete mass. However, if clusters do occur they shall be scattered before the concrete is vibrated. A few scattered individual pieces of coarse aggregate that can be resorted in to the mass by vibration will not be objectionable.

Except as interrupted by joints all formed concrete shall be placed in continuous approximately horizontal layers. The details of which generally shall not exceed 50 cm (20 inch). The Engineer-in charge has right to redeem depths of layers where concrete in 50 cm (20 inch). layers can not be placed in accordance whit the requirement of these specification all inter sections of construction joints with concrete surface which will be exposed to view shall be made straight and level or plumb. Construction joint shall be allowed only at places as directed by the Engineer.

In reinforced concrete work, the thickness of the layers shall be reduced to 150 mm to 300 mm ( 6 inch to 12 inch ) or as directed. In congested parts of concrete parts concrete care shall be taken to see that the bars are properly embedded and that no voids are left. On that horizontal surface, where the congestion of steel the forms makes placing difficult, a mortar of the same cement, sand ratio as used in the concrete shall be first deposited to cover the forms.

Placing of concrete may be delayed from 1 to 3 hours at the top opening and at the bottoms of levels under decks, floor slabs, girders, or other parts of structures when levels are not specified but in no case shall the placing be delayed so long that the vibrating unit will not readily penetrate of its own weight. The placing before the delay when compacting the concrete placed after the delay. The last 0.60 m ( 2ft ) more of concrete placed immediately before the delay be placed with the as low a slump as practicable and special care shall be exercised to affect through compaction the

concrete.

### **COMPACTION :**

Concrete shall be compacted to the maximum practicable density so that it is free from pockets of coarse aggregate voids, honeycombing, free of entrapped air and closed snugly against all surface of forms and embedded materials, compaction in structures shall be by petrol/diesel driven or electric or pneumatic drive immersions type vibrators

### **CURING :**

After the final set the concrete shall be kept continuously wet, if required by pending. Curing shall be done as directed by the Engineer-in-charge.

### **Mode of Measurement and Payment:-**

Measurement and payment of concrete shall be on the basis of the measurement taken for the actual work done on the site, and the payment shall be made on the basis of cubic meter of the actual volume of the concrete inclusive of formwork, mixing, laying, vibrating, finishing and curing.

**ITEM NO. 6 :- Providing & Laying in position "DESIGN MIX" cement concrete using cement sand and crushed aggregate for C.C./ R.C.C work by "FLORI" including necessary formwork, centering, scaffolding, compaction by vibrator, curing as directed with all lead & lift etc complete without dewatering and excluding the cost of steel reinforcement. (A) For Footing of column / Abutment / Pier / Bottom slab of barrel / Plinth course / Coping etc. (a) Concrete grade M-15 and MSA-20 mm (B) For Pier and Abutments / Wing wall / Head wall / Return wall / Dowel Wall etc. (h) Concrete grade M-15 and MSA-40 mm (E) For Column / Beam / Solid Slab of Road Bridge / Barrel / Cutoff wall / Approach Slab. etc. (q) Concrete grade M-25 and MSA-20 mm (A) For Footing of column / Abutment / Pier / Bottom slab of barrel / Plinth course / Coping / Approach Slab etc. (e) Concrete grade M-25 and MSA-20 mm (D) For Kerb / Wearing coat. (n) Concrete grade M-25 and MSA -10 to 20mm (F) For Perapet wall of Road Bridge / Structure (t) Concrete grade M-25 and MSA -10 to 20 mm**

All items of concrete work, concrete its constituents, methods and procedures of manufacture shall conform to latest Indian Standard Specification and other technical publication listed below unless otherwise specified.

### **Indian Standard: -**

1	IS : 330	Specification for Plywood for general purposes (second revision) (Amendment No. 1 to 4)
2	IS : 383	Specification for coarse & fine aggregates from natural sources for concrete (second revision).
3	IS : 432	Specification for Mild Steel and medium (Part – I – 1982) tensile steel bars and hard drawn steel wire for concrete reinforcement (third revision)
4	IS : 455	Specification for Portland Slag Cement (PSC)
5	IS : 456	Code of practice for plain & reinforced concrete (second revision) (Amendment No. 1)



6	IS : 457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
7	IS : 460 (Part – 1 to 3)	Specification for test sieves. (Third Revision)
8	IS : 516	Method of test for strength of concrete (Amendment No. 1)
9	IS : 650	Specification for standard sand for testing of cement (first revision) (Amendment No. 1, 2 & 3)
10	IS 883	Code of practice for design of structural timber in building (third revision)
11	IS : 1199	Method of sampling and analysis of concrete.
12	IS : 1489	Specification for portland pozzolona cement Part – I fly ash based (Third revision) (Amendments No. 1 to 7)
13	IS : 1791	Specification for batch type concrete mixers (second revision)
14	IS : 2386 (Part – I to VIII)	Method of test for aggregates for concrete.
15	IS : 2430	Method for sampling of aggregates for concrete (first revision)
16	IS : 2505	General requirements for concrete vibrators.
17	IS : 2506	Jute sacking bags for packing cement (second revision) (with Amendments no. 1 to 3 )
18	IS : 2580	General requirements for screed board concrete vibrators.
19	IS : 2722	Specification for portable swing weight batchers for concrete (single & double bucket type)
20	IS : 3085	Methods of test for permeability of cement mortar & concrete.
21	IS : 3370	Code of practice for concrete structures for the storage of liquids (Part I to IV)
22	IS : 3535	Method of sampling hydraulic cement (First revision)
23	IS : 3558	Code of practice for use of immersion vibrators for consolidating concrete
24	IS : 3873	Code of practice for laying in situ cement concrete lining of canals (first revision)

25	IS : 4031	Method of physical tests for hydraulic cement (first revision)
26	IS : 4032	Method of chemical analysis of hydraulic cement (first revision)
27	IS : 4558	Code of practice for under drainage of lined canals (first revision)
28	IS : 4634	Mixture efficiency test.
29	IS : 4656	Specification for form vibrators for concrete.
30	IS : 4845	Definitions & terminology relating to hydraulic cement (Ref. 1987)
31	IS : 4925	Specification for concrete batching & mixing plant
32	IS : 4926	Specification for ready mixed concrete (first revision)
33	IS : 4990	Specification for Plywood for concrete shuttering work (first revision) (Amendment No. 1)
34	IS : 5242	Method of test for determining shear strength of metal (first revision)
35	IS : 5256	Code of practice for sealing joints in concrete lining on canals
36	IS : 5512	Specification for flow table for use in tests of hydraulic cement and pozzolanic materials (first revision)
37	IS : 5513	Specification for vicat apparatus (first revision) (Amendment No. 1)
38	IS : 5515	Compacting factor apparatus (first revision)
39	IS : 5529 (Part – 1 to 2)	Code of practice for in situ permeability test.
40	IS : 5640	Method of test for determining aggregate impact value of soft coarse aggregates.
41	IS : 5816	Method of test for splitting tensile strength of concrete cylinders.
42	IS : 5889	Specification for vibratory plate compactor.
43	IS : 5892	Specification for concrete transit mixer and agitators.
44	IS : 6461 XIII)	Glossary of terms relating to cement concrete (Part I to vibrators.

