

A. WORK AND SITE CONDITION

Name of work :- **Reconstructing of Canal Syphon Structure at Ch. 149.73 RD On KRBMC.**

1. Location :-

The work of **Reconstructing of Canal Syphon Structure at Ch. 149.73 RD On KRBMC** is to be carried out at Moje : **Tadkeshwar** Under Jurisdiction of KRBC Remo. Sub Division, Tadkeshwar of K.R.B.C. Division, Surat.

2. DETAILS OF SOURCES OF MATERIALS ARE AS UNDER :

Sr. No.	Name of Materials	Sources	Approximate distance from the site of work
1.	Metal	Areth (Mandvi) Zankhavav (Mandavi) Chikhali (Navasari)	10 to 15 K.M.
2.	Sand & Gravel	Tapi river (near Gaypagala) Narmada River (Bodeli)	20-25 K.M. 50-60 KM

The above information are given in good faith and for general guidance to contractor. The contractor shall however ensure and satisfy himself regarding all viz. the site condition, source of material and their quantum, available service etc.

3. Brief description of the work :-

The work of **Reconstructing of Canal Syphon Structure at Ch. 149.73 RD On KRBMC** is to be carried out under jurisdiction of KRBC Remo. Sub Division, Tadkeshwar of K.R.B.C. Division, Surat.

The works content mainly **Dismantling Of Existing Damage Structure, Earth Work and Compaction Of Earthwork, Concrete Work, Steel work, CC canal lining work, PVC Water Stoper, Asphalt Filling, Sign Board and Photography etc.**

4. Labour: -

Only unskilled labour is available locally at the site. All skilled and semi-skilled labour will have to be brought from outside.

5. Housing Accommodation: -

No housing accommodation is available at the site. Godown or storage facilities are not available at the site and the department will not be in a position to provide such facilities at the site. The contractor shall have to make such arrangement for the work at his own risk and cost if found necessary.

6. Material to be used: -

In the proposed work materials like cement (OPC), steel, sand, & metal are to be used. If any Good Earth required to be used shall be brought by contractor himself. No borrow area will be given.

7. Water Supply :-

Potable water will be available nearby the site. Contractor shall have to make their own arrangement for drinking water supply and also for the construction purpose on the site of work.

- 8.** The information and data mentioned herein above as well as shown or given in the various drawings accompanying the tender documents are for general information only. The department shall have no responsibility in respect of accuracy of these information, interpretation and conclusions drawn by the contractor in so far as the in formations/data are concerned. The contractor shall have to make their own investigations to satisfy themselves in regard to in formations/data given herein above.

- 9.** It shall be deemed that the contractors have satisfied themselves as to the nature and pertaining to transport, handling and availability and storage of materials, availability of labour, weather condition, at site and that the renderer has estimated his cost accordingly and the department will bear no responsibility for any of such knowledge of site conditions and also consequences thereof.

10. Roads :-

The contractor shall construct and maintain suitable inspection path or vehicle road in the work limit. Any haul or approach roads if necessary for the contractor's work shall be constructed/removed if necessary at his own cost. There will, however, be no charge of any reasonable use of any road constructed by Government.

11. Electric Power :-

The contractor shall have to make their own arrangements for getting power supply. If any difficulty is experienced in getting the power, the department may help in setting the difficulty to the extent possible without any obligation on the part of the department on this issue. The power supply is available nearby the site.

12. Observation of forest :-

During the construction period, the laborers and other employed by the contractor agencies shall strictly observe the following requirements :-

(a) Shall not possess or make use of any sorts of weapons (gun, spears etc.) explosive etc. and also shall not engage in hunting animals either for their flesh or for their bites.

(b) Shall not fall or break the trees for use as fire wood.

(c) Purchase all the requirement of teak wood from authorised fire wood depots run by the forest department.

13. Medical Aid :-

A dispensary is not available at the site. The contractor shall make his own arrangement for normal medical aid to their staff and labour. For serious

cases which have to send to tadkeshwar Shifa Hospital & Civil Hospital at Surat.

The contractor shall also provide at his own cost first aid arrangement at various work spots in accordance with the labour rules and regulations and as may be directed by the Engineer.

14. Post & Telegraph :-

There is Sub Post and Telegraph office near **Tadkeshwar**. No telephone facility is available at the work site.

15. Supply of Petrol & Diesel :-

At present there is no such facility available for petrol and diesel at the work site. But this facility is available at **Tadkeshwar**.

Signature of contractor

Executive Engineer
K.R.B.C.Division
Surat

B. GENERAL CONDITION

1. In the specifications "as directed"/" Approved" shall be taken to mean "as directed"/" Approved" by the Engineer-in-charge.
2. Wherever a reference to any Indian standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.
3. In "Mode of measurement" in the specifications wherever a dispute arises in the absence of specific mention of a particular point or aspect, the provisions on these particular points, or aspects in the relevant Indian standard shall be referred to.
4. All measurements and computations unless otherwise specified, shall be carried out nearest to the following limits.

(i) Length, width and depth (Height)	0.01 meter
(ii) Areas	0.01 Sq. Mt.
(iii) Cubic contents	0.01 Cu. Mt.

In recording dimensions of work, the sequence of length, width and height (depth) or thickness shall be followed.

5. The distance which constitutes lead shall be determined along the shortest practical route and not necessarily the route actually taken. The decision of the engineer-in-charge in this regard shall be taken as final.
6. Where no lead & lift are specified, it shall mean "all leads" & "all lifts"
7. For excavating lift shall be measured from centre of gravity of excavation depth to centre of gravity of depositing heights. In case of foundation concrete, and other items of cement concrete lift shall be measured from ground level to centre of gravity of depositing concrete.
8. Definite particulars covered in the items of work though not mentioned or elucidated in its specifications shall be deemed to be included therein.
9. Reference to specifications of materials as made in the detailed specification of the items of works is in the form of a designation containing the number of the specifications of the material and prefix "M" e.g. 'M-5'.
10. Approval to the samples of various materials given by the engineer-in-charge shall not absolve the contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the engineer-in-charge.
11. The contract rate of the item of work shall be before the work completed in all respects.
12. No collection of materials shall be made before it is got approved from the Engineer-in-charge.
13. Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such manner as to prevent damage, deterioration or intrusion of foreign matters and to ensure the preservation of their quality and fitness of work.
14. Materials if and when rejected by the engineer-in-charge shall be immediately removed from the site of work.
15. All works shall be carried out in a workman like manner as per the best techniques for the particular item.
16. All tools templates, machinery and equipment for correct execution of the work as well as for checking lines, levels, alignment of the works, during execution shall be kept in sufficient numbers and in good working condition on the site of the work.

17. The mode, procedure and manner of execution shall be such that it does not cause damage or over-loading of the various component of the structure during execution or after completion of the structure.
18. Special modes of construction not adopted in general engineering practices, if proposed to be adopted by the contractor, shall be considered only if the contractor provides satisfactory evidence that such special mode of construction is safe, sound and helps in speedy construction and completion of work to the required strength and quality. Acceptance of the same by the engineer-in-charge shall not however absolve the contractor from the responsibility of any adverse effects and consequences of adopting the same in the course of execution or completion of the work.
19. The contractor shall be responsible for observing the rules and regulations imposed under the "Minor Minerals Act" and such other laws and rules prescribed by Government from time to time.
20. All necessary safety measures and precautions (including those laid down in the various relevant Indian standards) shall be taken to ensure the safety of men. Materials and machinery on the work and also of the work itself.
21. The testing charges of all materials shall be borne by the contractor.
22. Approval to any of the executed items for the work does not in any way relieve the contractor from his responsibility for the correctness, soundness and strength of the structure as per the drawings and specifications.
23. All the items of the work shall be required to be executed during the closer period of canal including in muddy or wet soil or in stagnant water or in partial flowing water. Contractor shall have to plan the execution of work according to the closer period available in consultation with the engineer-in-charge. No any claim shall be granted for the non-availability of closer period or enough closer period.
24. Taking photographs at site before starting the work, during execution & after completion of work. Photographs shall be taken before, after execution of work photo shall be clear enough to represent nature of work done. Size of photo shall as directed by engineer-in-charge contractor have to make all arrangement for taking photograph. Developing it & present to department before finalization of work measurement shall be made on the basis of the actual work done and payment shall be made on basis.

SPECIFICATION OF MATERIALS

M-1 WATER

Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and trace of oil and injurious alkalies, salts, organic matter and other deleterious materials which will either weaken the mortar or concrete or cause effluence or attack the steel in R.C.C. containers for transport storage and handling of water shall be clean. Water shall conform to the standard specified in I.S. 456-2000.

Water for drinking will generally be found suitable for mortar or concrete. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete during curing of these which produce objectionable stains or other unsightly deposition on concrete or mortar surface. Hard and bitter water shall not be used for curing. Potable water will generally be found suitable for curing mortar or concrete or masonry. The turbidity in water shall not be more than 2000 ppm and shall preferably be as low as possible.

(a) Water used for mixing of concrete and mortar shall be free from injurious amounts of deleterious materials. Potable water is generally considered satisfactory for mixing and curing.

(b) Where water is found to contain any sugar or an excess of acid, alkali or salt, the Engineer-In-Charge will refuse to permit its use. As a guide the following table represents the maximum permissible values.

Particulars	Percent by weight
Organic	0.02
Inorganic	0.30
Sulphate	0.05
Alkali Chlorides	0.10
PH value	6 to 8

- (a) The Contractor shall have to make his own arrangement for the identification of source of water for the purpose of use in construction and curing of the concrete & mortar work & for other miscellaneous work for his own use etc. If required Contractor may plan at his own way for the alternative arrangement for getting the usable water conforming to IS-456-2000 (Table-1 clause 3.5.4) at his own cost. No separate payment shall be made on account of such alternative arrangement. However, the approval of the Engineer-In-Charge shall have to be obtained for such installation of alternative arrangements. The quality of water shall be checked once in a season or whenever the source of water is changed or as directed by the Engineer-in-charge

M-2 CEMENT

2.1 Only Ordinary Portland Cement of grade 53 shall be used conforming to I.S. 12269 - 1987 or it's latest version for the entire work under the tender in all respects and shall be procured in bag. The contractor shall have to make his own arrangement to procure the cement (bearing I.S.I. mark & which Cement brand / Company should be approved by department) directly from the manufacturer / authorized Dealer of Cement Company. The contractor shall arrange a suitable & adequate infrastructure for procuring, conveying with loading & unloading and proper storing the same to the site of work at his own cost with sufficient quantity for advance planning of work to be done in next fifteen days as approved by the Engineer-in-charge of the work, so that Deptt. shall be conduct minimum required test to ascertain its quality. For verification of such purchase, the contractor shall have to produce all the bills of manufacturer / authorized dealer's along with testing details (i.e. manufacturer's test result conducted in the it's Q.C. laboratory for each batch of cement which is brought to the work site) to the Engineer- in-charge of the work, so that works can be allowed if manufacturer's lab. result is found OK till the receiving of test results from approved lab of Deptt.

2.2 All cement shall be stored in dry, water tight stored shade, facilities to protect cement from dampness & properly ventilated structure. In case of storage of cement bag, the floor on which cement is to be stored shall be raised at least 30cm. above ground level & the bags shall not be piled more than 10 bags height and shall be arranged in headers & stretches fashion as close as possible. The Contractor shall be responsible for proper storage of cement and if any damage or deterioration there in, shall be responsible for the change or removed at his own cost.

Cement should be used in the work, in order of receipt to the store/ site, for this purpose, such consignment it arrives should be stacked separately and play card bearing the date of arrival should be pinned to the pile. The arrangement of storage and utilization shall be such that to ensure the utilization of the cement in order of its arrival at the storage and the contractor shall maintain updated record which would at any time show the date of receipt and proposed utilization of cement laying in the store at the site.

The contractor shall provide a double locking arrangement for the store and the key of one lock will remain with the Engineer-in-charge of the work or his authorized. The Engineer-in-charge shall any time have an easy access to the store and the site of the work for checking. The Engineer-in-charge or his authorized shall have authority to check and examine the method of storage, records, accounting and security provided by the contractor. The Contractor shall produce the proof by way of record, books, return, Performa etc. maintain by his staff on site, on demand from Engineer-in-charge of the work or his authorized and the contractor shall at all time keep these records update to enable to Engineer-in-charge of the work or his authorized to apply the check may desire to impose.

2.3 The cement brought by the contractor at the site, department shall be sampled as per I.S. 3535 (or latest version of I.S.) & sent it in approved lab. of Deptt. for testing as per I.S. 4031, 4032 (or latest version of I.S.). The contractor shall made arrangement for sampling work & it's submitted to the Government Laboratory at his own cost. Testing At the Rate Of 1 % of Estimated Cost Put to Tender Shall Be Deducted from Contractor's Bill As per Clause No.-76 of B-2 Form. The testing shall be done for each consignment received at the site. The cement consignment shall be more than 50 tons or part thereof; each consignment shall be stacked separately.

2.4 The cement not satisfying the criteria as per I.S. 12269 for grade 53 and IS 1489 shall be rejected and such stack of cement shall be removed immediately from the site of work. No extra cost either for testing or for rejected cement shall not paid to the contractor. No cement shall be used for the work without being tested and such work shall not be paid by the Engineer-in-charge and shall be removed at contractor's own cost. The results of the cement should be submitted by the contractor as and when required by the Engineer-in-charge or his authorized. Manufactures result as per lot of manufacturing will also have to be submitted.

2.5 A regular day to day account of cement received and consumed / used in the work, together with the particulars tender item & quantity of each of the work shall be maintained in ink by the responsible representative of the department and shall be signed both i.e. by the departmental representative as well as the contractor, after proper verification at the end of the day's work. The accounting shall be shown to the inspecting officer when asked for. The Engineer-in-charge of the work or his authorized shall have the authority to verify the stock and check on the consumption in any manner he thinks proper. The volume of one bag cement weight 50kg shall be considered as 0.0342cum. for mixing in concrete.

2.6 Frequency for Cement testing shall as under.

Weight of lot / batch (in tonne)	No. of Sample to be taken
Up to 50	1
51 to 100	2
101 to 200	3
201 to 300	4
301 to 500	5
501 to 1000	6

Physical / chemical properties of cement shall confirm to IS 3535-1986 or its latest version.

The contractor shall have to procure cement directly from the large-scale manufacturer main producer or authorized dealer which shall confirm I.S.I. The cement so purchased only shall be permitted to be used. The contractor shall provide satisfactory evidence to the Engineer-in-Charge in support of such purchase.

The cement after it is brought on sight (store) by the contractor, can only be allowed to use after obtaining necessary certificate of the test from any Government approved Laboratory/Institute & Company test result about its suitability for the use on the concerned works. The contractor shall produce/ submit the laboratory test results of cement samples as prescribed in I.S. 12269-(1987) & I. S. 4031-1999. Manufactures result as per lot of manufacturing will also have to be submitted. The contractor shall collect the required samples from the cement bags brought on site or work in the presence of Engineer-in-Charge or his authorised supervisory staff of the department, each sample shall be of 15kg by weight. The number of sample shall be taken as prescribed in IS 269-1976 & 4031-1968 or as revised from time to time. The cement brought on site of work shall be utilised within three month from the date of manufacturing. The quality of cement which does not confirm to the requirement of I.S. standard shall have to be removed from the site of work at the risk and cost of contractor.

The cement to be used shall be O.P.C as per I.S.12269-1987. Each bag of cement shall contain full quantity of 50 kg. The contractor shall take every precaution to store the cement properly so that it is not supplied by dampness of moist atmosphere or influence of foreign matter as per the satisfaction of Engineer-in-Charge. Cement shall be stored in such a way as to allow the removal and use of cement in chronological order of receipt i.e. first receive in first used. Different brands of cement or cement of the same brand from the different factories shall be stored in separate groups and shall not be mixed during use. Cement shall be kept in a store under good condition. Any cement which is found defective shall not be used. Daily account of receipt and use of cement bags shall be maintained by the department and the contractor in proforma approved by the Engineer-in-Charge. The contractor shall be fully responsible for the scope of local transport of cement from the site godown to the place of work.

Cement shall be kept in a store under double locking arrangements.

The cement shall be measured by one bag for all uses in concrete (except otherwise stated) and masonry etc. In no case cement shall be measured by the boxes or other means for the volumetric proportion of concrete and mortar. For calculation for the proportion, the volume of one cement bags taken as 0.0342 cu. Mt. (1.20 cft) and measuring box / bag shall be of size 30 cms x 30cms x 38 cms. For weight batch of concrete to be used, the cement shall have to be used as per actual weight and the contractor shall not be entitled for any compensation for loss in weight due to shifting of bags or on account of any reasons.

M-3 SAND

The sand to be used will be from Tapi River or Narmada River. The maximum size shall be limited 5 mm (3/16"). The sand is available from river. It shall be tested in Government laboratory at contractors' risk and cost.

Details regarding F.M. etc. may be pointed out in particular that all the sand will be available in natural conditions and may require blending to specification.

Quality: -

The sand shall consist of hard, dense, durable, uncoated siliceous gritty material from rock fragments. It shall be free from injurious amounts of dust, lumps, soft and flaky particles, shale, alkali, organic matter, loan, mice and other deleterious substance, the max, percentage of the deleterious substance in sand as delivered to the mixer shall not exceed the following values.

Material passing I.S. No. 200

Sieve B. S. S. or (I. S. No. 8)	3 (three) percent by weight
Clay lumps	1 (One) percent by weight
Cinders and clinkers	0.5 (Half) percent by weight
Mica	2 (two) percent by weight

However, the sum of the percentage of all deleterious substances, Mica, coated grains, soft and flaky particles, Loam etc. shall not exceed by 5% of weight. The sand impurities and sand producing a colour darker than the standard colorimetric test for organic impurities and sand producing a colour darker than the standard calorimetric test for organic impurities shall be rejected.

Grading:-

The sand shall be well graded and the sieve analysis of natural sand shall confirm to the following limits of gradation.

I. S. Sieve	Cumulative % of weight passing through sieve
10 mm	100
4.75 mm	92-100
2.36 mm	75-92
1.18 mm	55-82
600 Micron	30-64
300 Micron	10-40
150 Micron	3-10

Deviations from the prescribed limits of cumulative percentage retaining on sieve 10 mm, 4.75 mm, 2.37 mm, 1.18 mm, 600-micron, 300 micron and 150 microns shall be permitted provided the total of such deviation should not exceed 10%.

Fineness Modulus: -

The sand shall have a fineness modulus ranging between 2.4 and 3.2 subject to the gradation specified in the preceding paragraph. The modulus shall be computed by adding cumulative percentage of the sand retained on the standard screens from 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600-micron, 300 micron and 150-micron I.S. Sieve and dividing the sum by 100. The gradation of the sand shall be controlled that the fineness modulus of at least 9 out of 10 consecutive test samples of finished sand shall not vary by more than 0.10 from the average of 10 test samples. Any deviation from the specified range of gradation and fineness modulus will not be permitted without the written permission of the Engineer.

M-4 METAL

4.1 Coarse aggregate shall be machine crushed stone of black trap and shall be hard, strong, dense, durable, clean, free from skin and coating likely to prevent proper adhesion of mortar. All aggregates shall conform to IS 383-1963 and IS 515-1959 or as per latest version of Indian Standard.

4.2 The aggregate shall generally be cubical in shape, unless special stones of particular quarries are mentioned. Aggregate shall be machine crushed from the best black trap stone as approved by the Engineer-in-charge. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement for plain cement shall generally be as per the table given below. However, in case of reinforced cement concrete the maximum limit may be restricted to 6mm less than the minimum lateral clear distance between bars or 6mm less than the cover whichever smaller.

Table:1 Uniform grading of aggregate

IS SIEVE DESIGNA- TION	PERCENTAGE PASSING FOR SINGLE-SIZED AGGREGATE OF NOMINAL SIZE						PERCENTAGE PASSING FOR GRADED AGGREGATE OF NOMINAL SIZE			
	63 mm	40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
80 mm	100	—	—	—	—	—	100	—	—	—
63 mm	85 to 100	100	—	—	—	—	—	—	—	—
40 mm	0 to 30	85 to 100	100	—	—	—	95 to 100	100	—	—
20 mm	0 to 5	0 to 20	85 to 100	100	—	—	30 to 70	95 to 100	100	100
16 mm	—	—	—	85 to 100	100	—	—	—	90 to 100	—
12.5 mm	—	—	—	—	85 to 100	100	—	—	—	90 to 100
10 mm	0 to 5	0 to 5	0 to 20	0 to 30	0 to 45	85 to 100	10 to 35	25 to 55	30 to 70	40 to 85
4.75 mm	—	—	0 to 5	0 to 5	0 to 10	0 to 20	0 to 5	0 to 10	0 to 10	0 to 10
2.36 mm	—	—	—	—	—	0 to 5	—	—	—	—

Note: This percentage may varied some what by the Engineer-in-charge, when considered necessary for obtaining better density and strength of concrete.

In concrete for canal lining the percentage at 4.75 to 10mm fraction shall be reduced to about 5 to 10 percent of the total coarse aggregate). However, the exact gradation required to produce a dense concrete of specified strength and desired workability shall be decided by the Engineer-in-Charge.

4.3 The percentage of deleterious substances in only size of coarse aggregate as delivered to the mixture shall not exceed the following value.

Material passing No. 100	percentage by wt.
Screen	1
Shale	1
Coal	1
Soft Fragments	1
Other deleterious substances	1
Clay lumps	1

4.4 The Grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in the I. S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregate shall be stored separately and handled in such a manner to prevent the intermixing of different aggregates. If the aggregates are covered with dust, it shall be washed to make it clean. The coarse aggregates for plain and ordinary reinforced concrete shall be measured by volume as per the direction of the Engineer-in-charge.

M-5 M.S. BARS

5.1 T M T bars reinforcement FE-500 for R.C.C works shall confirm to IS IS : 1786-FE 500 and shall be of tested quality it shall also comply with relevant part of IS 456-1978.

5.2 For the purpose of payment the bars shall be measured correct upto 10mm length and weight payable at the rate specified below.

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

The contractor shall have to procure TMT directly from the Main Producer or it's authorized dealer which shall conform to I.S. The steel so purchased shall only be permitted to use. The contractor shall provide satisfactory evidence to the Engineer in charge in support of purchase, test certificate of the manufactures shall be produced, if so, required by the Engineer-in-charge. If further test be necessary, they will be done according to I.S.226-1968 and I.S. 223-1950 or as revised from time to time. Testing to be Carried out in GERI Or Government engineering College.

M-6 Binding Wire

6.1 The Binding wires shall be of 1.63 mm or 1.22 mm or (16 or 18 gauge) diameter and shall confirm to I. S. 280-1972 and I. S. 432-1982 or as revised from the time to time.

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

6.3 Storages: The wire coils shall be stored so as to avoid deterioration.

6.4 The other requirements are as per para which are applicable.

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

M-7 Asphalt :

Bitumen 80/100: The characteristics of this grade confirm to that of IS 90 grade of IS-73-1992.

M-8 Testing of Material :

The testing of material shall be carried out as and when required as per instruction of Engineer-in charge.

contractor shall get the material tested before putting into use as per Instruction of Engineer in-Charge.

M-9 Rubble (Stone) :

1.0 The stone shall be of the specified variety such as Granite /Trap Stone /Quartzite or any other type of good hard stones. The stones shall be obtained only from the approved quarry and shall be hard, sound, durable, and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. Either heavier or lighter stones than the recommended should not be used in any layer of the sea wall. Use of flatter stones (except in the crest) should be avoided.

Water Absorption:

The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with I.S. 1134-1974. The minimum crushing strength of the stone shall be 200 Kg/Sq.Cm. unless otherwise specified.

Specific Gravity:

As per IS: 1124-1974 using specific gravity bottle (50 ml), value generally shall not be less than 2.60.

Weathering Test:

As per IS: 1125-1976, there should be no weather effect to the rubble stone. This test measures durability and strength of stone. The value shall not exceed 10%.

Abrasion Test:-

The abrasion value of the stone determined using impact abrasion machine shall not exceed 30 percent.

Petrography Test:-

The contractor shall have to get approval of quarry for stone before procurement and transportation of stone to be used under different item of work to site from Engineer-in-charge. Also one petrography shall have to be carried out in Govt. Approved laboratory for stones of approved quarry, if stones should be used from more than one quarry, for each quarry petrography test shall be carried out separately.

The samples of the stone to be used shall be got approved before the work is started. The khanki facing stone shall be dressed by chisel as specified in the item for khanki facing in required shape and size. The face of the stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm nor shall it have depressions more than 10 mm. from the average wall surface.

Signature of contractor

Executive Engineer
K.R.B.C.Division
Surat

General Technical Specification

1. General

1.0 The work **Reconstructing of Canal Syphon Structure at Ch. 149.73 RD On KRBMC** is to be carried out under jurisdiction of Executive Engineer, KRBC Division, Surat.

1.1 Time limit for the completion of the said work is kept **6 (Six) Months**. Though time limit of the work is **6 (Six) Months**, but most of the work (i.e **work to be executed inside the canal or constructing Canal Syphon Structure**) is required to be completed within days of canal closer period probably in month of **Nov-2026 to January-2027**.

1.2 The Contractor shall make his own survey, arrangement for construction materials such like Cement, Fine aggregate, Coarse aggregate, Water, Steel etc. as per tender Specification.

1.3 A motorable inspection road shall be prepared and maintained by contractor for transportation of material and machinery as well as for inspection of the work including approach road during construction period at his cost. In working period, necessary temporary inspection facilities on site of work shall be also provide for the detailed inspection of the work. Proper diversion roads, for highway road traffic shall be maintained by the contractor with proper signboards and red lights on entry and exist of the division etc. as directed by the Engineer-in-charge in during currency of the contract without any type extra payment.

1.4 The work in general shall be carried out in workmen like manner as well as to the correct section, better (side slope) and gradient as per drawing and to the entire satisfaction of the Engineer-in-charge or his authorized any representative. The various works shall be done true to line, level and grade. The periodical checking of these works by Government's staff shall not absolve the contractor of his responsibility regarding the accuracy. In case of any deviation or discrepancy in line, level or grade at the meeting faces, the contractor shall make good the discrepancy at his own cost and without any extra compensation for the additional work involved. Whenever such a discrepancy is found to arise at the junction of works of different contractors, the responsibility to set right such discrepancy lies with the contractors concerned. The Engineer- in -charge shall further have the unquestioned right, if need be, to rectify the discrepancies and recover the costs from the contractor or contractors according to proportion as he may consider reasonable.

1.5 All work shall be carried out as per specification given in P.W.D. volume I & II and / or as per relevant latest I.S.I. standard and technical specification of contract document. The list of I.S. code & other publications for earthwork, concrete work, steel work & other misc. work etc. are laid down in this Volume.

1.6 The site shall be cleared of all rubbish material and heaps etc. and shall be handed over in neat and good condition after completion of the work.

1.7 The proposed methodology and program of construction including Environmental Management plan, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

1.8 The Provisions detailed below are applicable to all items of work and are deemed to be integral part of the detailed specifications of items of work and are to be followed strictly.

It shall be distinctly understood that the contract rate of the items is for the work completed in all respects and shall invariably be inclusive of the cost of paras 1.8.1 to 1.8.13 below.

1.8.1 All labour, materials, use of equipment, tools, plants, appliances, etc and scaffolding, from work, shuttering, centering etc. as may be required for satisfactory execution and completion of the item of work.

1.8.2 Fabricating, erecting, handling, conveying, placing and keeping in position of materials.

1.8.3 Consolidation, vibrating, curing, finishing, etc. wherever the nature of the items is obviously indicative of the same.

1.8.4 Racking as directed to the entire concrete surface to provide proper bond to the abutting masonry & finishing.

1.8.5 All work tests of materials required to be carried out as per specifications or as are required to be carried out in the opinion of the engineer-in-charge.

1.8.6 Definite particulars covered in the items of work, though not mentioned or elucidated in its specification shall be deemed to be included therein.

1.8.7 General reference of Indian standard given for the mode of measurement and payment will not be considered to override any definite provision made therefore in specifications of item.

1.8.8 For the purpose of payment, the quantity in respect of cement concrete work shall be computed as per the size as cast (which shall be in conformity with the structural drawings only and not finished.)

1.8.9 In case of substandard results of test cubes, as per specification on account of any reasons what so ever, the defective work shall be reconstructed or strengthened as necessary, as required by the government, by the contractor at his risk and cost without any extra expenditure to the Government, of replacement of such defective work. Contractor shall take all precaution and care, during dismantling and re-doing the work to ensure that any other work, so far executed is not damaged or affected.

1.8.10 The work shall be carried out in true line and level and in conformity with the detailed drawings and specified patterns.

1.8.11 All works shall be carried out in a workman like manner and as per the best techniques for the particular item.

1.8.12 All tools, templates, equipments etc. for correct execution of the work, as well as for checking lines, levels, alignment of the works during execution shall be kept in sufficient numbers on the site of work.

1.8.13 Scaffolding shall be provided by the contractor at his own cost for the execution of items in which it is essential.

TESTING OF MATERIALS:

1.9 All materials before being incorporated in the work shall be inspected and if necessary, tested before being approved by the Engineer-in-charge. Any work on which such materials are used without prior inspection (and when necessary prior testing) and without approval or written permission of the Engineer- in -charge may be considered as unauthorized, defective and not acceptable.

1.10 The day-to-day / periodical tests to be carried out on materials, mixes and placed concrete, mortar etc. shall be specified by the Engineer- in- charge or as per relevant IS from time to time for ensuring quality and workmanship. The contractor shall allow all facilities and co-operation towards collection of samples & testing procedure etc. The contractor shall supply necessary materials for testing at his own cost. Also, required labour for collecting samples of materials & transport facilities with loading, unloading to samples of materials from work site to field laboratory / Govt. laboratory / Govt. approved laboratory/GERI for tests, shall be supplied by contractor free of cost to department. Necessary arrangement for proper curing of cast specimen on work site & transport it from work site to laboratory shall be arranged by the contractor at his own cost.

1.11 The contractor shall supply necessary materials at testing laboratory for working out suitable Mix designs at his own cost. The methods of sampling and testing, the procedure and standards shall be as laid down by the Engineer-in-charge for the respective item as per relevant latest I.S.I. standard.

1.12 The materials, mixes and placed concrete, mortar, cores etc. shall be tested day to day or periodically at the Government Laboratory / set up at the site of work by Q. C. wing of department and the results given thereof shall be considered correct and authentic by the contractor. The contractor shall be given access to all operations / tests that may be carried out as aforesaid so that he may satisfy himself regarding the procedure and methods adopted. Maintaining quality of work shall be the fully responsibility of the contractor under supervision of Q.C. staff & execution staff of the work.

1.13 If, department has no adequate arrangement for setup laboratory at site of work, the contractor shall be established a laboratory with necessary

required equipment with required facilities of light, water etc. at site of work at his own cost / expenses to carry out field test. The contractor shall provide a set of sieve, weight batcher, stove, pan, cube moulds, cube testing machine, slump cone with compacting rod, flakiness & elongation gauge etc. at field laboratory for field test.

1.14 For each material, minimum 10 % test out of total test of each material and/ or at least one test where total nos. of tests for any material are less than 10 (ten) shall be carried out at GERI's laboratory. If there is no testing facility of material at GERI for particular type of material, the same shall be tested as testing laboratory as decided and directed by the Engineer-in-charge. Other tests shall be carried out in Govt. or Govt. approved laboratory as decided by the Engineer-in-Charge.

1.15 The concrete mix design shall be carried out in GERI/Govt. Engineering College as decided by the Engineer-in-charge and the WRD staff shall witness the final mix.

1.16 The contractor shall submit the monthly schedule in advance for the work to be taken up during that month and which shall be approved by the Engineer –in –charge. The work shall be carried out in accordance with approved work schedule.

1.17 As per specification and relevant IS provisions, all required tests shall be carried out for all materials and concrete used under this work. However, if there may be any doubt regarding quality of material, further test shall be carried out as decided by the Engineer-in-Charge and no any extra cost shall be paid to the contractor. If there may be any doubt regarding the quality of concrete, non-destructive testing shall be carried out as decided by the Engineer-in-Charge and if the quality of concrete/ work found poor/ inferior, the contractor shall have to remove the same at his cost and re-construct as per specification at his cost.

1.18 If there is any typographical error in any clause, conditions, information and provisions made in this tender documents, it shall be corrected by the Engineer-in-charge as per standard meaning or standard norms / provisions and it shall be acceptable and binding to the contractor. Contractor shall not be allowed to get un-due benefits because of any typographical error.

Signature of contractor

Executive Engineer
K.R.B.C.Division
Surat

D. SPECIAL CONDITION

1. Probable Working period:

Though time limit of the work is **6 (Six) months**, most of the work (i.e work to be executed within Hydraulic Structure and Work Inside Canal prism) Must be required to **completed within 90 days** canal closer period. (Tentative Closer Period Nov-2026 to January-2027.)

Hence the contractor shall have to deploy sufficient staff technical as well as managerial, labours, machineries, tools, plants etc to the site at work. More ever the contractor shall have to stack sufficient quantity of material required for the work before beginning of the work in advance as soon as work order is given. there is no scope of time limit extension. work to be executed within Hydraulic Structure and Work Inside Canal prism will have to be completed in Canal closer period of **90 days**. (Please Refer Milestones In Contract Data Form.)

2. Contractor has to make his own arrangement for tools and tackles size trolley, ropes, sharp edge tools, scaffolding etc. required for working facilities of this works. No such materials will be supplied by the department.

3. All material to be used shall be purchased from standard ISO certified reputed company as finalised by Engineer-in- charge. Contractor will have to purchase material directly from company or authorised dealer. He will have to produce original bill and authorised dealer certificates before consumption of material.

4. All materials shall be used after approval of samples from Engineer in-charge for the above said work. Contractor shall have to bring all of brand approved by Engineer in-charge. No brand other than finalized by Engineer in-charge will be allowed to use for said work.

5. Contractor must have brought safety equipment for all skill and unskilled workers. Contractor will responsible for all type accident occur on site. Contractor must have labours insurance and follow prevailing labour laws.

6. Contractor shall have to produce digital photography/Videography of the work before start the work, during the work and after completion of work of different stages and execution of new item when started and submit the Hard Copies 3 (sets) and soft copy (CD) of the same.

7. Contractor shall have to establish field laboratory at work site for testing of materials and field tests etc. with following equipments.

(1) Sieve sets for Fine Aggregate and coarse Aggregates

(2) Field Compression Testing Machine for Compressive Strength Measure

(3) Cube moulds, core cutter, weight balance slump cone etc.

8. **Closer Period:**

Though time limit of the work is **06 (Six) Months**, most of the work (i.e work to be executed within Hydraulic Structure and Work Inside Canal prism) is required to be completed **within 90 days** canal closer period under time Limit.

9. The Contractor should make his own arrangement for Diversion of Road & Planning of work should be done in such a way that after Completion of scheduled closer the irrigation activity is not disturbed.

10. The work is required to be start on the issue date of Work order. Bidder shall remain in contact with Engineer- In -charge for getting information regarding canal closer. Bidder have all required machinery for concrete work, so that it can be mobilized on the same day of closer date.

11. As & When Required Necessary Core Samples Will have to be taken as per Instruction of Engineer in Charge and tested At GERI. Testing Charge will be bourne By Contractor.