45	IS : 6923	Methods of test for performance of screed board concrete vibrators
46	IS : 6925	Method of test for determination of water soluble chlorides in concrete admixtures.
47	IS : 7245	Specification for concrete pavers.
48	IS : 7320	Specification for concrete slump test apparatus (Amendment No. 1)
49	IS : 7861 (Part – 1 & 2)	Code of practice for extreme weather concreting.
50	IS : 8041	Specification for repaid hardening Portland cement (first revision) (Amendments No. 1 to 4 )
51	IS : 8043	Specification for Hydrophobic portland cement (first revision) (Amendments No. 1 to 3 )
52	IS : 8112	Specification for 43 grade ordinary Portland cement
53	IS : 8142	Method of test for determining setting time of concrete by penetration resistance.
54	IS : 8989	Safety code for erection of concrete framed structures
55	IS : 9013	Method of making, curing & determining compressive strength of accelerated cement concrete test specimens.
56	IS : 9077	Code of practice for corrosion protection of steel reinforcement in RB and R.C.C. construction.
57	IS : 9103	Specification for admixtures for concrete.
58	IS : 9284	Method of test for abrasion resistance of concrete.
59	IS : 12089	Specification for Granulated Slage for manufacture of Portland Slag Cement (PSC)
60	IS : 12200	Code of practice provision of water stops at transverse construction joints in masonry and concrete dams.
61	IS : 12269	Specification for 53 grade ordinary Portland cement
62	IS : 12330	Specification for sulphate resisting portland cement.
63	SP : 16 (S&T)	Design aids for reinforced concrete to IS : 456

#### Other Publications :-

1	USBR	Concrete Manual (Eight edition revised print 1981)
2	ASTM	C-156.80 Water retention test
3	ASTM	C-109.81 Type-2 Liquid membrane – Forming compound for curing concrete.
4	ASTM	C-491.80 Water reducing agent.
5	ASTM	C-494 Type –D
6	ASTM	C-494 Type-D Water reducing agent and set retarder.
7	CBIP	Manual on canal lining
8	ASTM E-97	Light reflectance test
9	Indian Road Congress	Standard specifications and code of practice of Road bridges. Section–I, Section–II ,Section – III.
10	The United states Bureau of Reclamation	Concrete Manual (Eight Edition) (Revised – 1981)
11	American Society for Testing Materials	C-494-80
12	ASTM	C-989
13	ASTM	C-1073

In addition to the above relevant Indian standards, Indian Road Congress codes and publications shall also apply.

Note : Generally the Bureau of Indian Standard code will be followed for all items of works. Whenever this code does not exist the reference will be taken to other technical publications as directed by Engineer - in - Charge.

#### **COMPOSITION:-**

Concrete shall be composed of cement, fine aggregate (natural sand), coarse aggregates (manufactured), admixtures and water well mixed in proportion and brought to proper consistency. The design mix proportions shall be adjusted to produce a durable and workable cohesive concrete, suitable for specified conditions of placement & design strength.

For all items of concrete in any portion of the structure or its associated works, concrete manufactured by automatic batching and mixing (B & M) plant which shall be termed as controlled concrete shall be used where specified.

The concrete for structure shall be controlled concrete and nominal mix concrete. The concrete shall be manufactured in automatic batching mixing plant only. For nominal mix concrete, the

volume proportion of different ingredients of nominal mix shall be converted in weight and nominal mix concrete shall be manufactured accordingly and for proper quality control, the volume weight ration shall be checked daily and regularly.

## **MATERIALS:-**

### **Cement:-**

The cement shall be as per Material Specification, M-2

### **Fine Aggregate:**

Sand :- The cement shall be as per per Material Specification, M-3.

### **Coarse Aggregate :-**

### **General :-**

Coarse aggregate for concrete shall consist of clean, hard, dense, and durable black trap crushed metal free from vegetable matter. Predominantly flaky aggregates shall not be used. (Flakiness index max.30 percent- IS 2386 Part-I) All coarse aggregates shall be washed and / or screened by the contractor, if required. The percentage of deleterious substance in coarse aggregate shall not exceed the following values.

(I)	Material finer than 75 Micron sieve screen	3 percent by weight
(II)	Coal and lignite	1 percent by weight
(III)	Soft fragments	3 percent by weight (For uncrushed only)
(IV)	Other deleterious substances	1 percent by weight
(V)	Clay lumps	1 percent by weight

Course aggregate will be tested for their gradation, specific gravity, water absorption, impact and abrasion values, soundness, petrography analysis, deleterious constituents, flakiness and elongation indices and alkali aggregate reactivity.

The sum of the percentage of all the deleterious substance shall however, not exceed 5 percent by weight. The coarse aggregates shall satisfy abrasion, soundness crushing and alkali aggregate reactivity tests and water absorption results as laid down in IS : 383 and other relevant Indian Standard Specifications.

### **Source:-**

Crushed aggregates are available in ample quantities from the quarries near Sevaliya (Dist : Kheda), Vadagam (Dist : Sabarkantha), Sayala (Dist :Surendranagar) . These aggregates are from black trap and are extensively used for construction of roads and concrete work. However the contractor shall procure approved quality of aggregates and rubble from any other sources for which no extra claim shall be entertained.

### **Grading:-**

Coarse aggregate shall be well graded and shall have a maximum size of 40 mm, 20mm and 10mm

as per requirement.

The gradation shall give a dense concrete of the specified strength and consistency that will work readily into position without segregation and without the use of excessive water content. The grading of coarse aggregate shall be in the nominal sizes as mentioned in Table-2 of IS: 383 reproduced as below.

**Table – 2 of IS: 383**

IS Sieve designation	Percentage Passing for graded aggregates of nominal size.		
	40 mm	20 mm	10 mm
63 mm	100	--	-
40 mm	95 to 100	100	-
20 mm	30-70	95 to 100	100
10 mm	10-35	25-55	85-100
4.75 mm	0-5	0 to 10	0 to 20
2.36 mm			0 to 5

.....

Flakiness and elongation index (Total) shall not exceed 35 % with maximum in dependent limit of 20 % for any type of concrete. However the exact gradation required to produce a dense concrete of specified strength and desired workability shall be decided by Engineer-in-Charge.

The material passing through the screen shall be in grade ranging from 40 mm to 4.75 mm. Each grade of material shall be stacked separately, for 40mm to 20mm, 20mm to 10mm and 10mm to 4.75mm.

Coarse aggregates shall consist of inert , clean, hard, strong, durable and structurally sound particles of crushed stone and shall be free from thin elongated soft pieces, organic or other deleterious matter capable of developing good bond with cement paste and weather resisting be unaffected by water. It shall have no adherent coating of clay, silt, mud or any other adherent coating. It shall be from a source approved by the Engineer-in- Charge. Coarse aggregates shall conform to IS : 383 and IS : 515.

Sr. No.	Item of work	Maximum nominal size of Coarse Aggregate (MSA)
1	Foundation concrete and gravity retaining walls (mass concrete)	20mm, 40 mm
2	RCC rafts, piers, abutments barrels, cutoff walls, breast walls, transition walls and staunching ring etc.	20mm, 40 mm Maximum nominal size of Coarse Aggregate (MSA)

Coarse	3	RCC work in main and cross girders, deck slab, wearing coat, kerb, parapet walls, approach slab, pier caps and other thin walled members and in zones of congestion caused by closely spaced reinforcement bars.	10 to 20mm
	4	For any other items of construction not covered by item 1 to 4.	As specified in the drawings or in case it is not specified in drawing, as directed by the Engineer-in-Charge.

aggregates shall be washed if necessary to remove all vegetations and other perishable substances and objectionable amounts of other foreign matter. The cost of washing & screening shall be borne by the contractor. In case of course aggregate brought to the site of work is not washed and screened at the source the contractor shall make necessary arrangement for washing and screenings at the B. & M. plant and its cost shall be borne by the contractor.