12. Wherever clauses or special condition of the tender are conflicting or similar in nature with reference to clauses SBD agreement, penalty actions shall be taken/initiated as per tender/special conditions in addition to provision of SBD agreement.

13. Award of the tender work is to be made to the tenderer whose esponsive tender is determined to be lowest evaluated tender and who satisfy condition laid down in the tender for respective class of registration.

14. All Bidders have to visit the site before quoting the tender. **(Site Visit Date :- 14.07.2026 Time :- 12.00 PM, For Site Visit Contact Shri S.Z.Patel (DEE) Mo. no. 98251 97301)** All the Bidders Shall have to make Their own assessment for Different resources available for construction and approaches to the site also and accordingly to quote the rates.

15. The Contractor shall have to submit the complete schedule and programme for completion of work, well in advance to the Engineer-in-Charge and get Approved.

16. The contractor shall have to mobilize sufficient form work (heavy form work: Acro plates) and machinery and other required resources for this work for time bound completion of work.

17. **Machinery Details**

Looking to the Time Schdule, Necessary Following Machinery Will have to be Avail By Procure or Hire Base by Contractor.

Sr. No.	Name of Machinery	Minimum requirement of equipment
(i)	Machinery for Excavation / Earthwork.	
1	Excavator / loader (min. 0.90 m3 bucket capacity)	2
2	Tipper / Dumper (capacity 5.0 m3)	3
3	Dozer (capacity 250 H.P.)	2
4	Vibratory Roller of suitable size	1
5	Water tanker	2
6	Compressor	1
7	Generator (65 KVA)	1
8	Water Pump	1
9	Batching Plant of required capacity	1
10	Slope Compacter & Hitachi Plate Compactor	1
11	Vibrators (needle and Surface)	2
12	Transit Mixer	5

Moreover, Above Machinery Listed is For Knowledge of Contractor. However Looking to the site condition As Instructed by Engineer in charge if any additional machinery required will have to be deploy by contractor.

18. The concrete for the construction of canal structure shall be produced using the concrete Automatic Batching mixing plant. The plant should have an auto measuring facility of different ingredients used for producing concrete on weight basis and have facility of printing the batching of concrete. Ordinary mixer with weigh batcher and concrete flori mixer machine shall not be allowed. The contractor shall have to mobilise sufficient nos. calibration of transit mixers for transportation of concrete. Where Transit Mixers Not ApproChable, Flori Should be allowed with prior Permission of Engineer in-charge.

19. The payment for the work executed shall be made as per availability of fund. If the payment will be delayed due to any reason, the contractor shall have to make his own arrangement for financial resources for the completion of works awarded to him within the time limit. Time limit extension will not be granted on account of delay in payment of executed work.

20. Contractor Shall have to establishe Site office at work site with necessary facility like Sitting arrangement, washroom, etc. If Contractor not established site office the penalty charges shall be apply by Engineer in charge From R.A.Bill payable to the contractor.

21. Contractor shall have to established mobile portable office at the camp site, with all basic aminiteis,i.e. pentry, washroom,restroom etc. facilites as per Clause no.63.Contractor also have to provide computers facilities with printer at mobile portable office. Paneltative action shall be taken to the contractor if he failed to provide so.and amount of Rs. 5,00,000/- shall be deducted from 1st R.A.Bill.

22. As per "Swachchh Bharat Abhiyaan" contractor shall have to provide mobile washroom facilities to his all staff i.e. helper, worker and other staff. If contractor failed to provide amount of Rs. 2,00,000/- Shall be deducted from 1st R.A.Bill.

23. Contractor shall have to submitted photographs of the mobile portable office, washroom at camp site with the 1st R.A.Bill.

24. The tenders (Notice No. 05) are invited for total __3__ Nos. of Packages. But maximum 2(Two) Packages will be awarded to the bidder even if lowest in more than two packages. Award of the work shall be decided by the department considering the options which are beneficiary to government. If the bidder will submit more than two bids, and also lowest in more than two bids, he shall have no any right for the choice of the particular work. If required the contractor's bid capacity and capability for completion of work, past performance records will also be considered for award of works and decision of department for award of work shall be final and binding to all the bidders under different works. • If the contractor is lowest in more than one Works and if required, the Engineer-in-charge will ask the contractor to prove their capacity to execute the work, he shall have to provide/prove the same immediately, otherwise nos of Works to be awarded shall be decided by the Engineer-in-charge and shall be binding to the contractor. The contractor shall have no any right to raise the objection against the decision of department.

Signature of contractor

Executive Engineer
K.R.B.C.Division
Surat

APPLICABLE PUBLICATIONS

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

Indian Standards

1	IS: 383-1970	Specification for coarse and fine aggregates from natural sources for concrete (third revision)
2	IS : 456-2000	Code of practice for plain and reinforced concrete (third revision)
3	IS : 457-1957	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
4	IS : 460-1985	Specification for test sieves (Part 1 to 3)
5	IS : 516-1959	Method of test for strength of concrete (Amendment No.1)
6	IS : 650-1966	Specification for standard sand for testing of cement (first revision) (Amendments No. 1,2 & 3)
7	IS : 1199-1959	Method of sampling and analysis of concrete
8	IS : 1489-1976	Specification for Portland Pozzolana cement (second revision) (Amendments No.1 to 7)
9	IS : 1791-1985	Specification for batch type concrete mixers (second revision)
10	IS : 2386-1977 (Part I to VIII)	Methods of test for aggregates for concrete
11	IS : 2430-1986	Methods for sampling of aggregates for concrete (first revision)
12	IS : 2505-1980	General requirements for concrete vibrators, immersion type (second revision)
13	IS : 2506-1985	General requirements for screed board type concrete vibrators

14	IS : 2580-1982	Jute sacking bags for packing cement (second revision) (with Amendments No.1 to 3)
15	IS : 3085-1965	Methods of test for permeability of cement, mortar and concrete
16	IS : 3535-1986	Method of sampling hydraulic cement (First revision)
17	IS : 3873-1978	Code of practice for laying in situ cement concrete lining of canals (first revision)
18	IS : 4031-1988 (Part 1 to 13)	Methods for physical test for hydraulic cement (first revision)
19	IS : 4032-1985	Method of chemical analysis of hydraulic cement (first revision)
20	IS : 4558-1983	Code of practice for under-drainage of lined canals (first revision)
21	IS : 4634-1968	Method for testing performance of batch-type concrete mixers.
22	IS : 4656-1968	Specification for form vibrators for concrete
23	IS : 4845-1968	Definitions and terminology relating to hydraulic cement (Reaffirmed 1987)
24	IS : 4925-1968	Specification for concrete batching and mixing plant
25	IS : 4926-1976	Specification for ready mixed concrete (first revision)
26	IS : 5256-1968	Code of practice for sealing joints in concrete lining on canals.
27	IS : 5512-1983	Specifications for flow table for use in test of hydraulic cement and pozzolanic materials (first revision)
28	IS : 5513-1976	Specification for Vicat apparatus (first revision)(AmendmentNo.1)
29	IS : 5515-1983	Specification for compacting factor apparatus (first revision)
30	IS : 5529-1985 (Part I & II)	Code of practice for in-situ permeability test

31	IS : 5640-1970	Method of test for determining aggregate impact value of soft coarse aggregates
32	IS : 5816-1970	Method of test for splitting tensile strength of concrete cylinders
33	IS : 5889-1970	Specification for vibratory plate compactor
34	IS : 5892-1970	Specification for concrete transit mixer and agitators
35	IS : 6461 (Part I to XII)	Glossary of terms relating to cement concrete
36	IS : 6923-1973	Method of test for performance of screed board concrete vibrators
37	IS : 6925-1973	Method of test for determination of water soluble chlorides in concrete admixtures
38	IS : 7245-1974	Specification for concrete pavers
39	IS : 7320-1974	Specification for concrete slump test apparatus (Amendment No. 1)
40	IS : 7861-1975 (Part I & II)	Code of practice for extreme weather concreting
41	IS : 8041-1978	Specification for Rapid Hardening Portland cement (first revision) (Amendments No. 1 to 4)
42	IS : 8043-1978	Specification for Hydrophobic Portland Cement (first revision) (Amendments No. 1 to 3)
43	IS: 8112-1989	Specification for 43 grade ordinary Portland Cement (First Revision)
44	IS : 8142-1976	Method of test for determining setting time of concrete by penetration resistance
45	IS : 9013-1978	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
46	IS : 9103-1979	Specification for admixtures for concrete
47	IS : 9284-1979	Method of test for abrasion resistance of concrete

- 48 IS : 12200-1987 Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.
- 49 IS:12269-1987 Specification for 53 grade ordinary Portland Cement (First Revision)

1.1.2 Other Technical Publications

- 1 Concrete Manual: USBR
- 2 ASTM: (i) C-156-80 water retention test
(ii) C-309-81 Type -2 Liquid membrane forming compound for curing concrete
(iii) C-491-80 Water Reducing Agent
(iv) E-97 Light reflectance Test
(v) C-494-80
- 3 Design Aids for Reinforced Concrete SP-16(S&T)-1980 To IS: 456-2000
- 4 CBIP: (Manual on Canal Lining)

Note: (i) 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 directed by Engineer-In-Charge.
(ii) Latest Version of IS and other publications shall be used.

Signature of contractor

Executive Engineer
K.R.B.C.Division
Surat

FREQUENCY OF TESTING

Sr.No	Test	Frequency	Acceptance Criteria
1	2	3	4
(A)	<u>Earthwork</u>		
1	Standard Compaction	1 per 1000 m ³ per source	1.5 to 1.7 gm/cc.
2	Field dry density	1 per 300 m ³ Minimum one in each zone per layer	(i) 85% density of standard compaction (ii) Moisture content shall be + 2% of O.M.C
3	Atterberg Limit & Swelling Pressure	1 per 1000 m ³ per source	LL:- 35 to 50, PL:- 20 to 30, PI :- 15 to 30
(B)	Cement one sample of 15 Kg. collected from 2% bags of 50 T. lot.		
(i)	Setting Time		
(a)	Initial setting Time	00 to 50 T. – 1 sample	(a) Initial time- Not less than 30 minutes
(b)	Final setting time	50 to 100 T. – 2 sample	(b) final time- No more than 600 minutes
(ii)	Fineness (By sieving)	100 to 200 T. - 3 sample	90% or more shall pass from 90 micron sieve.
(iii)	Consistency Test		About 30 percent
(iv)	Compressive Strength	200 to 300 T. - 4 sample 300 to 400 T. - 5 sample 500 to 800 T. - 6 sample 800 to 1300 T.-7 sample	<u>For O.P.C</u> Minimum 270 Kg/cm ² at 3 days. Minimum 370 Kg/cm ² at 7 days. Minimum 530 Kg/cm ² at 28 days.
(C)	<u>Fine Aggregate(Sand)</u>		
(i)	Silt content	1 per 150 m ³	Upto 3%
(ii)	Fineness modulus	1 per 150 m ³	2.6 to 3.2
(D)	<u>Coarse Aggregate(Metal)</u>		
(i)	Gradation Test	100 C.M. 1 Test	- Shall confirm to Mix Design

(ii)	Flakiness Test	101 to 500 C.M. - 1 Test	Maximum up to 20%															
(iii)	Impact Test	501 to 1500 C.M. - 1 Test 1501 to 5000 C.M. - 1 Test	Maximum up to 30%															
(iv)	Soundness Test	2 per season	Sodium Sulphate maximum 20% & with Magnesium Sulphate maximum 30%															
(v)	Specific Gravity & water Absorption	2 per season	Specific Gravity 2.5 to 3.0 Water absorption 1 to 1.5%															
(E)	<u>Water</u>																	
(i)	Chemical Analysis	1 per source	T.D.S - 300 mg/lit. Sulphate - 500 mg/lit Chloride - 6 to 8 Organic(Carbonic) Substances-200 mg/lit InOrganic(Non-Carbonic) Substances 300 mg/lit															
(F)	<u>Ordinary & Controlled Concrete IS 456-2000</u>																	
(i)	Compressive Strength	0 to 5 C.M. -1 Sample 5 to 15 C.M. -2 Sample 15 to 30 C.M. -3 Sample 30 to 50 C.M. -4 Sample 50 C.M. & above - 4+1 Sample for each C.M. or part thereof. 50 Note :a) 1 Sample= 6 Specimen of 15cm x 15cm x 15cm cube)	<table><tr><td colspan="3">For concrete of different grade the specified strength shall be as under :</td></tr><tr><td>Grade</td><td>7 Days (Kg/c m²)</td><td>28 Days (Kg/cm²)</td></tr><tr><td>M-10</td><td>70</td><td>100</td></tr><tr><td>M-15</td><td>105</td><td>150</td></tr><tr><td>M-25</td><td>175</td><td>250</td></tr></table>	For concrete of different grade the specified strength shall be as under :			Grade	7 Days (Kg/c m ²)	28 Days (Kg/cm ²)	M-10	70	100	M-15	105	150	M-25	175	250
For concrete of different grade the specified strength shall be as under :																		
Grade	7 Days (Kg/c m ²)	28 Days (Kg/cm ²)																
M-10	70	100																
M-15	105	150																
M-25	175	250																

		b) At least 1 Sample for a day's work			
(ii)	Slump Test	1 per day	60 mm to 80 mm		
(G)	TMT Steel	Qty			
	Test :- Ultimate tensile Strength, Yeild Stress, Elongation as per IS 1786				
		Lot below 100 tonne	Lot above 100 tonne		
	Under 10 mm	1 sample from each 25 tonne	1 sample from each 40 tonne		
	10 to 16 mm	1 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		
(H)	Rubble Stone				
	Specific Gravity	1 per season per Source	Not less than 2.5		
	Water Absorption	1 per season per Source	Shall not be absorb water more than 5 %		

TABLE SHOWING THE PHYSICAL PROPERTIES OF GEOFABRIC FILTER

Sr.No	Physical properties	Test Method		Value
Polymer composition, Structure and Physical properties				
1	Polymer	Polypropylene		
2	Structure	Woven with multifilament yarn in both Warp and weft directions		
3	Mass per unit area	ASTM D 3776		240 g/m
II	Mechanical Properties			
1	Tensile strength	Warp	IS 1969	55 KN/m
		Weft		30 KN/m
2	Elongation at designated peak tensile load	Warp		< 25%
		Weft		< 25%
3	Trapezoidal tearing strength	Warp	ASTM D 4533	> 1100 N
		Weft		> 750 N
4	Puncture strength(Mini)		ASTM D 4833 D	> 600 N
III	Hydraulic properties			
1	Apparent opening size		ASTM D 4751	0.15
2	Permeability		ASTM D 44981	32 lit/m2/sec
Roll Dimensions rate normal to the plane		Standard roll length;100 m Standard roll width; 5 m.		

SHOWING THE DETAILS OF WIRES WITH PHYSICAL PROPERTIES

Mesh Type Hexagonal	10 x 12 cms	Specification
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Mesh Opening D mm	100 (Between axis of Twists)	EN 10223
Mesh Tolerance	(+) 16% to (-) 4%	EN 10223
Tolerances (Box)	For length & Width (+/-5%); For Depth D = < 0.30 m...(+/-10%) D = > 0.30 m(+/- 5%)	ASTM A975
Characteristics	Zn + PVC	
Mesh wire Dia. mm	2.7 + 1.0	EN 10223
tolerance (+/-)	0.08	BS 1052
Zn coating Min(Gsm)	230	ASTM A641
Selvedge wire dia mm	3.4 + 1.0	EN 10223
tolerance (+/-)	0.10	BS 1052
Zn coating Min(Gsm)	260	ASTM A641
Lacing wire Dia mm	2.2 + 1.0	ASTM A975
tolerance (+/-)	0.06	BS 1052
Zn coating Min (Gsm)	220	ASTM A641
PVC Thickness		
Nominal mm	0.50	ASTM A975
Minimum	0.38	ASTM A975

Table 1
Material Tests Required To Be Carried Out For G.I.Wire And
P.V.C.Granuals.

Galvanized wire			PVC coating		
Test	Value	Specification	Test	Value	Specification
Tensile strength	350 to 500 N/mm ²	EN 10223	Hardness	Between 50-60 shore 'D'	ASTM D 2240
Elongation	10% min	EN 10223	Colour	Grey RAL 7037	ASTM D 1482
Adhesion of ZN	No Flakes	EN 10244	Tensile strength	20.6 Mpa Min	ASTM D 412
			Specific Gravity	1.3 to 1.35	ASTM D 792
			Abrasion Resist	< 12% Wt. Loss	ASTM D 1242
			Salt Spray Test	No effect	ASTM B 117
			Exposure to UV	No effect	ASTM A 975

TABLE : 2 MINIMUM MESH STRENGTH

Mesh Type	10 x 12
Characteristics	Zn + PVC
Mesh Wire mm	2.7
Parallel to twist K N/m	32.0
Perpendicular to twist k N/m	15.40

Signature of contractor

Executive Engineer
K.R.B.C.Division
Surat

Itemwise **Specification**

Item No. 1

Dismantling the R.C.C. work & disposing off the stuff including stacking of the useful materials etc. complete as directed. (a)Light reinforcement. (Main bar up to 16 mm dia.)

Workmanship:

The dismantling shall consist shall consist of dismantling the existing reinforced cement concrete as specified or shown in the drawing. Dismantling implies taking up or down or breaking. This shall consist of dismantling whole or work including all relevant items as specified or shown in the drawing.

The dismantling shall always be planned before hand and shall be done in reverse order of the one in which the structures was constructs was constructed. This scheme shall be got approved from the Engineer-in-charge before starting the work. This however will not absolve will absolve the contractor from the responsibility of proper and safe dismantling. Necessary propping, shoring and under planning shall be provided for the safety of the adjoining work or property. Which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.

Wherever required, temporary enclosures or partition shall also be provided. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.

Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or dismantling concrete etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.

All materials obtained from dismentling shall be kept in safe custody to the Contractor. Any serviceable materials obtained during dismentling shall be separated out and Material Amount Shall be Deduct From Contractors Final Bill.

On completion of work the site shall be cleared of all debris rubbish and cleaned as directed.

Mode of Measurement and payment:

The measurement of all works except hidden works shall be taken before dismantling and no allowances for increase in bulk shall be allowed. The dismantling of concrete shall be measured under this item. Specification for deduction for voids, opening etc. shall be on same basis as that employed for construction or work.

The work shall be measured in decimal system as fixed on its place.

The rate shall include cost of all labours involved and tools used in dismantling including scaffolding. The rate includes scrapping, straightening and stacking the reinforcement category wise including cutting of reinforcement. The rates shall also include the charge for separating out and stacking the serviceable material properly and disposing the unserviceable material with all leads and lifts. The rates shall also include for temporary shoring of the safety of the properly.

Payment shall be made on cubic meter basis.

Item No. 2

Dismantling the existing foundation concrete including disposing the dismantled stuff including sorting out and stacking the useful materials and removing the debris and making good the damage etc. complete as directed. (c) R.C.C for super structure.

Workmanship:

This work shall consist of removing, as here in after set forth, existing culverts, bridges, pavements, kerbs and other structures like guard-rails, fences utility poles, manholes, catch basins, inlets, Bridge slab, Rubble masonry pier etc. Which is in place but interfere with the new construction or are not suitable to remain in place, and of salvaging and disposing of the resulting materials and backfilling the resulting trenches and pits. Existing culverts, bridges, pavements and other structures which are within the highway and which are designated to be removed shall be removed up to the limits and extent specified in the drawings or as indicated by the Engineer-in-charge.

Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and any other work to be left in place. All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work. The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the serviceable materials to be salvaged, the part of the structure to be retained and any other properties or structures nearby.

Unless otherwise specified, the superstructure portion of culverts/bridges shall be entirely removed and other parts removed to below the ground level or as necessary depending upon the interference they cause to the new construction. Removal of overlying or adjacent material if required in connection with the dismantling of the structures shall be incidental to this item. Where existing culverts/bridges are to be extended or otherwise incorporated in the new work, only such part of the existing structure shall be removed, as, are necessary to provide a proper connection to the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Reinforcing bars which are to be left in place so as to project into new work as dowels or ties shall not be injured during removal of concrete. Pipe culverts shall be carefully removed in such a manner to avoid damage to the pipes.

Steel structures shall unless otherwise provided be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the drawing or directed by the Engineer-in-charge that structure is to be removed in a condition suitable for re erection, all members shall be match marked by the contractor with white lead paint before dismantling end pins, nuts, loose plates, etc. shall be similarly marked to indicate their proper location, (If pins, pin holes and machined surfaces shall be painted with a mixture of white lead and tallow and all loose parts shall be securely wired to adjacent members or packed in boxes.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber as is designated to be salvaged by the Engineer-in-charge.

In removing pavements, kerbs, gutters and other structures like guard rails, fences, manholes catch basins, inlets, etc. where portions of the existing construction are to be left in the finished work the same shall be removed to an existing joint or out and chipped to true line with a face perpendicular to the surface of the existing strata. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer-in-charge. All concrete pavements, slab base course in carriage way and shoulders etc. designated for removal shall be broken to pieces whose volume shall not exceed 0.02 cubic meter and stockpiled at designated locations if the material is to be used later or otherwise arranged for disposal as directed. Where directed by the Engineer-in-charge holes and depressions caused by dismantling operations shall be backfilled with excavated or other approved material and thoroughly compacted in line with surrounding area.

All materials obtained from dismantling shall be kept in safe custody to the Contractor. Any serviceable materials obtained during dismantling shall be separated out and Material Amount Shall be Deduct From Contractors Final Bill.

Structural steel removed from old structure shall, unless otherwise specified directed, be stored in a neat and presentable manner. Structures or portions thereof which are specified in the contract for re-erections shall be stored in separate piles.

Mode of measurement and Payment:-

The unit of measurement is for cum of qty. dismantled. These will include excavation and backfilling where necessary and for handling, salvaging, and disposing of the dismantled materials within all lifts and up to a lead of 100 metres. Payment shall be made for item at the rates for completed items of work tendered therefore in schedule-B on **cubic meter** basis of actual work done.

Item No.3

Removing of exiting disturbed C.C.Block lining including opening of joints, stacking the same and disposing of stuff as directed etc. complete with all leads and lifts.

1.0. Workmanship

1.1. Removal shall be commenced in a systematic manner. The removed articles shall be properly stacked as directed.

1.2. All materials obtained from removal of cc block lining shall be kept in safe custody to the Contractor. Any serviceable materials obtained during dismantling shall be separated out and Material Amount Shall be Deduct From Contractors Final Bill.

1.3. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.

1.4. Any serviceable materials, obtained during Removal of lining shall be separated out and Stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed' by the Engineer-in-charge.

1.5. On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.

2.0. Mode of measurements and payment

2.1. The rate shall include cost of all labour involved and tools used in Removal of lining. The rate shall also include the charges for separating out and stacking the serviceable materials properly and disposing the unserviceable materials with all lead and lift.

2.2. The rate shall be for a unit of one **Sqaure Meter**.

Item No.4

Excavation for foundation in all sorts of soil including yellow, sandy, gravelly soil, soft & hard murrum, etc. dry condition including depositing the excavated stuff in uniform layers in banks or as directed etc. complete for lead up to 1.0 Km and all lifts. (By machinery) (a) Above water table.

1 Clearing the site.

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

2 Setting Out.

2.1 After cleaning the site the center lines will be given by the Engineer-in-charge. The contractor shall ensure full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply laborers, materials etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

3 Excavation:

3.1 The excavation in foundation shall be carried out in length, width and depth as shown in the drawing or as directed. The contractor shall do the necessary shoring and stuffing or provide necessary slopes to safe angle, at his own cost.

The bottom of the excavated area shall be leveled 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, by mistake or any other reason excavation is made deeper or wider than shown on the plan or directed. The extra depth or width shall be made with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The placing and method of excavations for all foundation shall be as per the approval of the Engineer-in-Charge.

3.2 No permanent structure shall be started over the excavated surface until and unless approved by the Engineer-in-Charge.

4 DISPOSAL OF THE EXCAVATED STUFF :-

4.1 The whole of the excavated material shall be brought to the surface and disposed off as directed.

4.2 The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering the finished formation levels, in case of filling shall be kept higher than the required levels by making an allowance of 10% of depth of filling for future settlement in case

of ordinary consolidated fills and 5% in cash where the consolidation is done by heavy mechanical means.

4.3 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 50m. and all lift.

Also follow relevant specification given in General Technical Specification- (2) Excavation.

5 MODE OF MEASUREMENT AND PAYMENT :-

5.1 (a) Before commencement of work, drawing shall be signed both by the Engineer-in-charge and the contractor.

(b) No claim for extra rate will be entertained for any excavation that may be required to be done for widening or deepening the foundations consequent upon lowering foundation below the level shown on the drawings or in wet soil. It should be at the approved tender rate of item.

(c) The rate of excavation includes the excavation process, clearing of site, prescribed lead & lifts, disposal of excavated stuff as stipulated in the specifications, providing all tools plant machineries labour and material, shoring and strutting where required preparation and maintenance of haul roads, transport of excavated material to temporary stock pits/disposal areas of point of final use, maintaining excavated slopes and trenches in wet condition including dewatering if any etc. complete.

(d) The rates also include cost of all incidental operations required for carrying out the work in accordance with the specifications.

(e) When the classification of the strata changes, the contractor shall bring this to the notice of the Engineer-in-Charge, who will then verify and take levels for the changed strata for purpose of measurement and shall be signed by the contractor in token of acceptance and the work shall not be started before the levels so taken are signed.

5.2 Dewatering:-

If dewatering is required to be carried out at any stage of excavation, the same shall be carried out. No separate/additional payment shall be made under these Item

5.3 Government is not responsible for any slips/sides. :-

Slips/sides shall be avoided but if any slip/slides occur on account of any reasons, the excavation shall be properly restored to stability. No extra claim shall be entertained for such slip/slides and their consequences.

5.4 Monsoon Damage:-

Damages due to rain or flood either in cutting or in banks or in foundation of the structure shall have to be made good by the contractor till the final section is handed over the WRD.

The responsibility of de-silting and making good the damages due to rain or flood rests with the contractor, throughout the defect liability period of work and not only limited to earthwork. No extra cost is payable for such operations to protect the work done during the construction and the contractor shall therefore have to take all necessary precautions to protect the work done during the entire construction period. The provision made in this para shall be applicable to all the components of the work under this contract up to defect liability period of the entire work. The contractor shall take all precautionary measures well prior to onset of the monsoon to prevent entry of flood waters of River, drains, nallas and other area. Any damage done to the work or silting or slush caused shall have to be attended by the contractor without any extra cost to WRD.

During monsoon the contractor shall make available the machinery such as pumps, excavators, dozers, rollers etc. and skilled and unskilled manpower to attend the emergency conditions of flood inundation caused due to construction

work at and nearby site area. The cost for such operations shall not be paid separately and deemed to be included in the rates quoted in respective Items of Schedule-B. This clause is applicable to all the items and all the components of work under contract.

5.5 The quantity of excavation shall be computed from the initial and final cross-section. The payment shall be made for quantity executed in **cubic meter**. It should be at the approved tender rate.

Item No.5

Excavation for foundation in hard rock including blasting and chiseling if necessary sorting out and stacking seperately the usable rubble,depositing the excavated stuff a sand where directed including back filing trenches with suitable excavated stuff etc.complete for lead upto 1.0 Km. and all lifts.(By machinary) (B) below water table.

3.1. General

3.1.1 The relevant specification of item no. 1 and 2 shall be also be applicable except that the excavation shall be carried out for foundation in hard rock requiring blasting.

The item includes the excavation for foundation of structures in hard rock including drilling, blasting and dewatering if required shall be done according to the dimensions and levels shown on the drawings.

3.1.2 Usable hard rock

The contractor shall have to remove and stack usable hard rock from the site immediately as directed by Engineer-in-Charge. In case while doing so if any kind of problem arises due to occupancy of private land by such stacking and removal of the same, it shall be entire responsibility of the contractor to resolve it including compensation if any.

3.1.3 The work is deemed to be carried out by machineries, or other suitable means as approved by Engineer-in-charge.

3.2 Definition of lead and lift

3.2.1 Lead specified in item of excavation shall mean the longitudinal distance along the River bank line parallel to the center line of the River and across River.

3.2.2 Lift in the item of excavation includes all the depth from mean ground to the River bed level.

3.3 Recording initial cross-section

3.3.1 After clearing the site prior to the beginning of excavation, initial levels shall be taken at 3x3 meter grid or at closer interval as per nature of ground up to sufficient distance outside the limit of work and recorded in the field book in presence of the contractor or his authorized representative. The cross-section shall from the base for computing the quantities for payment. The levels shall be entered in ink or by a ball pen in the field books by the Engineer-in-charge or his representative in the presence of the contractor or his authorized agent if he so desires and these shall be binding to the contractor. The contractor or his authorized agent shall have to sign the field book and the cross-section in token of acceptance.

3.3.2 These cross-sections shall form the basis of all future measurements and payment. The original cross-section duly signed by the contractor and the Engineer-in-charge preserved in the safe custody of Engineer-in-charge.

3.3.3 No separate payment will be made to the contractor for the labour and material required for taking this cross-section.

3.4 Use of Blasting materials :

3.4.1 General :

The contractor shall acquaint himself with all the applicable laws and regulations concerning storing, handling and the use of explosive. All such laws, regulations and rules etc. as are current from time to time shall be binding upon the contractor.

The provisions detailed in these rules are supplementary to the above laws rules and regulations etc. and are applicable except where they conflict with the aforementioned law etc. from time to time. Further the engineer may issue modifications alternations or new instructions from time to time; the contractor shall comply with the same without these being made a cause for any claim.

For the blasting, the contractor shall have to get the permission from the competent authority and follow and implement the conditions as may laid down in permission at his cost. The Engineer-in-Charge may facilitate to get the permission.

3.4.2 Materials

All materials such as explosives detonators fuses, tamping materials etc that are proposed to be used in the blasting operation shall have the prior approval of Engineer-in-charge.

Black powder and safe explosives, (as commonly used in India) shall be used wherever possible. Explosive with Nitro-glycerine shall only be used under exceptional circumstances and where the above explosives are not effective.

The use of a fuse with only one protective coat is prohibited. The fuse shall be sufficiently water resistant as to be unaffected when immersed in water for thirty minutes. The rate of burning of the fuse shall be uniform and not less than 4 second per inch of length with 10% tolerance on either side.

Before use, the fuse shall be inspected and the moist damaged or broken ones discarded. The rate of burning of all new types of fuses or when they have been in stock for long shall be tested before use.

The detonators used shall be capable of giving effecting blasting of the explosive. Moist or damaged detonators shall be discarded.

3.4.3 Personnel :

Excavation by blasting will be permitted only under personal supervision of competent and licensed persons and trained workmen deployed by the contractor.

All supervisors and workman in charge or makeup handling, storage and blasting work shall be adequately insured by the contractors.

The storage shall be in charge of very reliable persons appointed by the contractor in consultation with the Engineer who may if necessary, deal police Enquiries being made as to his reliability. The Contractor shall have to produce a security for the person in charge of the explosives if and as required by the Engineer, or the civil authorities of the District.

The contractor shall make sure that his supervisors and workmen are fully conversant with all the rules to be observed in storing, handling and use of the explosive. It shall be assured that the supervisor in charge, is thoroughly acquainted with all the details of the handling and the blasting operations

3.4.4 Storage of Explosive:

The contractor shall build a magazine for storing the explosives. The site of the magazine, its capacity and design shall be subject to approval by the Engineer and the inspector of explosive before the construction is taken up. As a rule, the explosive should be stored in a clean dry well ventilated bullet proof and fire proof building or on isolated site.

The explosive, detonators and fused shall each be separately stored.

A careful and day to day account of the use of explosive shall be kept by the contractor in an approved register and in an approved manner. The register shall be produced by the contractor for the inspection of the Engineer-in-charge. When so required by the later. The Engineer may also pay surprise visit to the storage magazine. In case of any unaccountable shortage of the explosive or if the account is not found to have been maintained in a manner prescribed by the Engineer the contractor shall be liable to be penalized with forfeitures of security deposit lodged by him with the government or his tender shall be liable to be cancelled in which case he shall not be entitled to any compensation for the losses etc. The action taken under this clause shall be in addition to that which might be taken by the competent civil authorities in a court of law.

The magazine shall of all timed be kept scrupulously clean all the time. No unauthorized person shall at any time be admitted inside the magazine.

The magazine shall, when not in use of authorized persons be kept well and securely locked.

The magazine shall on no account be opened during or on the approach of a thunderstorm and no person shall remain in the vicinity of the magazine during such period.

Magazine shoes without nails shall, at all times be kept in the magazine, and a wood-tub or cement through about 30cm high and 20cm in diameter filled with water shall be fixed near the door of the magazine. Persons entering the magazine, must put on the magazine shoes which shall be provided by the contractor for the purpose and be careful.

- (i) Not to put their feet on the clean floor unless they have the magazine shoes on.
- (ii) Not to allow the magazine shoes to touch the ground outside the clean floor.
- (iii) Not to allow any dirt or grit to fall on the clean floor.

Persons with barefoot, shall before entering the magazine dip their feet in water and then step direct from the tub over the barrier (if there be one) on to the clean floor. Brush or broom shall be kept in the log by the magazine for cleaning out the magazine on each occasion it is opened, for the receipt delivery or inspection of explosives.

No matches or inflammable material shall be allowed in the magazine, light shall be obtained from an electric storage battery later.

No persons having articles of steel or iron on him shall be allowed to enter the magazine.

Oil, cotton waste and articles liable to spontaneous ignition, shall not be allowed inside the magazine.

Workman shall be examined before they enter the magazine to see that they havenone of the prohibited articles on their persons

No tools or implements other than those of copper brass, gunmetal or weed shall be allowed inside the magazine. All tools shall be used with extreme gentleness and care.

Boxes of explosive shall not be thrown down or dragged along the floor and shall be stacked on wooden trestles. Where there are white ants, the legs of the trestles should rest in shallow copper, lead or brass bowls containing water. Open boxes of dynamite shall never be exposed to the direct rays of the sun.

Empty boxes or loose packing material shall not be kept inside the magazine.

The magazine shall have a lightning conductor, which shall be got tested at least once a year, by an officer authorized by the Engineer, the testing fee shall be a charged on the contractor which will be Rs.20 for each inspection. The contractor,

shall within 15 days comply with all the recommendations made by the affair testing the lightning conductor, failing which the Engineer, shall be entitled to comply with the same at the contractor's expense, which shall not be opened to question, or may consider any action that he may consider fit.
A notice shall be hung near the store prohibiting entrance of unauthorized persons.

The following shall be hung in the lobby of the magazine:

- (a) A copy of rules both in English and in the languages which the workers concerned are familiar with
- (b) A statement showing the up to date stock in the magazine.
- (c) A certificate showing the last date of testing of the lightning conductor.
- (d) A notice that smoking is strictly prohibited.

The magazine will be inspected at least twice a year by an officer representing the Engineer, who will see that all the rules are strictly complied with. He will notify all commissions etc. to the contractor, who shall rectify the defects within a period of 15 days from the date of receipt of the notice failing which the Engineer may take appropriate action in this regard.