Following shall be maximum size of coarse aggregate for the different items of work.

For heavily reinforced concrete members, as in the case of ribs of main beams, maximum size of aggregate shall usually be restricted to 5 mm less than minimum lateral clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller. However if required under special circumstances, the Engineer-in-Charge may permit an aggregate of maximum size 25% more than the critical spacing / cover provided that proper vibration is ensured.

### Testing :-

The following testing frequencies shall be mentioned for the same source of coarse aggregates at the contractor's cost.

Sr. No.	Name of Test	Minimum number of test specified
1	Gradation	Daily one test for each nominal size of aggregates.
2.	Water Content	Daily one test for each nominal size of aggregates
3.	Silt Content	Daily one test for each nominal size of aggregates.
4.	Sp. gravity and water absorption, Impact or Abrasion value, Density, Soundness, Alkali-Aggregate reactivity,	Twice in a concreting working season.
5	Petrography examination	Ones in a season.

### Storage:-

Aggregate shall be stacked in such a way as to prevent the admixture of foreign materials such as soil, vegetable matter etc. Heaps of fine and coarse aggregates shall be kept separate. When different sizes of fine or coarse aggregate are procured separately they shall be stored in separate stock piles, sufficiently away from each other to prevent the materials at the edge of the piles from getting intermixed.

- (a) The aggregates shall be stockpiled adjacent to the batch mix plant site so as to require minimum re-handling and labour when conveyed to the mixer.
- (b) The aggregates shall be placed on a dry patch of ground if available otherwise a platform of planks or plain galvanized iron sheets or alternatively on a floor of dry bricks or a thin layer of lean concrete.
- (c) The stock piles of the aggregates shall be kept free from dirt, rubbish, papers, vegetable matter and pouch of pan-masala, bidi, plastics and all organic material etc. collected by the people.
- (d) To minimize moisture variations the stockpiles shall be spread over as large in area as possible but left low and fairly uniform in height preferably 1.25 to 1.50 m and the lowest layer of about 30 cm height shall be allowed to act as drainage layer and not used till the end.

**Water:-**

The water shall be as per Material Specification, M-1.

**General :**

Air Entraining Agent (AEA) as an admixture shall be added to the concrete batch in solution. It shall be batched by means of mechanical batcher capable of correct measurement and in such a manner as will ensure uniform distribution of the agent throughout the batch during the specified mixing period. The amount of AEA used shall be such as to affect air entrapment from 4 to 6 percent by volume in that portion of the concrete containing aggregate smaller than the 40 mm square mesh sieve after its placement and vibration in the forms. The actual percentage of air shall be as fixed by the Engineer-In-Charge and will be changed whenever necessary to meet the varying conditions encountered during construction. The resulting modification if any to the content or portion of cement as a consequence thereof shall be accounted for in the rate for payment according to general technical specification for concrete. The contractor will be allowed to use admixture, only after prior approval of the Engineer-In-Charge. Cost of such admixture shall be borne by the contractor and shall be deemed to have been included in the unit rates quoted by the contractor for relevant items.

**Tests :**

If the contractor uses his approved admixture, the contractor shall provide satisfactory facilities for easy and quick collection of adequate test samples. All tests for the evaluation and approval of an admixture shall be made by and at the expense of the contractor. The suitability of an air entraining admixture shall be determined as per the requirement of IS: 9103.

**Accelerator /retarder**

Admixture to be used in recommended proportions as per IS:9103 to accelerate/retard setting of concrete, improve workability without impairing strength and durability as per written instruction from Ex. Engineer. Engineer-in-charge shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work. This shall, however, not relieve Contractor of any of his responsibilities. All materials which does not confirm to this specification shall be rejected.



**Reinforcing steel**

The provisions made in Material Specification M-6 shall apply for reinforcement.

**Epoxy**

Use of Epoxy for bonding fresh concrete for repairs shall be permitted on written approval of the Engineer-in Charge. Epoxy shall be applied in accordance with the instructions of the manufacturer. The cost of such repair including cost of Epoxy shall be borne by the contractor.

**CONCRETE FOR STRUCTURES:**

Controlled concrete shall be used for the structures in grades of concrete designated as M-15, M-20, and M-25

**Mix Design :**

At the beginning of the work in each working season Contractor as may be decided by the Engineer-In- charge shall make a test to determine the mix proportion required to produce the strength specified with the material to be used in the work. The mix proportions are designed in a scientific method at Govt. approved laboratory / GERI as directed by Eng. and proportions are fixed by weigh for different grades of concrete.

The mix design shall be as per IS 456, salinity class-I and for moderate exposure condition for different grades of concrete.

For Design Mix Concrete the mix shall be designed according to IS:10262 and SP:23 to provide grade of concrete having the required workability and characteristics strength not less than appropriate values given in IS:456. The mix shall be designed using representative samples of approved coarse and fine aggregates as well as cement and water to be used by the contractor to achieve the required workability, cohesion, strength and durability at minimum level of cement, mix design studies and tests carried out by the Contractor and approved by the Engineer in Charge.

The proportion of mix design ingredients shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the means available. The design mix shall be such that it is cohesive and does not segregate and should result in dense and durable concrete and also capable of giving the finish as specified. For water retaining structures, the mix shall also result in watertight concrete. The Contractor shall exercise great care while executing the works to achieve the desired result.

During the execution of work if the source of any ingredient of the concrete changes or in new working season, the contractor shall inform the Engineer-in-Charge sufficiently in advance so as to allow him to proportion of a new mix design to attain the specified strength of concrete. At that time the representative samples of approved ingredient shall be supplied and tested by the Contractor and approved by the Engineer-in-Charge.

The details of mix design including the proportion of each separate size and grading of aggregates and actual cement level required shall be declared to the contractor in writing by the Engineer-in-charge.

As a results of Para (d), if there is any subsequent change in mix design, similarly declared.

The water cement ration shall be properly maintained during the execution of work as per approved mix design.

Unless otherwise specifically mentioned, the cement content for Design Mix Concrete shall be as

given below in absence of Mix design.

**∴ TABLE NO. 1 ∴**

Sr. No.	Class of concrete (Grade of concrete)	Tentative cement in Kg/M <sup>3</sup> of concrete.	Coarse aggregate	Max. size coarse aggregate Nominal size in mm	Location & Remarks.
1	2	3	4	5	6
1	M-25	400 Kg.	B.T.Metal	10-20 mm	For Structure
2	M-25	380 Kg.	B.T.Metal	20 mm	
3	M-20	330 Kg.	Metal	40 mm	
4	M-20	360 Kg.	B.T.Metal	20 mm	
5	M-15	280 Kg.	Metal	40 mm	
6	M-15	300 Kg.	B.T.Metal	20 mm	For Concrete of lining
7	M-10	220 Kg.	Metal	40 mm	For Foundation
8	M-15	300 kg	B.T.Metal	20 mm	For PCC blocks

The cement level shown above Table is tentative. Actual cement level required for the aggregate to be used shall be determined by mix design and laboratory test. As per design mix, if it becomes obligatory to use more cement per cubic meter of concrete, the contractor shall execute the same without claiming any extra cost of excess qty. of cement to be used w.r.t as mentioned in above table. In case of actual use being less than the cement level specified in the above table, the Govt. shall deduct the cost of cement from the bill at a base rate of Star Rate per MT (Metric Ton) (As per NWRWs & KP Dept. letter no. MIS102010/17/k-1 Dt.30.07.2018 , PRCh. /2010/67/Q.C. /Dt. 15-3-2011) & MIS/1020/10/17/K-1 , Dt 30/07/2018

The contractor shall prepare mix design of concrete in accordance with IS 456 and relevant codes to achieve desired strength, durability and workability and using approved ingredients viz. cement, fine aggregates, coarse aggregates, admixtures for concrete of lining (if any) and water. The ingredients of concrete shall be got tested and approved by the Engineer-in-Charge. The contractor shall get approved the mix design thus prepared by him from Engineer-in-Charge and only after approval of Engineer – in – Charge, the same shall be used for construction.