3.5 Use of Explosive:

For the transport of the explosive and detonators between the store and site, closed and strong containers made of soft materials such as timber, zinc, copper, leather and the like shall be used.

Explosive and detonators shall be carried in separate boxes and transported separately. For the conveyance of primers special containers shall be used.

The boxes and containers used shall be kept well closed.

Explosive shall be stored and used chronologically to ensure the ones, received earlier, being used first.

A make-up house shall be provided at each working place in which cartridges will be made up by experienced man as required. The make-up house shall be separated from other buildings. Only electric storage battery lamps shall be used in this house.

No smoking shall be allowed in the make-up house.

3.6 Preparation of Primers:

The primers shall not be prepared near upon flames: or fires. The work of prepared of primers shall always be entrusted to the same personnel; primers shall be used as soon as possible after they are ready.

3.6 Charging of Holes:

The work of charging shall not commence before all the drilling work of the site is completed and the supervisor has satisfied himself to that effect by actual inspection.

While charging, open lamps shall be kept away for charging with powdered explosives, naked flame shall not be allowed.

Only wooden tamping rods, without any kind of metal on them, shall be allowed to be used.

Bore holes must be of such a size that the cartridges can easily pass down them.

Only one cartridge shall be inserted at a time and gently pressed home with the tamping rod. The sand, clay or other tamping material used for filling the holes completely shall not be tamped too hard.

3.7 Blasting:

Blasting shall be carried out during fixed hours of the day, which shall have the approval of the Engineer-in-charge. The hours once fixed shall not be altered without prior written approval of the Engineer-in-charge.

The site of blasting operations shall be prominently demarcated by red Tapier flag. The order to fire shall be given only by the supervisor in charge of the work and this order shall be given only after giving the warning signal three times, so to enable all the labour watchmen etc., to reach safe shelter and after having ascertained that nobody is within the Tapier zone.

A bugle with a distinctive note shall be used to give the warning signal. This bugle shall not be used for any other purpose. All the labour shall be made acquainted with the sound of the bugle and shall be strictly warned to leave their work immediately at the first warning signal and to make for safe shelters, and not to leave the shelters until the clear signal has been given.

All the road and foot paths leading to the blasting area shall be watched.

In special cases, suitable extra precautions shall be taken. The Engineer may however permit blasting for underground excavation without restriction of fixed time, provided that, he is satisfied that proper precautions are taken to give sufficient warning to all concerned and that the work of other agencies on the site is not unduly hampered.

For, lighting the fuses, a lamp with a strong flame such as a carbide lamp shall be used.

The supervisor shall watch the time required for the firing of the fuses and shall see that all the workmen are under safe shelters in good time.

3.8 Electrical firing:

Only the supervisor in charge shall keep key of the firing apparatus and he shall keep it always with himself.

Special apparatus shall be used as a source of current for the blasting operations. Power lines shall not be tapped for the purpose.

All the detonators shall be checked before use.

For blasts in one series only detonators of the same manufactures and of the same group of electrical resistance shall be used.

Such of the electrical lines as could constitute Tapier for work of charging shall be removed from the site.

The firing cable shall have a proper insulting cover so as to avoid short circulating due to contact with water and metallic parts of rock. The use of the earth as a return line shall not be permitted. The firing cable shall be connected to the source of current only after ascertaining that nobody is in the area of blasting.

Before firing, the circuit shall be checked by a suitable apparatus.

After firing whether with or without an actual blast the contact between the firing cable and the source of current, shall be cut off before any persons are allowed to leave the shelters.

During storms, charging with electrical detonators shall be suspended. The charges already placed into the holes shall be blasted as quickly as possible, after taking all the safety and precaution giving necessary warning signals. If this is not possible, the site shall be abandoned till the storm has passed.

3.9 Precautions after blasting.

After the blast, the supervisor shall carefully inspect the work and satisfy himself that all the charges have exploded.

After the blast has taken place in underground works, the workmen shall not be allowed to go to the face till all the toxic gases disappear from the face.

3.10 Misfires

It is suspected that part of the blast has failed to fire or is delayed sufficient time shall be allowed to elapse before entering the Tapier zone. When fuses and blasting caps are used, a safe time should be allowed and then the supervisor alone shall leave the shelter to see the misfire.

Drilling near the hole that has misfired shall not be permitted. Until one of the two following operations have been carried out by the supervisor.

(i) The supervisor should very carefully (When the tamping is of damp clay) extract the tamping with a wooden scarper or jet of water or compressed air (using a pipe of soft material) and withdraw the fuse with the primer and detonator attached. A fresh primer and detonator with fuse shall then be placed in this hole and fired.

(ii) The supervisor shall get one of the tamping cleared off and indicate the direction by placing a stick in the hole. Another hole may then be drilled at least 9" away and parallel to it, this hole should then be charged and fired. The balance of the cartridges and detonators found in the muck shall be removed.

Before leaving his work, the supervisor should inform the supervisor of the relieving shift of any case of misfire and shall point out the position with a red cross denoting the same and also state that action, if any, he taken in the matter.

The supervisor shall at once report to the office all cases of misfire, the cause of the misfire the steps taken in connection therewith.

The names of the supervisor in-charge of day and night shift must be noted daily in the contractor's office.

If a misfire has been found to be due to defective detonator, or dynamite, the whole quantity of box from which the defective articles was taken, must be returned to the authority as may be directed by the Engineer-in-charge for inspection to ascertain whether the whole box containing defective materials.

Re-drilling the holes that have misfired either wholly or partly shall not be permitted.

3.11 SHORING AND STRUTTING:

To avoid sliding of earthen side slopes necessary shoring & strutting shall be done using wooden or M.S. sections looking to the situation of site and as directed by the Engineer in charge, If directed layout/ for such shoring & strutting shall be get approved. Dewatering shall be done by bailing water or by operating pump set or by any other means without any extra cost.

3.12 Maintenance

The excavated foundation shall be maintained satisfactorily and protected by the contractor at his own cost against all damage, till it is taken over by the department. No extra payment shall be made to contractor for such maintenance.

3.13 Accident:

The contractor shall be fully responsible if any accident occurs due to carelessness in the blasting as well as careless in storage and preservation and safety of explosives, any all the damages and claims shall be paid by the contractor if any arise.

3.14 Mode of Measurement and Payment

(a) All items of excavation shall be measured and paid in cubic meter basis. The quantity of excavation shall be computed from the initial and final cross-section as described earlier in relevant Para. No payment shall be entertained for any excavation beyond pay line.

(b) No claim for extra rate will be entertained for any excavation that may be required to be done for widening or deepening the foundations consequent upon lowering foundation below the level shown on the drawings or in met soil. The works so done will be paid at the tendered rates of item.

(c) The rate of excavation includes the excavation process, clearing of site, prescribed lead & lifts, disposal of excavated stuff as stipulated in the specifications, providing all tools plant machineries labor and material, shoring and strutting where required preparation and maintenance of haul roads, transport of excavated material to temporary stock pits/disposal areas of point of final use, maintaining excavated slopes and trenches in wet condition including dewatering if any etc. complete.

(c) The rates also include cost of all incidental operations required for carrying out the work in accordance with the specifications.

(e) When the classification of the strata changes, the contractor shall bring this to the notice of the Engineer-in-Charge, who will then verify and take levels for the changed strata for purpose of measurement and shall be signed by the contractor in token of acceptance and the work shall not be started before the levels so taken are signed.

(f) No extra rate shall be payable for excavation below designed depth shown on the drawings. No claim for extra rate shall be entertained for any excavation that may be required to be done for widening or deepening the foundations consequent upon lowering of foundation below the level shown on the drawings. The works so done will be paid at the tendered rates of the item.

(g) No extra rate shall be payable for excavation of loose boulders which are embedded in soil and can be removed by pick bar and shovel without blasting.

(h) The excavation of structures shall be measured and paid on cubic metre basis. The quantity of excavation shall be computed from the initial and final cross sections as described in relevant para under canal excavation. No payment shall be entertained for any excavation beyond pay line. The rate shall include providing all the materials, tools, plants and labour required for excavation.

(i) The rate for the respective items of excavation for structures includes the excavation in all lifts, disposal of excavated stuff as stipulated in the specifications, providing all tools, plant, machinery, survey instruments, labour and material, preparation and maintenance of haul roads, transport of excavated material to temporary stock piles, re-handling of excavated material temporarily deposited in stockpiles to disposal areas or points of final use, disposal of excavated waste materials, maintaining excavated slopes and trenches, etc. complete. The cost of sorting and stacking the useful excavated material above high flood levels will not be paid extra and shall be deemed to have been included in the unit rate of completed item of excavation.

(j) No extra payment shall be made for the required shorting and strutting.

(k) The rate also includes cost of all incidental operations required for carrying out the work in accordance with the specifications. For Foundation excavation, intermediate payment will be made at rate as follow 95% rate of tendered rate up to 100% Qty. Remaining 5 % payment shall be released when the backfill is completed as per designed profile true to the line and levels and finally accepted on completion by the Engineer – in – Charge.

(l) The rate shall be for a unit of **one cubic meter**.

(m) The amount of quantity of hard rock available from the excavation shall be recovered at prevailing SOR Rate Rs. 211 cubic meter from contractor bill.

Item No.6

Dewatering the foundation trenches during excavation of canals, drains, foundation tranches, concrete, masonry etc. till completion and diversion of surface and sub surface water by using pumps of suitable capacity either

diesel or electrical driven including cost of labour, pipelines etc. for delivery distance beyond 50 meters.

During the execution of works, like excavation for foundation dewatering should constantly be carried out by means to make the foundation complete dry for further execution of works. This will help to be done till the work is carried to the safe stage. Register shall have to be maintained on site for operation of pumps.

No extra payment shall be claimed by the contractor on account of any damage. The contractor should visit the site of work and should ascertain and make their own necessary arrangement against dewatering problem.

The coffer dam if required shall be constructed for dewatering of foundation and for the execution of work. This may be done by constructing earthen bund or with putting up empty cement bags filled up with smooth compact earth and to be stacked in proper order. The rate of dewatering is including this work. Other relevant work is to be completed as early as possible. No extra payment shall be made for construction and maintenance of coffer dam and other works.

After completion of the work, the coffer dam shall have to be completely removed and site shall be cleared from obstruction of canal flow. No extra payment shall be made for this work.

Any diversion of flow, dewatering or bailing out that may be required shall be deemed to have been covered under this item.

Mode of Measurement and payment :

The measurement shall be made as per actual work done and maximum upto 1400 HP/HR, whichever is less and shall be taken on HP.HR basis. The payment shall be made on HP. HR basis for the completed period.

Item No.7

Providing and laying plain/ reinforced Design Mix cement concrete of various grade with cement, sand and coarse aggregates including centering, shuttering, batching, mixing, transporting, placing, vibrating, smooth finishing, curing etc. complete for all lead and lift. (Batching Plant Based, Including dewatering) (i) M-10 grade (ii) M-15 grade (iii) M-20 grade & (iv) M-25 grade.

1 Composition

Concrete shall be composed of cement, fine aggregate (Natural and /or crushed sand), coarse aggregates (crushed or natural or otherwise where specifically mentioned in the item in the schedule B of the tender) and water, well mixed in specified proportion

2 MATERIALS :

Water shall confirm to M-1 of specification of material.

Cement shall confirm to M-2 of specification of material.

Sand shall confirm to M-3 of specification of material.

Coarse aggregate shall confirm to M-4 of specification of material.

TMT Steel shall confirm to M-5 & M-6 of specification of material.

3 GENERAL :

Concrete mix shall be "DESIGN MIX" only and is to be design by preliminary tests in the laboratory. The proportions for ingredients shall be by mass only except for water. The grade of concrete shall be M-10, M-15, M-20 & M-25 with maximum size of aggregate is 20 mm.

4. PROPORTIONING CONCRETE

- (a) Concrete mix shall be designed on the basis of preliminary tests. The proportion of 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.
- (b) Except it can be shown to the satisfaction of the Engineer-in-charge that supply of properly graded aggregate of uniform quality can be maintained till the completion of work. grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions as required Different sizes however shall be stacked in separate stock piles Required quantity of material shall be stock piled several hours preferably a day before use. In proportioning concrete the quantity of both cement and aggregate shall be determined by weight water shall either be measured by volume .
- (c) It is most important to keep the specified water cement ratio constant To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge. The amount of mixing water shall then be adjusted to compensate for any variations needed in the moisture content. For the determination of moisture content in the aggregate IS: 2386-1977 (Part-III) shall be referred to Suitable adjustments shall also be made in the weight of aggregate to allow for variations in weight of aggregates due to variations in their moisture content.
- (d) The cement level for various grades of controlled concrete shall be considered as under as described in general technical specification for cement concrete works

Sr.No.	Grade of concrete	Cement level required in Kg per cubic meter of concrete
1	M.10	210
2	M.15	300
3	M.20	360
4	M.25	380

- (e) Actual cement level required for the aggregate to be used shall have to be determined by laboratory tests. 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 reinforcements and completely fills the form work. When concrete is hardened, it shall have the required strength, durability and surface finish As described in general technical specifications for cement concrete works

described above in condition no iii) In case for starting new works the mix design obtained from National council for cement and building material laboratory can be used for starting of work until the mix design of the corresponding work is available , so the necessary delay in starting the work due to want of mix design is avoided.

However the materials from the work site should be immediatly sent to laboratory for mix design.

- (f) A mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than that stipulated in tender specification. However, due to change in design mix, if it becomes obligatory to use less or more cement per cubic meter of concrete the Contractor shall do the same without claiming any extra cost for handling of extra cement, however due to change in design mix it is obligatory to use less/more cement per cumt of concrete. Contractor shall do same without claiming extra cost for using cement. In case actual cement use being less then cement level specified in table here in above, the department will deduct the cost of cement from the bill at the base price of star rate and rate analysis per tonne of cement at work site for reduce consumption of cement . In case actual use of cement being more than specified above no extra payment for additional cement level shal be made and contractor shall have to bear addition cost. Design mix and actual cement level required shall be communicated to the Contractor in writing by the Engineer-in-charge.
- (g) The quantity of water shall be just sufficient to produce a dense concrete of required workability and strength for the job. An accurate and strict control shall be kept on the quantity of water.
- (h) In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend upon the nature of work and methods of vibration of concrete, shall be determined by regular slump tests at work site , Slumps shall be adopted for different types of works by considering medium type degree of workability as per I.S.456-2000 and value for the same is as under.

Type of work	Slumps allowed
Raft/Wall/Structure	50-100 mm at site

5 DESIGN MIX CONCRETE

The design mix shall be design to produce the grade of concrete having the required workability and a characteristic strength and target mean strength as per IS-456-2000.

The design mix shall be carried out in Govt. laboratory (GERI) as per IS-10262./ OR Government Engineering college.

6 Strength Requirement of Concrete

The compressive strength requirements for the various mixes by concrete shall be as follows :

Type of concrete. Minimum Compressive strength in kg/cm² of 150 mm cubes.

Grade Of Concrete	7 Days	28 Days
M-10	2/3 of 28 Days Strength	100
M-15	2/3 of 28 Days Strength	150
M-20	2/3 of 28 Days Strength	200
M-25	2/3 of 28 Days Strength	250

6.1 Quantity of Water

- (a) The quantity of water shall be just sufficient to produce a dense concrete with required workability.
- (b) The workability shall be such that the concrete gives values of slumps as specified in para 4-(h).

6.2 PRODUCTION OF CONCRETE

6.2.1 MIXING

- Concrete Must be mixed in a Batching Plant or on Wheel Batching Plant and shall be as dense as possible, plastic enough to consolidate well and stiff enough to stay in place on the slopes. Where Transit Mixers Not Approachable, Flori Should be allowed with prior Permission of Engineer in-charge.

- (a) Mixing shall be continuous until there is uniform distribution of the materials and the concrete is uniform in cool and consistency. The time of mixing shall be as shown in Table 1 of IS:457-1957.

Consistency :

The quantity of water to be used in the concrete shall be determined from time to time during the course of concreting work in order to secure concrete of proper consistency and also adjust for any variation in the moisture content or grading of the aggregates as they enter the mixer.

Addition of water to compensate the stiffening of the concrete resulting from over mixing or objectionable drying before placing shall not be permitted. Uniformity in concrete consistency from batch to batch shall be ensured by taking slump test. Concrete shall be laid from the bottom to the top of the slope, for which consistency shall be such that the concrete will just stay in place on the slope.

7 Transporting Concrete

- (a) Concrete shall be transported from the mixer to the placing position as rapidly as practicable by methods that will prevent segregation or loss of

ingredients or the loss of slumps in excess of 25 mm before the concrete is placed in position.

- (b) Chutes used for conveying concrete shall be of such size and shape as to ensure a steady uniform flow of concrete in a compact mass without separation or loss of ingredients and shall be protected from wind and sun wherever necessary to prevent loss of slump by evaporation, and shall be furnished with a discharge hopper. Free fall or drop of concrete shall be limited to 150 cm. Chute sections shall be made of or lined with metal and all runs shall have approximately the same slopes not flatter than 1 vertical to 2½ horizontal. The required consistency of concrete shall not be changed in order to facilitate chuting. Wherever there is a free fall within the conveying system, suitable baffle plates, splash boards or down spouts shall be provided to prevent segregation, splashing or loss of ingredients. Whenever it is necessary to hold the discharge end of a chute more than 3 meters above the level of the fresh concrete, a flexible down spout shall be used to break the fall and to confine the flow. The lower end of the spout shall be held close to the place of deposit. Wherever depositing is intermittent, a discharge hopper shall be provided. All chutes shall be thoroughly cleaned before and after each run. All wash water and debris shall be disposed off outside the forms.

8 PREPERATION FOR PLACING CONCRETE

8.1 General Requirement

- (a) No concrete shall be deposited until the foundation has been inspected and approved and until all form work required is completed, embedded parts if any installed and checked and surfaces prepared for placing.
- (b) All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned off all such mortar or grout fresh concrete is placed.

8.2 Foundation Surfaces

- (a) Immediately before placing concrete, all soft or loose stuff shall be removed. For foundation over soil, the surface shall be moistened to depth of about 15 cm to prevent the sub grade from absorbing water from the fresh concrete. Just before placing the concrete, the surface of the earth shall be tamped or otherwise consolidated sufficiently to prevent contamination of concrete during placing. If subsoil water is met with the foundation, it shall be dewatered. The dewatering shall be continued till the placing and the setting of concrete is completed.
- (b) Foundation of porous or free draining material shall be thoroughly wetted and compacted by tamping or rolling if necessary. The finished foundation surface shall then be blanketed with a layer of a tar paper or a closely woven burlap, carefully lapped and fastened down along the seams. This shall be done to prevent the loss of ingredients including water form the concrete.

8.3 Surface of Construction and Contraction Joints

- (a) The surface of construction/ contraction joints shall be clean, rough and damp but free from standing pools of water at the time of receiving the next lift. Cleaning up shall comprise removal of all loose or uncompacted

materials surface coating, and other foreign materials, through by scrapping, chipping, water jetting or other suitable means.

- (b) The method used in disposing off waste water employed in cutting, washing and rinsing of concrete surface shall be, such that the waste water does not stain, discolour or affect exposed surfaces of the structures. Methods of disposal of waste water shall be subject to approval.
- (c) Nominal cover to meet durability requirements (clause 26.4.2) I.S 456-2000.

Exposure	Nominal concrete cover in mm not less than
Mild	20
Moderate	30
Severe	45
Very Severe	50
Exterme	75

9 Placing and Compacting Concrete

- (a) As far as it is possible, concrete shall be placed directly in its final position and shall not be caused to flow in a manner to permit or cause segregation. Methods and equipment employed in placing concrete shall ensure that aggregate is not separated from the concrete mass.
- (b) Manual concrete placing by head basket shall be permitted. The concrete shall be used within 30 minutes of mixing. Re-tampering of concrete shall not be permitted. Any concrete which has become so stiff that proper placing without re-tampering can not be ensured, shall be wasted.
- (c) In form work, structural concrete placement shall generally be started with an over-sanded mix containing 20 mm maximum size aggregate and 10% extra cement with a slump of about 125 mm placed several centimeters deep on the joints at the bottom of the form. Concrete placement shall commence immediately thereafter.
- (d) Concrete shall be compacted to the maximum practicable density, in such a manner that it is free from pockets of coarse aggregate and is in intimate contact with surface of forms and embedded materials. Unless otherwise permitted, all concrete shall be compacted by mechanical vibrator.
- (e) Compaction of concrete shall whenever practicable be carried out by the use of immersion type vibrators. Vibrators having vibrating heads less than 100 mm in diameter shall be operated at speed of at least 7,000 revolutions per minute in the concrete. Normally formwork shall be designed to provide for the insertion and operation of mechanical vibrators in the placed concrete. Form vibrators shall be used wherever internal vibration is not possible or would be inadequate.
- (f) In compacting each layer of concrete, the vibrator shall be operated in almost vertical position and the vibrating head shall be allowed to penetrate and re-vibrate the concrete in the upper portion of the under laying layer. In the area where freshly placed concrete in each layer joints with previously placed concrete, more vibration than usual shall be performed with the vibrators penetrating deeply at close intervals along these contacts. Layers of concrete shall not be placed until layers previously placed have been

vibrated thoroughly as specified. Contacts of the vibrating head with surface of the forms shall be avoided.

- (g) During placing and until curing is completed, the concrete shall be protected against the harmful effect of exposure to sunlight, wind and rain as directed.

10 Form Work

10.1 General

- (a) Forms shall be used wherever necessary to confine the concrete and shape it to the required lines, or to ensure against contamination of the concrete by material caving in or sloughing from adjacent surface left by excavation or other features of the work. All exposed concrete surface left by excavation or other features of the work and all exposed concrete surfaces having slope steeper than that of two horizontal to one vertical shall be formed.
- (b) Form work shall be of Steel Acro plate and adjustable steel props form work shall be substantially and rigidly constructed to the shapes, lines and dimensions required, efficiently propped and braced to prevent deformation due to placing, vibrating and compacting concrete, other incidental loads or the effect of weather. If any Specific Design Shape of concrete work required as per drawing, Steel mould shall be fabricated as Requirement.
- (c) The surfaces of form work shall be made such as to produce the surface finishes as specified. The form work joints shall be tight enough to prevent loss of liquid from concrete. Joints between the form work and existing concrete structures shall also be "grout tight". Form work shall be arranged to facilitate easing and removing of the various parts in correct sequence, without jarring or damaging the concrete. Fixing block bolts or similar devices may be embedded in the concrete, provided they do not reduce the strength or effective cover of any part of the structures below the required standard but the use of through bolts shall be avoided whenever possible. Temporary openings shall be provided at all points necessary in the forms to facilitate cleaning and inspection immediately before placing of the concrete.
- (d) Forms shall overlap the hardened concrete in the lift previously placed by not more than 75 mm and shall be tightened strongly against the hardened concrete so that when concrete placement is resumed, the forms will not spread and allow offset or loss of mortar at construction joints. Additional bolts or form ties shall be used as necessary to hold forms tight against hardened concrete. Particular attention shall be paid in setting and tightening the forms for construction joints so as to get a smooth joint free from sharp deviations or projections.
- (e) Moulding strips shall be placed in the corners of forms so as to produce chamfered edges as required on permanently exposed concrete surface.

10.2 Form, Centering and Temporary Works

- (a) All centering, form work and temporary works shall be constructed according to the approved drawings and specifications.
- (b) As soon as practicable, after the acceptance of the tender, the Contractor shall submit a scheme showing the order of procedure and method by which he proposes to carry out the work, together with such details as are necessary to demonstrate the adequacy, stability and safety of the methods.

- (c) The approval to the general scheme of centering as well as design criteria and loading shall be obtained in good time to facilitate all preparatory works. Any delay on this account shall be the responsibility of the Contractor.
- (d) After approval of the general scheme, the contractor shall prepare detailed designs and drawings for execution of the form work, centering and temporary works. These shall be forwarded to the Engineer-in-charge for approval. No work shall be carried out without prior approval of the Engineer-in-charge.
- (e) The approval of the Engineer-in-charge is specified with a view to reasonably ensure that the form work in general, is adequately designed. Notwithstanding the approval given to the design criteria and loading and the general scheme for the centering, the entire responsibility for the satisfactory execution of the centering and all temporary works shall rest with the Contractor and he shall be liable to pay all claims and compensation arising from any loss or damage to life and property due to any deficiency, failure or malfunctioning of the centering or the temporary works.
- (f) Forms required to be used more than once shall be maintained in serviceable condition and shall be thoroughly cleaned and repaired before reuse. Where metal sheets are used for lining forms, the sheets shall be placed and maintained in the forms without humps or other imperfections. All forms shall be checked for shape and strength before reuse.

10.3 Cleaning and Treatment of Forms

At the time the Concrete is placed in the forms, the surface of the forms shall be free from encrustations of mortar, grout or other foreign material. Before the concrete is placed, the surface of the forms shall be oiled with a commercial form oil, that will effectively prevent sticking and will not stain the concrete surface. For timber forms, form oil shall consist of pure refined pale paraffin mineral oil or other approved form oil. For steel forms, form oil shall consist of refined mineral oil suitably compounded with one or more ingredients which are appropriate for the purpose. Care shall be taken to keep form oil out of contact with reinforcement.

10.4 Removal of Forms

- (a) Except as otherwise provided in this sub-clause, forms shall be removed as soon as the concrete has hardened sufficiently, for earliest practicable repair of surface imperfections.
- (b) Forms on upper sloping surfaces of concrete, such as forms on the water sides of warped transition, shall be removed as soon as the concrete has attained sufficient stiffness so as to prevent sagging. Any needed repair or treatment required on such sloping surface shall be performed at once and be followed immediately by specified curing.
- (c) In order to avoid excessive stresses in the concrete that might result from swelling of the forms, timber forms for wall openings shall be loosened as soon as this can be accomplished without damage to the concrete.
- (d) Subject to the approval, forms on concrete surface close to the excavated rock surface may be left in place provided that the distance between the concrete surface and the rock is less than 400 mm and that the forms are not exposed to view after completion of the works.

- (e) Forms shall be removed with care so as to avoid damage to the concrete. Damage if any due to form removal shall be repaired immediately.
- (f) For ordinary Portland cement concrete the following minimum intervals of time as per specifications in IS : 456-2000 shall generally be allowed between placing the concrete and striking the formwork. The period shall be modified if required, in case of wet weather etc. as per direction of the Engineer-in-charge.

(i)	Wall, columns and vertical faces.	24 to 48 hours
(ii)	Slabs (Props left under)	3 days
(iii)	Beam soffits (Props left under)	7 days
(iv)	Removal of props under	
	Slabs spanning up to 4.5m	7 days
	Slabs spanning over 4.5 m	14 days
(v)	Removal of props under beams and arches	
	Spanning up to 6 m	14 days
	Spanning over 6 m	21 days

The number of props left under, their sizes and deposition shall be such as to be able to safely carry full dead load of slab, beams or arch as the case may be together any live load likely to occur during the curing or during further construction.

11 Finish and Repairs to Concrete

- (a) All exposed concrete surfaces shall be finished true to line and level, either manually or by mechanical contrivances. It shall be cleaned off impurities, lumps of mortar or grout and unsightly stains. The finished surface shall be even, smooth and free from pockets and equivalent to that obtainable by the effective use of a long handled steel trowel. Where the surface produced meets the specified requirements, no further finishing operation shall be required.
- (b) The surface of concrete finished against form shall be smooth and shall be free from projections, honeycombing and other objectionable defects. Immediately on removal of the forms, all unsightly ridges or lips shall be removed and undesirable local bulging on exposed surface shall be removed by tooling and rubbing.
- (c) Repairs to concrete surface and additions where required shall be made by cutting regular openings into the concrete and placing fresh concrete to the required lines. Chipped openings shall be sharp and shall not be less than 75 mm in depth.

12 Curing of Concrete

12.1 General

All equipment, material etc. needed for curing and protection of concrete shall be kept handy and ready for installing before actual concreting begins. Detailed plans, methods and procedures whereby the various phases of curing and protection shall be firmly established, shall be settled and got

approved from the Engineer-in-charge sufficiently in advance of the actual concreting.

12.2 Watering/ Curing

- (a) Uniform top surfaces of walls, piers etc. shall be moistened by covering with water saturated material or by other effective means as soon as the concrete has hardened sufficiently to prevent damage by water. These surfaces and steeply slopping and vertical formed surfaces shall be kept completely and continuously moist, prior to and during form removal, by water applied on the unformed top surfaces and allowed to pass down between the forms and the formed concrete faces. This procedure shall be followed by the specified water curing.
- (b) Concrete cured with water shall be kept wet for at least 14 days immediately following placement of the concrete or until covered with fresh concrete by covering with water saturated material or any other suitable method, which will keep all surfaces continuously (not periodically) wet.

13 Requirement of Concrete construction

13.1 General

All concrete construction shall conform to the permissible tolerance and technical provisions as described in this section and to the detailed requirements of the following paragraphs. All structures shall be built in a workman like manner or to the lines, grades and dimensions shown in the drawings or as prescribed by the Engineer-in-charge. The location of all the construction joints shall be subject to the approval of the Engineer-in-charge. The dimensions of each structure shown on the working drawings, which shall be given after award of contract shall be subjected to such changes as may be found necessary by the Engineer-in-charge.

13.2 Concrete in Structures Block outs

- (a) The item of the schedule for concrete in aforesaid structures include all concrete in the various components of the structure and in the blocks left for subsequent concreting.
- (b) All concrete required to be placed in blocks to permit the installation and adjustment of mechanical and other equipments shall be included in the respective concrete as directed above. The concrete surface inside the blocks left un-concreted, blocks shall be chipped and roughened as described hereinafter before the block concrete is placed.
- (c) Exceptional care shall be taken in placing the concrete in a blocks in order to ensure satisfactory bond with the concrete previously placed and to secure complete contact with all metal work in the blocks left.
- (d) The roughening of the concrete surface in the space left for the blocks shall be performed by chipping or sand blasting as approved by the Engineer-in-charge and in such a manner as not to loosen, crack or shatter any part of the concrete beyond the roughened surface. After being roughened the surface of the concrete shall be cleaned thoroughly to remove loose fragments, dirt and other objectionable substances and shall be sound and hard to ensure good mechanical bond between the existing and new concrete. All concrete, which is not hard, dense and durable, shall be removed to the depth required to the satisfaction of the Engineer-in-charge.

13.3 Embedment in Concrete

At some of the locations of structures as shown on the relevant drawings a few conduits or openings shall have to be provided through R.C.C./P.C.C. work. Construction of the surface for either placement of concrete shall have to be suitably carried out so as to meet with the placement of such conduits or openings. No extra claim for such provisions in constructions shall be entertained. Similarly, for gates, stop logs etc. anchors shall have to be embedded for blocks in concrete as shown in the drawings. For this also no extra payment shall be entertained.

13.4 Construction Joints

- (a) Concreting shall be carried out continuously up to the construction joints, the position and details of which shall be as shown on approved drawings or as directed by the Engineer-in-charge.
- (b) For vertical construction joints stopping boards shall be fixed previously at a predetermined position and shall be properly stayed for sufficient lateral rigidity to prevent its displacement or bulging when concrete is placed against it. Concreting shall be continued right up to the board. The board shall not be removed before expiry of the specified period of removal of vertical forms.
- (c) Before resuming work at any construction joint when concrete has not yet fully hardened, all laitance shall be removed thoroughly, care being taken to avoid dislodgement of coarse aggregates.
- (d) When work has to be resumed on a surface which has hardened, it shall be thoroughly raked, swept, clean, wetted and covered with a layer of neat cement grout, just prior to the placement of the concrete.
- (e) In all cases, the position and detailed arrangement of all construction joints shall be predetermined and got approved by the Engineer-in-charge.

14 Testing FOR concrete and acceptance of work

(a) Sampling Procedure

A random sampling procedure shall be adopted to ensure that each concrete batch has a reasonable chance of being tested, i.e. the sampling shall be spread over the entire period of concreting and shall cover all mixing units.

(b) Frequency :

The minimum frequency of sampling of concrete of each mix shall be in accordance with the following :

Quantity of concrete in m ³	Number of Samples
0 to 5	1
5 to 15	2
15 to 30	3
30 to 50	4
50 and above	4 Plus One Additional

sample for each additional 50 m³ or part there of However, at least one set of cubes in a day, irrespective of quantity of concrete shall be taken.

(c) Test Specimen

Three test specimen shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes, such as to determine the strength of concrete at 7 days or at the time of striking formwork, or to determine the duration of curing or to check the testing cubes cured. The specimen shall be tested as directed in IS : 516-1959.

Testing of Concrete Cubes Must be tested at Govt. approved Laboratory and at least 10 % Sample are tested at GERI by Contractor.

(d) Test strength of Samples

- (i) The test strength of the sample shall be the average of three specimen. Individual variation more than 15 percent of the average, shall be deleted for the purpose of averages.
- (ii) Contractor shall provide necessary unskilled labour and facilities for transport, for collection of samples, cores, etc. and shall remain present at the time when the samples are taken. Testing shall be carried out at the project testing laboratory or at any other laboratory that the Engineer-in-charge may decide upon and the results given thereby shall be considered as correct and authentic and acceptable to the contractor. The Contractor shall be given access to all operations and tests that may be carried out as aforesaid.
- (iii) The material and labour including transport for the materials for testing shall be provided by the contractor at his cost. He shall not be eligible for payment for this. The preparation and the testing of the cubes shall be carried out by the contractor at his cost.

(e) Acceptance Criteria

- (i) The average strength of the group of cubes cast in shall not be less than the specified works cube strength 20 % of the cubes cast may have values less than the specified strength provided the lowest value is not less than 85% of the specified strength.
- (ii) In case the concrete does not conform to the acceptance criteria for strength as specified above the Engineer-in-charge reserves the right to reject the work or accept the same at a reduced rate corresponding to the mix under which that concrete satisfies the strength requirements specified at para 3.6.2.6 for the leanest mix, the reduced rate shall be derived from the contract rate in proportion of reduction of strength.
- (iii) Whenever necessary for the purpose of obtaining economy, workability, density, impermeability, durability or strength or on account of variation in the quality and gradation of aggregates or other materials. The Engineer-in-charge, in consultation with laboratory organisation shall after testing make necessary changes in the proportion of mix. Contractor shall have to effect these changes and shall not be entitled to any compensation on account of such changes.

15 Steel Reinforcement

Steel shall conform to para M-5 & M-6 of specification of material of steel.

16 Tolerance for DRAIN structure

Variation in alignment, grade and dimensions of the structures from the established alignment, grade and dimensions shown on the drawings shall

be within the tolerance specified in Table below. Variation shall not be cumulative.