The proportion of mix – design ingredients shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the means available.

During the execution of the work if the source of any ingredient of the concrete changes then the contractor shall inform the Engineer- in - Charge sufficiently in advance so as to allow him to prepare a new mix design to attain the specified strength of concrete. At that time the representative samples of approved ingredient shall be supplied by the contractor to the Engineer - in - Charge without any extra cost.

#### **STRENGTH REQUIREMENT OF CONCRETE :**

The strength requirements of the concrete mixes ascertained on 150mm cubes as per IS: 516 shall comply with the requirements of IS: 456

Ordinary Portland cement grade 43 and 53 conforming to IS: 8112 and IS: 12269 respectively shall be used. The compressive strength requirements for the various grades of controlled concrete shall be as given in Table given below:

Grade of concrete	Compressive test strength in N/mm <sup>2</sup> on 150 mm. cube after mixing conducted in accordance with IS 456	
	Min at 7 days	Min. at 28 Days
M-10	7	10
M-15	10	15
M-20	14	20
M-25	18	25

In all cases the 28 days compressive strength specified in table shall alone be the criterion for acceptance or rejection of the concrete. Where the strength of a concrete mix as indicated by tests lies in between the strength for the two grades specified in Table, such concrete shall be classified for all purposes as concrete belonging to the lower of the two grades between which its strength lies.

#### **PROPORTIONING CONCRETE:-**

Except when it can be shown to the satisfaction of the Engineer- In-Charge that supply of properly graded aggregates of uniform quality can be maintained till the completion of the work, grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions as required. Different sizes, however, shall be stacked in separate stockpiles. Required quantity of material shall be stockpiled several hours, preferably a day, before use. Grading of coarse and fine aggregates shall be checked as frequently as possible, 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 test. In proportioning concrete, the quantity of both cement and aggregate shall be determine by weight. Water shall either be measured by volume in calibrated tank or weight. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

To keep the specified water cement ratio constant as determined by mix design moisture content in both fine and coarse aggregate shall be predetermined by Engineer-In-Charge. The amount of mixing water shall then be adjusted to compensate for any variations noted in the aggregate IS:2386 (Part-III) shall be referred to make suitable arrangement in weight of water. Suitable adjustments shall also be made in the weight of aggregates to allow for variations in weight of aggregates due to variations in their moisture content.

Actual cement level required for the aggregates to be used shall be determined by laboratory tests, keeping in view the aggressive condition of salt, durability, workability, exposure condition etc. as per I.S code provision. The mix proportions shall be selected to ensure that the workability of the fresh concrete is suitable for the conditions of handling and placing so that after compaction it surrounds all reinforcement and completely fills the formwork. When concrete is hardened, it shall have the required strength, durability and surface finish.

A mix shall be designed to produce the grade of concrete having the required workability,

cohesiveness and characteristic strength not less than that stipulated in table under para 3.7 above. The quantity of water shall be just sufficient to produce a dense concrete of required workability Cohesiveness, durability and strength for the job. An accurate and strict control shall be kept on the quantity of water.

In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degrees of consistency, which shall depend upon the nature of work and methods of vibration of concrete, shall be determined by regular slump tests. Following slumps shall be adopted for different types of works.

Sr. No.	Type of work	Slumps allowed
1	Mass concrete for RCC raft foundations, footings and retaining walls	25 to 75 mm
2	Beams, slabs & columns, syphon barrel, transition walls	50 to 100 mm
3	Thin RCC section with congested steel	75 to 100 mm

- N.B. (1) Slump test shall carry out at location of placing of concrete.  
(2) In case pump concrete is used slump shall be between 100 mm and 120 mm.

## **PRODUCTION OF CONCRETE:**

### **Production of Aggregates:**

Production of aggregates may include quarrying of the raw material and processing viz, transporting, crushing, screening and washing. Water used for washing aggregates shall be clean and free from alkali, salts and other impurities. After washing, fine aggregates must be stored in stockpiles with a free draining base for at least 3 days to ensure that aggregates delivered to the batching plant will have a reasonably uniform moisture content. The storage and handling shall be in such a manner as to prevent inter-mingling of various sizes of aggregates required separately for grading purposes. No foreign matter shall be allowed to be mixed up with the aggregates.

### **Batching and Mixing of concrete by weight :**

The contractor shall provide such means and equipments as are required to accurately determine and control the relative quantity of the various materials including water, cement, admixtures, sand and each specified size of coarse aggregates entering the concrete and such means and the equipments and its operation shall be subjected at all times, to the approval of the Engineer- In-Charge. The amount of cement, sand, each size of coarse aggregates and water entering each batch of concrete shall be determined by weight.

The measuring equipments shall operate within the limits of accuracy specified. Standard test of weights and other auxiliary equipments required for checking their satisfactory performance shall be provided. The equipment shall be capable of controlling the delivery of materials for weighting measurements so that the in accuracies in filling and measuring during normal operations will not exceed 1.5 percent for water, cement and admixtures and 2 percent for sand and coarse aggregates.

### **Batching and Mixing**

The Mobile Batching and Mixing Plant (flori) with automatic weighing operation of materials are showing in Computerized Display when designated weight of each material is reached and interlock.

It must be necessary to have printer facility for getting printout of each batch of mixing. The wet mixing of the concrete shall be done in mixer attached with batching plant. The contractor shall have to make the calibration of plant at site before starting of work in each season as well as at regular interval as decided by the Engineer-in-charge and to submit the certificate of calibration to the Engineer-in-charge.

### **Batching :**

The prescribed amount of the various materials of concrete including water, cement, admixtures the grouping of fine aggregates and each individual size of coarse aggregate shall be measured and controlled within the specified limits of accuracy. The amount of water, cement and aggregate shall be determined by weighing. In the case of fine aggregates, the surface moisture shall be determined in accordance with the method prescribed in Appendix-D of IS: 456 and its subsequent amendments or publications. In the case of coarse aggregates, percentage of free water shall be determined by weighing a representative sample, then surface drying each particle individually with a clean piece of cloth and re-weighing. Necessary arrangement for silos or other arrangement shall be made for Ordinary Portland Cement.

The proportions of various materials shall be changed as directed in order to maintain the desired quality of the concrete. The batching equipment shall be constructed and operated so that the combined inaccuracies in feeding and measuring the materials shall not exceed 1 ½ percent for water and cement and 2 percent for each size of aggregate.

Aggregate shall not be batched for concrete or mortar when free water is dripping from the aggregate.

Before the concreting operation start the contractor shall provide communication facility in form of wireless, walki- talki or telephone between the batching and mixing plant and site of various concrete placement site / sites and got approved by the Engineer-in-charge.

### **Mixing :**

The kind of cement such as Ordinary Portland Cement shall be used in the work requirement and as decided by Engineer-In- Charge. In order to prepare the concrete mix with the specified cement, such arrangement shall be made in the batching plant at site of the work.

For any one batch, uniformity of fresh concrete weight of air free mortar of two samples, one taken at the front and one at the end of the mixer discharges, when determined in accordance with the provisions of the mixer performance tests, designation 26 in the Appendix, Concrete Manual – Eighth Edition, Revised – 1981, United States Bureau of Reclamation shall not exceed 1.6 percent of the mean value. The adequacy of mixing shall also be determined in accordance with "Method of sampling and analysis of concrete" as per IS: 1199 – 1959 and its subsequent amendments. Excessive variation on the unit weight of air free mortar indicates that mixing time should be increased. Mixer efficiency tests shall be made at the start of a job and at such intervals as may be necessary to ensure compliance with the requirements for effective mixing. The minimum mixing time specified herein may be reduced if mixer efficiency tests confirm that the reduced time permits satisfactory mixing.

- (a) The first concrete batch at the start of continuous mixing operation or after a lapse of 30 minutes in continuous mixing operation shall be made richer by the addition of extra cement as directed. No extra payment shall be done for the extra cement to be used in starting mix of concrete.
- (b) For any one batch, the difference between the unit weight of coarse aggregate from concrete samples from the front and end of the mixer discharge, when determined in accordance with the above mentioned mixer performance test shall not exceed 10 percent of the mean value.
- (c) Mixing shall be continuous until there is uniform distribution of the materials and the concrete is uniform in color and consistency.

The mixing of each batch shall continue, for not less than the period stated in Table – I of IS : 457 as shown below, unless tests of mixer performance show that variation in the prescribed time is necessary or acceptable. Each mixer shall have a timing device for indicating the completion of the required mixing period. The mixer shall have 15 to 20 revolutions per minute.

Capacity of Mixer	Minimum time of mixing	
	Material Aggregate	Manufactured aggregates
3 m <sup>3</sup> or larger	2 minutes	2.5 minutes
2 m <sup>3</sup> or larger	1.5 minutes	2.0 minutes
1 m <sup>3</sup> or smaller	1.25 minutes	1.5 minutes

- (d) The actual time of mixing shall be checked at least twice during each shift and the timing device shall be adjusted if there is error. The timing device shall be so interlocked with the discharge gate of the batch hopper that the timing does not start until the discharge gate is fully closed and all ingredients are in the drum. A suitable record shall be kept of the average time consumed in charging, mixing and discharging a batch during each run.
- (e) The full contents of the drum shall be discharged quickly to avoid segregation.
- (f) The minimum mixing periods specified are considered on the materials being fed into the mixer in a manner which will facilitate efficient mixing and an operation of the mixer at its designed speed. The following sequence of charging the mixer may be adopted.
- (1) Five to ten percent of the total quantity of water required for mixing, adequate to wet the drum thoroughly, shall be introduced before the other ingredients in order to prevent any caulking of the cement on the blades or sides of the mixer.

#### **Mode of Measurement and Payment:-**

Measurement and payment of concrete shall be on the basis of the measurement taken for the actual work done on the site, and the payment shall be made on the basis of cubic meter of the actual volume of the concrete inclusive of formwork, mixing, laying, vibrating, finishing and curing.

#### **ITEM NO. 7 :- Providing & Placing in position reinforcement bars including cutting, bending, welding joints where necessary, hooking etc. complete as per drawing for all lead and lifts.**

##### **(A) TMT / CRS (FE 500 D)**

##### **General**

- (1) The TMT (FE-500 D) bars shall be procured by the contractor from reputed primary/secondary manufacturers. The reinforcement bars produced by re-rolling of steel shall not be permitted.
- (2) Steel reinforcing bars shall be placed in concrete as shown on the drawings or as directed by the Engineer-In-Charge. The drawings issued with these specifications are typical ones. Further working drawings shall be issued by the Engineer-In-Charge for each structure during the course of the contract.
- (3) Not less than 10 days prior to placement of reinforcement, the contractor shall submit to the Engineer-In-Charge three prints and a reproducible prints of each of reinforcement detail working drawings for approval. The Contractor's reinforcement detailed drawing for approval

shall be prepared in accordance with IS: 456 “Code of Practice for plain and Reinforced Concrete”; IS: 2502 “Code of Practice for Bending and fixing of Bars for concrete Reinforcement” and IS- 5525” Recommendation for detailing of Reinforcement in reinforced concrete work” unless otherwise shown on the reinforcement detail drawings. Contractor’s drawings shall show necessary details for checking the bars during placement and for use in establishing payment quantities. Reinforcement bars shall conform to requirements shown on the drawings or as directed by the Engineer- in-Charge. The approval of the Engineer-in-Charge to the Contractor’s reinforcement detailed drawings shall not absolve the Contractor of his responsibility for the correctness of details or for conformance with the requirements of these specifications

- (4) Steel reinforcing bars shall be placed in concrete where shown on the drawings or as directed by the Engineer-in-Charge.
- (5) As far as possible high yield strength deformed TMT bars conforming to IS-1786 shall be used as reinforcement as shown in the drawings or as directed by the Engineer-In-Charge. The steel shall be used in various components of various canal structures as per the drawing or as per instruction of the Engineer-In-Charge. The payment shall be made and considered as per the unit rate quoted in the item no. 10 of Schedule-B.
- (6) The contractor shall have to procure the required category and type of steel such as mild steel, TMT bars and the stacking of each type steel shall be made separately. For each type of steel, the central place for stacking shall be established by the contractor at each site of work.
- (7) The reinforcement steel shall be procured from the BIS manufactures, BIS primary / Secondary manufacturer or his authorized dealer only, before 15 days prior to the using in works. The contractor shall furnish BIS manufacture’s test certificate along with test results for each category for every lot brought to the site of work. The manufacture’s test results shall be from the manufacture’s laboratory only. The test results from other laboratory shall not be accepted and the consignment will be rejected. Testing of steel shall be carried out as per relevant IS code.

Frequency for steel testing (Physical properties) are as under as per IS 1786.

<b>Normal Size of bar</b>	<b>Quantity</b>	
	<b>Lot below 100 tonne.</b>	<b>Lot above 100 tonne</b>
Under 10 mm	Sample from each 25 tonne	1 Sample from each 40 tonne
10 to 16 mm	Sample from each 35 tonne	1 Sample from each 45 tonne
Over 16 mm	1 Sample from each 45 tonne	1 Sample from each 50 tonne

However, the frequency of testing shall be decided by the Engineer- In-Charge as per necessity during the course of execution, but the frequency as mentioned above shall not be increased in any case. i.e. nos. of sampling and testing shall be more than as mentioned above.

For the chemical analysis of steel, the frequency shall be twice in a working season for each diameter bar and Brand and as decided by the Engineer-in-charge.

The steel conforming the required standards as per tests for which the contractor shall have to produce the authentic certificates from the manufacturer for such type of testing for each lot of steel manufactured at a time and transported to the works site.

### **Cutting, Bending and Binding**

The Contractor shall be responsible for the accuracy for the cutting, bending and placing of the reinforcement. Reinforcement shall be inspected for compliance with the requirements as to grade, size, shape, length, placing and locations after it has been placed. No concreting shall be started unless the reinforcement as placed in the work is finally checked, recorded and certified by the Engineer-In- Charge. All bending shall be as per the IS:456 IS : 2502 : 1963 & only cold bending shall be allowed.

Before the reinforcement is placed, the surface of the bars and the surfaces of the metal bar supports shall be cleaned of the rust, scale, dirt, grease and other objectionable foreign substances. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in the concrete.