- (i) Departure from established alignment 25 mm
- (ii) Departure from established grade. 25 mm
- (iii) Variation from plumb as for surfaces of columns, piers and walls when overall length of surface is 3 m or less

Exposed	10 mm	Buried	20mm
More than 3 m			
Exposed	12 mm	Buried	25mm

- (iv) Variation in cross-sectional dimensions of columns, beams, slabs, walls and similar members of

Minus	6 mm
Plus	12 mm

- (v) Variation in location from those specified for slab and wall openings
12mm

17 Centering and Scaffolding

- (a) The scaffolding must take account of all construction loads as well as speed of erection. Scaffolding may be bolted on the sleeves embedded in the concrete wall (initially used for fixing shuttering). After concreting, the scaffolding will have to remain in position near stressing points till all the stressing is completed. Complete drawings of false work, accompanied where necessary by calculations shall be submitted for the approval of the Engineer-in-charge, 3 months prior to commencement of erection.
- (b) Any modification that the Engineer-in-charge may require shall be made by the Contractor. Notwithstanding the approval of or alternation suggested by the Engineer-in-charge in the submitted design for any of the temporary works, etc. the contractor shall remain wholly and entirely responsible until the final acceptance of works, for the efficiency, security and maintenance and for all obligation and risks in regard to such work specified or implied in the contract. He shall reinstate the work at his own cost, should any mishap or accident occurs causing damage or injury thereto, subject, however, to such provisions of the conditions of contract as may be applicable in the case of such damage or injury.
- (c) Scaffolding may be released as per the convenience of the work. Centering shall be lowered only with the approval of the Engineer-in-charge and in a manner which shall not damage the work. Scaffolding shall rest on wedges or sand boxes or on screw jacks in order to permit controlled de-shuttering. After initial lowering, centering shall be kept in place till all finishing, repairing work is completed on the underside of the structure.
A suitable designed flight of stairs giving temporary access to the top shall be provided by the Contractor at his own cost as a part of the false work scheme.

18 Measurement and Payment

18.1 General

The prices entered in the Schedule-B for the incorporation of the various classes of concrete, plain and reinforced required by this section shall be inclusive of mobilizing, demobilizing, supplying all equipments, forms, materials, labour, supervision and all incidental work except for any item specifically exempted there from and for which, in addition, a specific item for payment has been included in the schedule-B.

- (a) Except or otherwise especially for in the specifications, measurement of concrete for payment shall be made on the basis of the volume of concrete calculated as being contained within the concrete outlines shown on the relevant drawings.
- (b) Measurement, for payments, for the concrete laid in pockets in the foundation shall be made on the basis of the volume of the pockets filled.
- (c) No payments shall be made for the concrete backfill beyond the minimum lines of excavation shown on the drawings except where such payment is specifically authorised. Measurement of concrete shall be made after deducting the volume of all recesses, passageways, chambers, openings, cavities and depressions, but without deductions for round or beveled edges or space occupied by electrical conduits and reinforcement.
- (d) Concrete shall be measured on the basis of volume of concrete calculated as being contained within the concrete outlines shown on the relevant drawings.
- (e) The unit rate for concrete shall include the cost of all materials, labour, tools and plant required for mixing, placing in position, vibrating and compacting, finishing as per direction of the Engineer-in-charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown in the drawings and according to these specifications. The rate shall also include the cost of providing, fixing and removing of all centering and formwork required for the work unless otherwise specified in the contract.
- (f) The unit rate also includes the cost of dewatering, diversion and protection work as may be necessary during and after concreting work.
- (g) All expenses likely to be incurred by the Contractor in transporting materials supplied to him to the site of work, the expenses incurred in improving the quality of materials to acceptable levels (such as screening, washing etc) and the expenses incurred in proper storage of materials as directed by the Engineer-in-charge etc. are deemed to be included in the unit rate.
- (h) Payment for the various classes of concrete shall be made on the basis of unit rate per cubic metre for relevant items in schedule-B.

Mode of Measurement :-

The concrete work shall be measured in length, breadth and depth as specified in drawing or as directed.

The rates shall be paid for a unit of one cubic meter.

Item No.8

Providing and 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

Materials :

TMT steel shall conform M-5 of this specification

M.S. binding wire shall conform M-6 of this specification.

General

(a) The TMT Bars be procured by the Contractor from approved manufacturers. Steel reinforcing bars shall be placed in concrete where shown on the drawings as directed by the Engineer-in-Charge. The tender drawings issued with these specifications show only tentative requirement of reinforcement and further detailed construction drawings shall be issued by the Engineer-in-Charge during the course of the contract.

(b) The contractor shall go through the schedule of reinforcement given with the construction drawing and if there is discrepancy in the same, the contractor shall bring to the notice of the Engineer-in-Charge for construction. In case of detailing of structural member where bending schedules are not given, the contractor shall prepare and get it approved by Engineer-in-Charge.

At least before 30 days prior to placement of reinforcement the contractor shall submit to the Engineer-in-Charge three prints and reproducible tracings of each of reinforcement detailed working drawings for approval. The contractor's reinforcement detailed drawing for approval shall be prepared in accordance with IS : 456-2000 "Code of Practice for plain and Reinforced Concrete." IS :2502-1963 "Code of Practice for Bending and Fixing of Bars for concrete reinforcement" and IS 5525 - 1969 "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 on 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.

(c) As far as possible Thermo mechanical treated Bars, conforming to IS : 1786-FE 415 shall be used as reinforcement as shown in the drawings. The steel shall be used in various components of various canal structures as per the drawing or as per instruction of Engineer-in-Charge. The payment shall be made and considered as per the unit rate quoted in the respective items of Schedule-B.

(d) The reinforcement steel shall be procured from the BIS approved manufacturer or his authorized dealer only, before thirty days prior to the using in works. The contractor shall furnish BIS manufacturer's test certificate along with test results for each category for every lot brought to the site of work. The manufacturer's test results shall be from the manufacturer's lab only. The test results from other lab shall not be accepted and the consignment will be rejected.

Testing of steel shall be carried out as per relevant IS code. In no case rerolled steel shall be allowed.

Frequency for steel testing (Physical properties) are as under as per IS : 1786- FE-415

Nominal Size of bar	Quantity	
	Lot below 100 tone	Lot above 100 tone
Upto 10 mm	1 sample from each 25 tone	1 Sample from each 40 tone
10 to 16 mm	1 sample from each 35 tone	1 sample from each 45 tone
Over 16 mm	1 sample from each 45 tone	1 sample from each 50 tone

Note: The frequency for chemical analysis if required for steel to be decided by the Engineer-in-Charge as per the requirement.

(e) Stacking of each type of steel shall be made separately at the central place for stacking, if established by the contractor or at each site of work.

(f) Thermo Mechanically Treated conforming to the chemical, physical and corrosion resistant properties as below shall be used in the work as per drawings and as per the instruction of the Engineer-in-Charge.

The contractor has to procure TMT bars as per the standards

(B) **Mechanical Properties** of TMT bars. (As specified in IS. 1786-FE - 415)

Sr. No Mechanical Properties Proportion (Limit)

1. Yield stress MPa (minimum) 500
2. Ultimate tensile stress MPa (min) 545
3. Elongation percentage minimum 20
4. Bend upto including 22mm

Mechanical Properties

Elongation % (Minimum) 20

Bend up to and including 22 mm 2d

However, the Engineer-in-Charge shall decide the acceptable test result and field requirement for use of TMT bars in the RCC work and it shall be considered as final.

TMT bars shall be used in the work for the various components of various canal structures to be constructed under the contract.

TMT bars shall be tested prior to use in the work and after getting the acceptable test results for the assessment of its quality, before it shall be used in the work.

Testing of TMT bars :

1.0 The testing of TMT bars for mechanical properties shall have to be done prior to use in the work. The Contractor shall submit the results for chemical properties obtained from the manufacturer.

2.0 The steel shall also conform the above mentioned required standards for the above 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. Moreover the further testing shall be done by approved Laboratory before its use in the work. Testing of steel should be carried in Government laboratory or any other approved laboratory as per instructions of the Engineer-in-charge .

3.0 The frequency of testing shall be one number per any load of 50 M.Ton or part there of. The testing charges shall be borne by contractor

Cutting, Bending and Binding

(a) The Contractor shall be responsible for the accuracy of 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.

(b) Before the reinforcement is placed, the surface of the bars and the surfaces of any metal bar supports shall be cleaned off 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.

(c) 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 ensure that there is no disturbance of the reinforcing bars in concrete during placement in concrete and correct location shall be maintained in the cast concrete.

(d) Wire for binding reinforcement shall be of soft and annealed mild steel and shall conform to IS : 280-1978*. Binding wire shall have a tensile strength of not less than 56 kg/mm². The wire shall have a minimum diameter of 1mm. 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 payment.

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 times the diameter for deformed such bars, to ensure that the concrete around the bars is not damaged.

MEASUREMENT AND PAYMENT

(a) Measurement, for payment for furnishing and placing reinforcing bars shall be based on the calculated weight of the bars placed in concrete. The payment shall be made on the basis of unit rate per Quintal quoted for relevant items in schedule-B.

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

Table : Cross Sectional Area And Mass (IS : 1786-FE-415)

Nominal size mm	Cross-Sectional mm ²	Area Mass per Metre Run kg
6	28.3	0.222
8	50.3	0.395
10	78.6	0.617
12	113.1	0.888
16	201.2	1.579
18	254.6	1.999
20	314.3	2.467
22	380.3	2.985
25	491.1	3.855

* Or its latest edition.

(ii) The joints or splices shown on the drawings or as directed by the Engineer-in-charge shall be measured as laps. Mechanical couplings and welded joints approved by the Engineer-in-charge, shall be measured for payment, in terms of length of equivalent lap joints. Payment for placing reinforcement bars shall be made at the rate tendered thereof in the Schedule B. The rate shall include the cost of preparing workshop drawings for reinforcement based on the construction drawings, issued by the Engineer-in-charge.

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

Mode of measurement and payment:

The measurement and payment shall be paid on weight basis i.e. **Qtl.**

Item No.9

Providing and fixing in position pre moulded asphalt or bitumin cork board of approved quality and specification as per design and drawing as directed. (D) 12mm thickness.

ASPHALT OR BITUMEN CORK BOARD:

The work includes providing and fixing in position pre-moulded asphalt or bitumen cork board as per drawing and finishing smooth as directed. The material required for the work shall be approved first before bringing on site.

The bituminous pad shall be pre-moulded fiber board impregnated with bituminous materials to render it durable and rat 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.

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.

The work includes providing and fixing in position pre-moulded asphalt or bitumen cork board as per drawing and finishing smooth as directed. The material required for the work shall be approved first before bringing on site.

Open joints shall be constructed at the locations as directed by the Engineer-In-Charge, using a wood strip metal plate or other suitable material which is subsequently removed and While removing, care shall be exercised to avoid chipping or breaking the edges of the concrete. The edge of the concrete at the joints shall be finished. Reinforcement shall not be extended across in the open joint.

When pre-moulded asphalt or bitumen cork board is to be provided as shown on the drawing, the board shall be placed in the correct position. The cork board shall form part of the joint and while concreting the slab, care shall be taken to prevent the cork board from being displaced. After the work is completed, the exposed face of the joint shall be cleaned off all loose materials sticking to it.

The materials used for filling expansion joints shall be bitumen impregnated felt. Impregnated felt shall conform to the requirements of relevant portions of IS:1838 or its latest edition, pre-moulded asphalt / bitumen cork board for expansion joint in concrete non extruding and resilient type. The joint shall consist of large pieces and assembly of small pieces to make up to the required size shall be avoided.

The thickness of the expansion joint will be 12 mm and width of the expansion joint shall be equal to full depth of the slab.

The rate shall include the cost of all materials, labour, equipments and other incidental charges for fixing the joints complete in all respects as per these specifications and as shown on the drawings.

Measurement and Payment:

The measurement and payment will be on **square meter** basis.

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.

Item No. 10

Providing and fixing in position PVC heavy duty water stops in barrels, trough, and wing wall with 25 mm wide expansion joint as shown in drawing including filling the joints with asphalt pad or bitumins or cork board of approved quality. (A) 225mm wide PVC water stop.

Material

The item includes provision of P.V.C. stops of approved quality and size. If in case it is not available, ribbed type water stops may be allowed by the Engineer-in-Charge at his discretion. The dimensions as well as shape and type of water stops shall be as per approved drawing and design. The water stops shall have a center bulb of 12.70mm inside diameter and 25.4mm outside diameter and shall be 225 mm in width and shall have a minimum of 5 longitudinal ribs on each side of central bulb.

Method of Joining:

The water stops shall be cut with sharp knife as directed, P.V.C. water stops to be welded shall be trimmed keeping an allowance of 1.50mm for each strip to get correct measurement. Metal strip or iron bar shall be heated by temperature around 200°C the correct temperature can be tested by applying a piece of the water stop to the hot metal strip. If the piece softens immediately on application of heat, the metal strip has achieved satisfactory temperature. The metal strip shall thoroughly be cleaned by heating.

The tow ends of the water stops to be jointed shall be pressed against the surface of the hot metal strips in position. When the P.V.C. softens the two ends the water stops shall then side away from the metal strip. They shall then be pressed firmly against each other until the cool. It is important that during welding of two pieces of water stops alignment of the central bulb is taken care of.

Installation:

The basic principles, in the installation are to embed one half of the water stop in each side of the joint between the adjacent section of the concrete or masonry. After the concrete on the first half of the water stop sets, the pre-testing cover on the other half if removed and concrete poured to embed it. It is essential that the water stop is properly aligned and placed in position during embedding. Water stops should not be positioned closer to any reinforcing member, than the distance equal to twice the size of largest aggregate.

Size of P.V.C. water stop shall be thickness 25mm, width 225mm.

P.V.C. water stops to be used shall be manufactured from high grade P.V.C. compound with I.S.I. mark. Contractor will have to produce test result from manufacturer.

Mode of Measurement & Payment:-

Payment shall be made on **running meter** basis of P.V.C. water stops laid in position.

Item No. 11

Providing and filling the polysulphide joint selent of the approved make in the expansion and contraction joints in the c.c. lining including clearing the joints with air water jet.

General

The work to be done under this item shall consist of furnishing all tools, Plants laborers 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 filling the two-part polysulphide-based sealant material. The size of joint shall be 24 mm x 25 mm.

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 filled with the approved quality of polysulphide sealant material for 25 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.

Expansion joint groove to be carried out during lining before initial setting of concrete with use of metal strip of required dimensions. Oil to be applied on metal strip so that required groove size can be obtains on pulling out metal strip. Groove must be uniform in size and required line level in bed, slope and key. The expansion joint groove size is 12mm wide & depth is shall not be $<1/3$ of the lining thickness. Before filling groove with bituminous and find sand in proportion of 2:1, joint surface must be painted with two coat of bituminous primer. Second coat must be applied only after first coat is properly dried. Materials inside the groove must be cleaned before applying bituminous primer coat. Mechanized gun must be use for filling the groove so that filling material reach up to bottom of the groove. After filling the groove surface is leveled with trowel so surface look even.

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 24 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. 12

Earthwork in embankment using soil, soft & hard murrum excavated from approved borrow area/village tanks etc.including breaking clods, dressing to the design section with lead up to 5.0 kilometer and all lifts.(By poclane machinary)

EMBANKMENT FOR CANALS

General

Earthwork is required to be done on existing banks & slopes of canal in order to maintain designed section of this canal. Preparation of seat under embankment of the canal on which work is to be carried out. Which is eroded & strengthening and resectioning of banks.

PREPARATION OF SITE

Clearing the Site

This shall include cutting down trees of up to 0.50 m girth, removing bushes, stumps, and roots of trees up to 30 cm depth, stacking and disposing off the excavated stuff as directed by the Engineer-in-Charge.

- (ii) The ownership of all the useful materials encountered in the clearing of site and/or in excavation shall be the property of the Govt. of Gujarat.
- (iii) The roots of trees etc shall be removed up to a depth of 30cm. All ant-hills shall be completely dug out and queen ants destroyed before the earthwork is started. The contractor shall dispose off all such materials which are not required to be kept at site, as directed by the Engineer-in-Charge. No separate payment shall be made to the Contractor for complying the requirements outlined in forgoing paragraphs.

Materials to be used in the embankment.

- (a) The excavated usable stuff obtained from the approved borrow area up to specified lead, after stripping.

Borrow Area Watering

- (a) Before excavating the soil from the borrow areas, adequate borrow area watering shall be done
- (b) No extra payment for the borrow area watering and for stock piling the excavated material before use in view of excess water, shall be made.

Borrow area stripping and operating

- (a) Earth shall be obtained from the designated borrow area as designated by the Deputy Executive Engineer. These area include drains, village tanks and any other places designated by the Deputy Executive Engineer. The depth of cut in borrow area shall be designated by the Deputy Executive Engineer . The

cut shall be made to such designed depth only. Shallow cut will be permitted in the borrow areas if un stratified materials with uniform moisture contents are encountered. Each designated borrow area shall be fully exploited before switching over to the next designated borrow areas.

- (b) Haphazard excavation will not be permitted. The type of equipment used and the operations in the excavation of materials in borrow areas shall be such as to produce the required uniform materials for the embankment.
- (c) Borrow pits shall be operated so as not to impair the usefulness or spoil the appearance of any part of the work or any other property. The surfaces of wasted materials shall be left in a reasonably level and even condition.
- (d) Borrow area shall be stripped off the top soil and any other objectionable materials to the required depth. The minimum depth of stripping shall be 15cm. Stripping operations shall be limited only to the designated borrow areas. Materials from stripping shall be disposed off in exhausted borrow areas or in the approved adjacent areas. No separate payment shall be made for stripping.
- (e) The agreed rate for the earthwork in the embankment shall be deemed to have included the cost of stripping of the borrow area.
- (f) Borrow area shall be Decided by the Agency.

Conveyance of Borrow Area Material

The borrow area material shall be conveyed up to maximum lead of 5 km and for all lifts involved at borrow areas and at the placement site. No extra payment shall be made for more than 5 km lead.