Reinforcing bars shall be accurately placed and secured in positions so that the clear distance between two main bars shall not be less than the greatest of the following :

- (i) The Diameter of the bar if the diameter are equal.
- (ii) Diameter of larger bar if diameter are unequal.
- (iii) 5 mm more than the specified maximum size of coarse aggregate.

The bars and fabric shall not be displaced during the placing of concrete. The contractor shall also ensure that there is no disturbance of the reinforcing bars in concrete that has already been placed.

Wire for binding reinforcement shall be of soft and annealed a mild steel and shall conform to IS:280. Binding wire shall have a tensile strength of not less  $56 \text{ kg/mm}^2$ . The provision made in M-8 (material Specification) shall be applicable. Chairs, hangers spacers and other supports for reinforcement may be of concrete, metal or other approved material.

The minimum allowable clearance between parallel round bars shall not be less than 1.5 times the diameter of the largest bars and for square bars shall not be less than twice the side dimensions of the larger bars or 1.5 times the maximum size of aggregate whichever is greater.

Bars crossing each other, where required shall be secured by binding wire in such a manner that they do not slip over each other during the fixing and concreting. Wire used for binding reinforcement shall not be measured for payments.

## **Splicing**

Where it is necessary to splice reinforcement the splices shall be made by lapping, by welding or by mechanical means.

Joints or splices in reinforcing bars shall generally be made at the location where neither shear nor bending moment is maximum, but the Contractor would be permitted to make joints or splices at other position provided that such positions are approved by the Engineer- in-Charge and joints and splices in adjacent bars are staggered as directed by the Engineer-in-Charge. Approval of such additional splices will generally be restricted to splices not closer than 8 m in horizontal bars or 4 m in vertical bars measured between midpoints of laps.

If the Contractor proposes, to use welded splices in reinforcing bars, the equipment the material and all welding and testing procedures shall be subject to the approval of the Engineer-in-Charge. The Contractor shall also carry out test welds as required by the Engineer- in-Charge.

Reinforcing bars 28 mm in diameter and larger may be connected by butt welding provided that lapped splices will be permitted if found to be more practicable than butt welding and if lapping does not encroach on cover limitation or hinder concrete or reinforcement placing.

Reinforcing bars 25 mm in diameter and less may be either lapped or butt welded, whichever is the most practicable.

Butt welding of reinforcing bars shall be performed under cover from weather and may be



performed either by the gas pressure or flash pressure welding process or by the electric arc methods. The following requirements shall apply to all welding of reinforcing bars including butt welding and the preparation of welded reinforcement mats.

Welded pieces of reinforcement shall be tested at the rate of 0.5 % of total number of joints welded. Specimens shall be taken from the actual site of work. Strength of the weld provided shall be at least 25% higher than the strength of bar.

If the contractor proposes to use mechanical couplings for reinforcing bars, he shall submit samples of the proposed coupling to the Engineer-In-Charge for approval not less than 60 days prior to their proposed use.

In case of welded splices for reinforcing bars conforming to IS:1786, welding shall be done in accordance with IS:9417. For reinforcing bars conforming to IS:432-(Part-I), welding shall be done in accordance with IS:2751. Electrodes for manual metal arc welding shall conform to IS:814 (Part-I) and IS:814(Part-II). Mild steel filler rods for Oxy- acetylene welding shall conform to IS:1278 provided they are capable of giving a minimum butt weld tensile strength of  $41 \text{ kg/mm}^2$ .

#### **Cover and cover block:-**

The clear cover and cover to the reinforcement shall be provided as shown in the drawing. In case it is not shown, the clear cover and cover block to be ascertained from the Engineer-In-Charge. To maintain the correct clear cover, cement mortar block of size 5 cm x 5 cm and thickness according to the clear cover as of the strength of the concrete shall be fasted. The cover block shall have binding wires rigidly inserted in them to tie it with the reinforcement. The cover block shall be sufficiently cured to attain the required strength.

All protruding bars from concrete to which the other bars are to be spliced and that will remain exposed to action of weather for indefinite period shall be protected from rusting by thin coat of neat cement grout. Accurate records shall be kept at all time of numbers, sizes, lengths and weight of bars placed in position for different parts of the work.

#### **Care of Placed Reinforcement and Concrete**

Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position, care shall be taken to ensure that at no time the radius of the bend is less than 6 diameters for deformed bars and 4 diameters for plain mild steel bars. Care shall also be taken, when bending such bars, to ensure that the concrete around the bars is not damaged.

#### **Mode of Measurement and Payment:-**

Measurement for payment, for furnishing and placing reinforcing bars will be made only on the calculated weight of the bars placed in concrete, in accordance with the drawings or as directed by the Engineer-in-Charge. The calculated weight for reinforcing bars shall be determined as follows. The calculated weight/meter of reinforcing bars used shall be based on the standard weight and the corresponding lengths of bars placed in concrete by the Contractor as per Material specification specified **M-6** and reproduced as under.

The weight of reinforcing bars shall be based on following table:

**Table : Cross Sectional Area and Mass (IS:1786**

Nominal size in mm (dia)	Cross section area in $\text{mm}^2$	Mass per m run in kg.
1	2	3
6	28.3	0.22

8	50.3	0.39
10	78.6	0.62
12	113.10	0.89
16	201.20	1.58
18	254.60	2.00
20	314.3	2.47
22	380.30	2.98
25	491.10	3.85
28	616.00	4.83
32	804.60	6.31
36	1018.30	7.99
40	1257.20	9.86
45	1591.10	12.49
50	1964.30	15.42

All other joints or splices shown on the drawings or as directed by the Engineer-in-Charge shall be measured as laps. Except as provided additional joints or splices shall not be measured for payment. Payment for furnishing and placing reinforcement bars shall be made at the rate tendered thereof in the Schedule B. The rate shall include the cost of preparing reinforcement as per detailed drawings. The unit rate shall also include cost of all incidental operations necessary to complete the work as per specifications.

Supporting chairs/separators prepared from TMT reinforcement preferably of equal dia. or as directed by the Engineer-In-Charge shall be measured and paid for as per standard weights on the lines of payment for reinforcing bars.

#### **Mode of Measurement and Payment:-**

The measurement and payment shall be made per metric ton (MT) of steel used in the work.

#### **ITEM NO. 8 :- Providing and fixing in position pre-moulded asphalt or bitumen cork board of approved quality and specifications as per design and drawing.20 mm thickness**

##### **General**

The bituminous pad shall be premoulded fiber board impregnated with bituminous materials to render it durable and rot proof. It shall be easily compressible and shall recover nearly to its original thickness after releasing the compression.

The bituminous pad shall be of the required size and standard measures and should conform to IS 1838-1983.

The pad shall be cut to the required size and placed in positions firmly so that it shall not be displaced at the time of concreting. The bituminous pad shall consist of large pieces. Assembly of smaller pieces to make up to required size shall not be permitted to be used.

#### **Mode of Measurement and Payment:-**

The measurement and payment will be on sq. meter basis of the actual quantity placed in position.

The unit rate shall include all the cost for furnishing, transport and include of bituminous pad and all cost of incidental operation needed to site of work as per specifications. The rate shall be on square meter basis of the actual quantity of asphalt pad.

**ITEM NO. 9 :- Providing and fixing 110 mm diameter P.V.C..Pipe (6 kgf / sqcm) Water spout with necessary iron grating as per design**

The P.V.C Pipes to be used shall be of standard, ISI make and of good quality. It shall be of specified diameter and shall be first approved by the Engineer in charge.

The pipe shall be fixed as per the drawing and or as directed by the Engineer-in-charge or his agent. After the pipe is laid, taste shall be carried out to ensure that, the water poured on Road slab gets drained to the satisfaction of the Engineer in charge.

**Mode of Measurement and Payment:-**

The workdone under this item shall be measured at unit of running meter of PVC Pipe provided including necessary fitting work completed. The payment of PVC Pipe shall be made on completion of work for running meter basis

**ITEM NO. 10 :- Providing and laying in position 110 mm dia (6 kgf/sqcm) P.V.C. Pipe for weep holes with non corroding jali in abutments, wing walls, retaining walls etc. complete.**

The PVC Pipes to be used shall be of standard make and of good quality. It shall be of specified diameter and shall be first approved by the Engineer in charge. The pipe shall be fixed as per the drawing and or as directed by the engineer-in-charge or his agent. After the pipe is laid, taste shall be carried out to ensure that, the water poured on Road slab gets drained to the satisfaction of the Engineer in charge.

**Mode of Measurement and Payment:-**

The workdone under this item shall be measured at unit of running meter of PVC Pipe provided including necessary fitting work completed. The payment of PVC Pipe shall be made on completion of work for running meter basis

**ITEM NO. 11 :- Providing and fixing in position P.V.C. heavy duty water stops in barrels, troughs and wing walls with 25 mm wide expansion joint as shown in drawing including filling the joints with asphalt pad or bitumen cork board of approved quality. (Asphalt pad or bitumen cork board will be paid seperatly) (a)225 mm WIDE P.V.C. WATER STOP**

**General :-**

- (a) Polyvinyl Chloride (PVC) water stop shall normally have a centre bulb of 12.4 mm inside diameter and 25 mm outside diameter. It shall be 225 mm in width and shall have minimum of two or three longitudinal ribs on each side of the bulb evenly distributed between the bulb and the edge of the water stop. Each rib shall be 6.35 mm high and the rib adjacent to the center bulb shall have web thickness 12.5 mm and the rib adjacent to the edge shall have a web thickness of 10 mm. The Contractor, however will be permitted to use water stop with diamond shape and bulb, provided if the same conform to the specification and the functional and constructional requirement. For this purpose, the Contractor shall to the Engineer-in-charge, for approval, four sets of drawing

showing details of the water stop, including dimensions, shape and detail of intersections and splices between water stops of the same size and different sizes. Fabrication and procurement of materials shall be made only after the approval of the drawings by the Engineer-in-charge. Any fabrication or procurement of materials performed prior to approval of the drawing shall be at the Contractor's risk. The Engineer-in-charge shall have the right to ask Contractor to make any changes in the drawing which may be necessary to make the finished installation conforming to the requirements and intent of these specifications without additional cost to the Department. Approval by the Engineer-in-charge to the Contractor's drawing shall not relieve the Contractor of his obligation to meet all the requirements at these specifications or of the responsibility for the correctness of the Contractor's drawings.

- (b) One set of the above drawing will be returned to the Contractor either approved, disapproved, or conditionally approved and these shall be resubmitted for approval, if so directed.
- (c) The water stops shall dense, homogeneous and free from holes and other imperfections. The water stops shall meet the material and test requirements given hereinafter. The cross section of the water stops shall be uniform along its length and the thickness shall be symmetrical transversely. Tolerance for the dimensions given above shall be plus 5 mm in width, plus 2 mm in thickness and plus 1 mm for other dimensions.
- (d) Certificate copies of the laboratory test reports on the physical properties of the PVC water stops and a certificate stating that PVC water stops as furnished meeting with all other requirement of those specifications, be obtained by the Contractor from the manufacture of the PVC water stops and shall be submitted to the Engineer-in-charge for approval. 1.5 meter long three samples of the PVC water stops shall be obtained by the Contractor from the manufacture of the PVC water stops and shall be submitted to the Engineer-in-charge. These samples shall be furnished at least 60 days prior to embedment of any water stops in the structure.
- (e) The Contractor shall arrange to obtain the water stops from the suppliers in rolls securely packed. Containing a single length of not less than 12 liner meters and having inside diameter of not less than 0.3 meter.

## Materials

(a) The PVC water stops shall be fabricated by an extrusion process from an elastomeric plastic compound the basic resin of which shall be virgin Polyvinyl Chloride. No reclaimed Polyvinyl Chloride shall be used.

(b) The compound shall contain any additional resin, plasticizers inhibitors or other materials needed to ensure that the finished product shall have the following physical characteristics as per the CWC specification for PVC seal.

(i) Tensile Strength minimum	116 kg/cm <sup>2</sup>
(ii) Ultimate elongation minimum	300 %
(iii) Tear resistance minimum	49 kg/cm <sup>2</sup>
(iv) Stiffness in flexure minimum	24.6 kg/cm <sup>2</sup>
(v) Accelerated extraction	
(a) Tensile strength minimum	105 kg/cm <sup>2</sup>
(b) Ultimate elongation minimum	250 %

(vi) When tested in accordance with the effect of alkali test as described in the following paragraphs the material shall not show an increase in weight of more than 0.25 percent or a loss in weight of more than 0.10 % after 7 days, or more than 0.40 % increase in weight or more than 0.30 % loss in weight after 28 days. After 28 days immersion the dimension of the sample shall not differ from those of the original sample by more than 1.0 %. After 7 days immersion the Durometer hardness reading of the sample shall not differ by more than plus or minus 5 from the reading on the original sample.

(vii) When tested in accordance with the cold bend test described in the following paragraph, the material shall show no signs of cracking or chipping.

### **Inspection and Tests.**

- (a) All water stops shall be subject to laboratory tests before transport samples of the finished water stops and material for tests shall be furnished to the Engineer-in-charge. All tests shall be made by and at the expense of the Contractor.
- (b) Three samples from each lot of PVC water stops shall be taken for laboratory tests to determine physical properties of the compound in accordance with the random process.
- (c) Laboratory tests to determine physical properties of the water stops required to the furnished under these specifications shall be performed on test specimens cut from test units taken from the finished products. The Contractor shall furnish the specimens at his cost tests at places as directed.
- (d) Tests shall be made in accordance with the following methods
  - (i) Tensile strength                      ASTM designation D 638
  - (ii) Elongation                              ASTM Designation D 638
  - (iii) Durometer hardness    ASTM Designation D 2240 (type A)
  - (iv) Accelerated contraction test
  - (v) Effect of alkali
  - (vi) Cold bend test
  - (vii) Impact resistance

### **Installation**

- (a) Location and embedment of the PVC water stops shall be as shown on the drawing with approximately one half of the width of the water stops embedded in the concrete on each side of the joint. In order to eliminate faulty installation that may result in leakage. care shall be taken that the water stops are correctly positioned and secured during installation. All water stops shall be installed so as to form a continuous water light diaphragm in the joint, unless otherwise shown. Adequate provision shall be made to completely protect the water stops during the progress of the work.
- (b) Additional vibration over and above that used for adjacent concrete placement. Shall be carried out to ensure complete embedment of the water stop in the concrete. Large pieces of aggregate near the water stop shall be removed by hand during embedment to assure complete contact between the water stop and the surrounding concrete. Splices in the community or at the intersection of junction of PVC water stop shall be performed by heat sealing the adjacent surface in accordance with the Manufacturer's recommendations. A thermostatically controlled electric heat source shall be used to make all splices. The correct temperature at which splices should be made will differ with the material compounds but should be sufficient to melt. All splices shall be neat with ends of the joined water stop in true alignment. A meter box guide and portable saw shall be provided and used to cut the ends to be joined to ensure good alignment and contact between joined surfaces. After splicing, a remolding iron with ribs and corrugations to match the pattern of the water stop shall be used to reform the ribs at the splices. The continuity of the characteristic members of the cross sections of the water stop design (ribs, tubular center axis, protrusions, and the like) shall be maintained across the splices.
- ( c ) Where splices are required between water stop of different sizes, the splices shall be made as recommended by the manufacturer of the water stop and drawings showing the details of the splices shall be submitted to the Department for approval, as required in paragraph 'General' above.
- (d) Prior to embedment, the edges of the water stop shall be secured to looped wire in the end bulbs to improve the concrete bond as shown on the drawings. The bars shall conform to the provision of

section 5 'Reinforcement Steel fabrication and erection. The manner-in which the water stop is secured to the reinforcing bars shall be subject to approval.

**Mode of Measurement and Payment:-**

Measurement for payment for furnishing and placing PVC water stops shall be made on the basis of **Running meter** measured along the center line of the water stop with no allowance for lap at splices and intersection. The payment shall be made at the rate quoted for the item in Schedule-B. The unit price shall include the cost of making splices and intersections and of furnishing all labour, equipment, and materials required for installing the water stops and protecting the water stops from damage during the progress of the work. The unit rate shall also include the cost of preparing and submitting the drawing, producing samples of approval of the Engineer-in-charge and costs of all incidental work needed to complete the work as per the specifications. The rate does not include providing of asphalt pad.

**ITEM NO. 12 :- Providing and filling the polysulphide joint sealant of the approved make in the expansion and contraction joints in the c.c. lining including clearing the joints with air water jet.**

The work to be done under this item shall consist of furnishing all tools, Plants labourers and material required to carry out sealing of the joints in canal lining on slopes and bed between joints in transition walls, joints in through, between bottom slab of trough and R.C.C. floor. R.C. C. floor and R.C.C. lining between and walls of trough and stopping pier between stop log pier, transition wall, etc. including cleaning of joints with air and/or water jets and suitable equipment machinery as necessary to carry out the work as per specifications to the satisfaction of the Engineer-in-charge and providing and filing the two part polysulphide based sealant material.

**Material and Installation**

(a) Before taking up the work the existing joints shall be made good and thoroughly cleaned by suitable equipment/machinery and water jet to the satisfaction of the Engineer-in-charge. The joints shall be cut to the exact dimensions and shape as per detailed drawing before sealing the joint. The joints shall be filled perfectly with polysulphide joint sealant as carefully as possible. The expansion and Contraction joints are required to be filed with the approved quality of polysulphide sealant material for 12 mm depth. The contractor shall not claim any extra payment for any excess consumption of material or for the variation in the size of the groove.

(b) The polysulphide sealant material supplied/on the field shall conform to the British Standard BS. 4254-1983 or any other equivalent American Standard such as ASTM/U.S. Federal Specifications/U.S.B.R. Specifications and the work shall be carried out in accordance with the relevant standards. The tenderers shall furnish the following details along with the tender.

(i) Test certificate from the standard Institute for the sealant material which is to be used.

(ii) Technical details of the product.

(iii) The equipment proposed to be used on the site for the application and the procedure for carrying out the work.

(iv)The contractor shall furnish all the detailed calculation regarding consumable material such as two part polysulphide based sealant material.

**Mode of Measurement and Payment:-**

Measurement for payment for providing and filling two part polysulphide based sealant shall be made at unit rate for **linear meter** of sealant material joint provided. The unit rate includes the cost of cleaning the joints providing and filling joints with 12 mm thick sealant material and all other operation, required for completing the job. It shall also include the cost of preparing and submitting

the drawing, producing samples for approval of the Engineer-in-charge and costs of all incidental works needed to complete the work as per the specifications and the best workmanlike manner.

**ITEM NO. 13:- Providing temporary all weather and fair weather diversion suitable for traffic during the construction period of the bridge including providing necessary drains and all safety measures including red lamps/ signals at night for traffic etc. comp.**

Providing temporary all weather and fair weather diversion suitable for traffic during the construction period of the bridge including providing necessary drains and all safety measures including red lamps/ signals at night for traffic, WBM Road etc. comp as per instruction by Engineer in charge like requirement as per site condition.

In including Temporary Diversion item like earth work in drain /canal section ,900 mm dia NP2 pipe for water divert, After completion of work Excavation for removing diversion, removing 900 mm dia NP2 pipe, Dismantling WBM road etc.

**Mode of Measurement**

The measurement shall be taken on No. basis

**Mode of Payment:-**

The Payment shall be made on the Actual work done in No.

**ITEM NO. 14: Excavation in all sorts of soil. By machinery including preparing etc. comp. (Where qty. cannot be measured).Hyundai Long Reach Hydraulic Excavator R210 LC7LR (0.52 CM) Chain.**

Any soil which generally yields to the application of pick axes and shovels, phawadas, rakes or any such ordinary excavating Implement or organic soil, gravel, grit, sand, turf loam, clay, peat etc. fall under this category.

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

After clearing the site, excavation/earthwork should be carried out as per the direction given by engineer in charge. The excavation/earthwork shall be carried out in true line and level and shall have the width and depth as shown in the drawing or as directed. The contractor shall do the necessary shoring and strutting or providing necessary slopes to safe angle, at his own cost. For the said unmeasured work, the contractor has to deploy **Hydraulic Excavator R210 LC7LR (0.52 CM) Chain any similar equipment.**

The bottom of the excavated area shall be levelled both longitudinally and transversely as directed by removing excavated stuff and watering as required. No earth filling will be allowed for bringing it to level, if by mistake or any others reason excavation is made deeper or wider then shown on the plan or directed, no additional payment is being paid to contractor

The excavated stuff of the selected type shall be used in filling the trenches or levelling the ground in layers including ramming and watering etc. 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 50 m and all lift.

## **Mode of Measurement and Payment**

The measurement and payment shall be done on number of hours Hydraulic Excavator R210 LC7LR (0.52 CM) Chain or any similar equipment worked on site

**ITEM NO. 15: Excavation in all sorts of soil. By machinery including preparing road etc. comp. (Where qty. cannot be measured). Tractor with Trailer, RA as per Narmada SOR.**

Any soil which generally yields to the application of pick axes and shovels, phawadas, rakes or any such ordinary excavating Implement or organic soil, gravel, grit, sand, turf loam, clay, peat etc. fail under this category.

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

After clearing the site, excavation/earthwork should be carried out as per the direction given by engineer in charge. The excavation/earthwork shall be carried out in true line and level and shall have the width and depth as shown in the drawing or as directed. The contractor shall do the necessary shoring and strutting or providing necessary slopes to safe angle, at his own cost. For the said unmeasured work, the contractor has to deploy **Tractor with trailer**.

The bottom of the excavated area shall be levelled both longitudinally and transversely as directed by removing excavated stuff and watering as required. No earth filling will be allowed for bringing it to level. If by mistake or any others reason excavation is made deeper or wider then shown on the plan or directed, no additional payment is being paid to contractor.

The excavated stuff of the selected type shall be used in filling the trenches or levelling the ground in layers including ramming and watering etc. 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 50 m and all lift.

## **Mode Of Measurement and Payment**

The measurement and payment shall be done on number of hours Tractor with trailer worked on site.

**Signature of Contractor**

**Deputy Executive Engineer  
Drainage Sub Division  
Mahudha.**