Spreading the Material in Embankment

- (a) Embankment materials in general shall be spread in successive horizontal layers of 15 cm to 23 cm thickness extending to the full width of the embankment slope at canal.
- (b) Thickness of layers shall be adjusted by the Contractor to satisfy the Engineer-in-Charge that hammer compaction can be done properly
- (c) In case of existing embankment is being resectioned, care shall be taken to provide adequate bond between old and new earth work, preferably by benching and shall be compacted with tamping as per site situation and space available for compacting equipment.
- (d) Fresh soil free from vegetative articles, stones and other unwanted material shall be borrowed from canal borrow pits and shall be laid in 15 to 23 cm. layer and shall be watered & compacted with suitable manually.
- (e) No fresh layer shall be laid until the previous layer is properly watered and compacted as per requirement. The work of spreading and compaction shall be so adjusted as not to interfere with each other & in such a way that neither of the operation is held up because of non-completion of the spreading rolling or watering.

Excavation of canal section in embankment

The canal section in embankment, either partial or full banking shall be cut to the required slope, and grade, as indicated in the drawings.

Before Compaction

Materials delivered to the fill shall be visually examined and their properties estimated by way of inspection.

Borrow Area Inspection and Testing.

Excavation of borrow area shall be limited in extent and depth as directed by Engineer-in-charge.

Embankment

It shall be ensured that the methods of dumping, spreading are such as will result in reducing segregation.

During Compaction

Following shall be ensured :

- i) The thickness of the layer of the material to confirm with the compaction equipment.
- ii) That no excessive rutting, waving or scaling of the fill occurs during compaction.

MEASUREMENTS AND PAYMENTS

Canal Earthwork

Initial & Final level shall be taken on Working Site as directed by the Engineer-in-charge of the work.

MODE OF MEASUREMENT & PAYMENT

- (a) The payment shall be made for quantity in cubic meter at the rate under relevant items of work. No extra payment for more than 5 km. lead shall be made irrespective of completion of work. Payment shall be made @ rate in schedule-B i.e. **cubic meter** basis.
- (b) No extra payment shall be made for borrow area stripping and for the material wasted on this account No extra payment shall be given for earthwork & rolling watering done during preparation of seat under embankment or for scarifying. The labour and implements required for the work as well as for the incidentals are also not payable. The rates for relevant items is deemed to cover such costs.
- (c) The rates cover all the activities specified for relevant items of work.

Item No. 13

Compaction of selected soil/hardmurrum/soft murrum in even thickness of 15 to 20 cms including watering rolling of suitable capacity etc. complete as directed.

Workmanship:-

- (1) Whatever earth work is to be done, is required to be compacted by hand rammer to proper slope and shape.
- (2) While resectioning of canals, slopes are required to be brought to true profile by filling strip of earth of width less than compacting width of roller, compaction with hand remmer shall be done.
- (3) In case of backfilling, excavated trench after constructing foundation or abutment / wing wall / head wall etc. compaction shall be done by hand rammer properly to necessary slope as instructed by site incharge.
- (4) Earth borrowed shall be placed in thickness of 15 to 20 cm. thickness suitably watered at O.M.C. and shall be compacted with hand rammer to achieve required density. Placing of earth shall not be allowed without dewatering the extra water in the pit. In case of canal slopes earth shall be placed on slopes and watered before compaction.
- (6) In case of compaction of the canal slopes, compaction should be completed 2 to 3 hours before lining work is done to avoid loss of moisture.

Mode of Measurement and Payments.

Quantity of compaction shall be measured in **cubic meter**.

Payment shall be made @ rate in schedule-B i.e. **cubic meter** basis.

Item No. 14

Providing and laying plain / reinforced cement concrete lining of M-15 grade in bed, side slopes and curvature including batching, mixing, transporting placing, smooth finishing, curing including dewatering where required. (machinery based without Paver) (c) 15 cm thick lining in Bed & slope.

General specification of cement concrete lining shall be apply.

1. Scope of work:

In this item the 15.00 cm thick lining is to be carried out in M-15 Grade with required quantity of water to maintain water cement ratio as per design mix.

2. MATERIALS:

CEMENT: Cement shall beconfirm to M-2 of Specification of Materials

SAND: Sand shall beconfirm to M-3 of Specification of Materials

COARSE AGGREGATE: Coarse Aggregate shall be confirm to M-4 of Specification of Materials

WATER: Water shall be confirm to M-1 of Specification of Materials

3. Clearing SITE:

The area proposed for lining the canal as a whole shall have to be cleared of all objectionable material. Any waste material obtained from such site clearance shall be disposed off in a manner directed by the Engineer-In-Charge. The cost of this operation shall be deemed to have been covered under the rates quoted for canal lining.

4. Preparation of Sub grade consisting of earth.

The sub grade shall be prepared, dressed and rolled true to level and according to the required cross section of canal to form a firm compacted bed for lining.

If at any point material of prepared sub grade has been excavated beyond the pay line required to receive the lining, the excess excavation shall be refilled in horizontal layers with selected material compatible with sub grade material and thoroughly compacted.

5. PROPORTIONING CONCRETE:

5.1 Concrete

(a) Concrete mix shall be designed in GERI or Government Approved Laboratory. The proportion of 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.

(b) 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 determined 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.

(c) To keep the specified water cement ratio constant as determined by mix design moisture content in both fine and coarse aggregate shall be determined by Engineer-In-Charge. The amount of mixing water shall then be adjusted to compensate for any variations noted in the aggregate IS: 2386-1977 (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.

The cement level for various grades of concrete shall be considered as under for the purpose of working out the rates to be quoted in Schedule-B.

Table no-1

Sr.No	Type of concrete	Grade of concrete	Cement level required in kg for one cubic metre of concrete.
1	2	3	4
1	Plain	M-15 (MSA-20)	300

(e) Actual cement level required for the aggregates to be used shall be determined by laboratory tests. 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 Form work. When concrete is hardened, it shall have the required strength, durability and surface finish.

(f) A mix shall be designed to produce the grade of concrete having the required workability and cohesiveness and characteristic strength not less than stipulated in table under Para 5.1 (d) above.. However, due to change in design mix, if it becomes obligatory to use less or more cement per cubic meter of concrete, the contractor

shall do the same without claiming any extra cost towards labours for work carried out by using of extra cement. In case of actual use of cement will be less w.r.t cement level specified in Table no-1, Col. no.4 cost of cement used less in quantity in the work w.r.t cement level as mentioned in col. No.4 shall be deducted from the bill at the base price of star rates of cement. If the consumption of the cement in the work is more w.r.t cement level specified in col.no.4, No payment shall be made for excess use of cement to the contractor. i.e if the cement level of concrete mix is more w.r.t cement level as specified in above table col. No.4, no payment shall be made to the contractor for excess use of cement in the work and if the cement level of concrete mix is less w.r.t cement level as specified in above table col. No.4, recovery of less consumption of cement in the work shall be made from the bill of at base price of star rate of cement. In case of actual use being more than that specified above, the contractor will not be paid for the increase in use of cement. Design mix details of this includes the proportion of each separate size or grade of aggregate and actual cement level required shall be declared to the contractor in writing by the Engineer-in-Charge & any subsequent changes in the mix shall be suitably decided

STRENGTH REQUIREMENT OF CONCRETE

The compressive strength requirements for the various mixes by concrete shall be as follows:

Type of concrete	Minimum Compressive strength in kg/cm ² of 150 mm cubes	
	7 days	28 days
M-15	2/3 of 28 days strength	150

(g) 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.

(h) In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree 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 (without any Admixture)
1	C. C. Lining	60 mm to 70 mm

6.0 PRODUCTION OF CONCRETE:

6.1 CONTROLLED CONCRETE.

6.1.1 Batching and Mixing 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 equipment 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 aggregate and water entering each batch of concrete shall be determined by weighing.

The measuring equipments shall operate within the limits of accuracy specified. Standard tests 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 weighing measurement so that the inaccuracies in feeding and measuring during normal operations will not exceed 1.50 percent for water, cement and admixtures and 3 percent for sand and coarse aggregates. Periodical tests shall be made at least once in every two weeks in the case of equipments for measuring water, cement and admixture sand at least once every month in the case of equipment measuring and coarse aggregates. However, this will not obstruct any surprise checking and testing at any time as desired by the Engineer-in-Charge. Repairs, replacements or adjustments shall be made as necessary to secure satisfactory performance.

The weighing equipment shall conform to the requirements of the relevant portions of IS:2722-1964. Portable wing weight batchers for concrete and ordinary concrete mixer conventional type shall conform to the requirement of relevant portions IS:5891-1970.

The mixer should be able to handle all the grades of coarse aggregates, fine aggregates, water and cement and admixtures where specified, facility should be available to obtain samples of each ingredients entering the mixture. The contractor shall maintain a record of number of batches mixed and all other required for checking the correctness of the mix as per the directions of Engineer-in-Charge. Suitable mixer so as to mix uniformly the various ingredients and discharging the mix without segregation should be used. Preferably tilting types of mixtures should be used. For non tilting type of mixers, suitable device shall be used and care shall be taken to avoid segregation of large size aggregates. Hand mixing shall not be allowed

6.1.2 Batching

Manual lining is required to be carried out with On-wheel Batching plant (Flouri) or Digital Weighing System Conventional mixer of required capacity.

In many canals where at present, canal's banks are eroded, as a result at which canal bank width are less in that case earth work in embankment for raising & strengthening has been planned in this work.

Hence, works related to earth work in embankment will have to started immediately on priority basis with sufficient machinery for easy moving of Transit Mixers.

(b) The prescribed amount of the various materials of concrete including water, cement, admixtures, the groupings 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: 456-2000 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.

(c) The proportions of various materials shall be changed as directed in order to maintain the desired quality of the concrete. The batching equipments shall be constructed and operated so that the combined inaccuracies in feeding and measuring the materials shall not exceed 1½ percent for water and cement and 2 percent for each size of aggregate.

(d) The operating performance of each scale or other measuring device shall be checked by standard test weight to be supplied by the Contractor and test weight shall be got calibrated by the Contractor and the tests shall cover the ranges of measurements involved in the batching operations. Tests of equipment in operation shall be made at least once every fortnight and adjustments, repairs or replacement, be made as necessary to meet the specified requirement for accuracy of measurement.

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

(f) Before the concreting operation starts the Contractor shall provide communication facility in form of wireless, walky-talky or telephone between the batching and mixing plant and site/sites of various concrete placements and got approved by the Engineer-In-Charge.

6.1.3 MIXING

For Design mix concrete, contractor will have to establish automatically operated batching plant or can use on wheel batching plant (Flouri machine).

7.0 FORMWORK:-

Wooden or steel form shall be used for the work. They shall conform to the shapes line and dimension etc. as indicated on plan or as directed by the Engineer – in – Charge. Form shall be set to the exact grade alignment, curve and slope sufficiently well in advance of depositing concrete. The formwork shall be thoroughly cleaned and oil shall be applied to the same before concrete is placed. No form shall be removed before at least 24 hours. Every care shall be exercised during their removal to ensure that the concrete shall not be damaged any way. The form shall be thoroughly cleaned before reused.

8. CAST IN-SITU CONCRETE STRUCTURE / LINING:

8.1. General

The work shall conform to IS:3873-1993. All concrete for Structure/lining shall be

governed by IS:456-2000. The concrete shall be of controlled grade with suitable admixtures of approved air entraining agents, using well graded aggregates with maximum size of aggregate of 20 mm. The proportioning of concrete shall be as per Para 5.1

8.2 Mix Design.

(a) At the beginning of the work in each working season, a test to determine the mix proportion required to produce the strength specified with the material to be used in the work. (The necessary ingredients shall be provided free of cost by the contractor.)

The mix shall be designed using representative samples of approved coarse and fine aggregates as well as cement and water to be made available by the contractor, to achieve the required workability, cohesion, strength and durability at minimum level of cement.

Mix design will have to done in Government Laboratory or Government Approved **Laboratory.**

(b) 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.

(c) During the execution of work if the source of any ingredient of the concrete changes, the contractor shall inform the Engineer-in-Charge sufficiently in advance so as to allow him to proportion 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 without any extra cost. And the charge of mix design shall also be borne by the contractor.

(d) 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, same shall be similarly declared.

8.3 STRENGTH REQUIREMENT OF CONCRETE:

Ordinary Portland Cement are used. The compressive strength requirements for the various grades of Controlled / Nominal concrete shall be as given in Table given below:

Type of Concrete	Minimum Compressive Strength in kg/cm ² of (150 x 150 x 150 mm) cubes	
	7 days	28 days
M-15	100	150

Note: Seven days test results give an early indication of a possible weak concrete. 28 days compressive strength specified in table shall alone be the criteria for acceptance or rejection of the concrete. Where the strength of a concrete mix as indicated by test lies in between strength of two grades specified in table, such concrete shall be classified for all purposes as concrete belonging to lower of the two grades between which its strength lies.

9. TRANSPORTING CONCRETE:

- (a) Concrete shall be transported from the mixer to the placing position as rapidly as practicable by methods that will prevent segregation or loss of ingredient or the loss of slumps in excess of 25 mm and / or a loss in air content of more than one percent before the concrete is placed in works.
- (b) Chutes used for conveying concrete shall be of such size and shape as to ensure a steady flow of concrete in a compact mass without separation or loss of ingredients and shall be protected from wind and sun where necessary to prevent loss of slump by evaporation and shall be furnished with a discharge hopper. Free fall or drop of concrete shall be limited to 150 cm. Chute sections shall be made of or lined with metal and all runs shall have approximately the same slopes not flatter than 1 vertical to 2.5 horizontal. The required consistency of concrete shall be changed in order to facilitate chute conveying. Wherever there is a free fall within the conveying system suitable baffle plates, splash boards or down spouts shall be provided to prevent segregation, splashing or loss of ingredients. Wherever it is necessary to hold the discharge end of a chute for more than 3 meters above the level of the fresh concrete, a flexible down spout shall be used to break the fall and to confine the flow. The lower end of the spout shall be held close to the place of deposit. Wherever the position is intermittent a discharge hopper shall be provided. All chutes shall be thoroughly cleaned before and after each run. All wash water and debris shall be disposed of outside the forms.

10.0 PLACING AND COMPACTION

10.1 General

- (a) No concrete shall be deposited until the foundation has been inspected and approved and until all form work required is completed, embedded parts if any installed and checked and surfaces prepared for placing.
- (b) All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned off all such mortar or grout before fresh concrete is placed.
- (c) Concrete shall be placed only in the presence of a duly authorized representative of the Govt. Concrete shall be placed and compacted before initial setting time and should not be subsequently disturbed. Compaction shall be carried out with proper type of Compactor.
- (d) Placing of concrete shall not be started until all form work, installation of parts to be embedded, if any, and preparation of surface upon which concrete is to be laid, have been completely inspected and then so directed by the Engineer-in-Charge. All absorptive surfaces against which concrete is to be laid shall be moistened adequately so that moisture will not be withdrawn from freshly placed concrete. The surface, however, shall be free from standing water and mud.
- (e) Concrete shall be deposited in all cases as neatly as practicable directly in its final position and shall not be caused to flow in a manner to permit segregation. Excessive separation of the coarse aggregate caused by allowing the concrete to fall freely from too great a height or at too great an angle from the vertical shall not be permitted and where such separation would otherwise occur, the Contractor shall provide suitable means to convey the concrete without allowing such

separation.

10.2 **Placing**

Placing of concrete shall be manually.

Concrete shall be deposited and spread on the bed and sides of the canals indicated on the drawing with cutting grooves for panel joints in between them as per drawing but such that in no case panel dimensions exceed 3 m. Concrete may be laid to facilitate placing, vibrating, finishing and curing operations. The side lining concrete shall be spreaded up the slope, the concrete being vibrated ahead of the screed. Concrete required for keys as shown on the drawings shall be laid integrally with the side slope lining.

If Contractor wants to carry out concrete lining by paver machine for his suitability, he may given permission by Engineer-in-Charge, but no extra payment shall be made for paver lining instead of manually lining.

10.3 **Finishing**

(a) All exposed concrete surface shall be cleared of impurities, lumps of mortar or grout and unsightly stains. The finished surface shall be even, smooth and free from pockets and equivalent to that obtainable by effective use of a long handle steel trowel.

(b) The surface of concrete finished shall be smooth and shall be free from projection, honeycombing and other objectionable defects. Undesirable local bulging on exposed surfaces shall be remedied by tooling and rubbing.

(c) Repairs to concrete surface and additions where required shall be made by cutting regular openings into the concrete and placing fresh concrete to the required lines. Chipped openings shall be sharp and shall not be less than 75 mm in depth.

11. **CURING**

11.1 **water Curing**

(a) Uniform top surfaces of lining shall be moistened by covering with water saturated material or by other effective means as soon as the concrete has hardened sufficiently to prevent damage by water. These surfaces and slopping and vertical surfaces shall be kept completely and continuously moist, prior to and during form removal, by water applied on the unformed top surfaces and allowed to pass down between the forms and the formed concrete faces. This procedure shall be followed by the specified water curing.

(b) Concrete cured with water shall be kept wet for at least 28 days immediately following placement of the concrete by saturated material or any other suitable method, which will keep all surfaces continuously (not periodically) wet.

11.2 **Membrane Curing:**

Membrane shall be confirm to M-9 of Specification of Materials

(a) Specification of materials cover curing the concrete using membrane forming compound to retard the loss of water during the early hardening period and to reduce the temperature rise in concrete exposed to radiation from the sun. This compound shall be suitable for use as curing media for fresh concrete after initial moist curing.

(b) Concrete of canal lining on slope including key at the top and curved portion

at the bottom of the slope of the canal as well as canal bed shall be curved with liquid membrane forming white pigment curing compound which shall form water retaining surface to achieve the desired effect of water curing at 28 days. The curing compound shall be white pigmented of approved quality conforming to ASTM-309-81(Type-2)

(c) Membrane curing shall be applied as & when directed by engineer in charge.

Method of Application

The compound shall be sprayed using mechanical sprayer with agitator only of approved design to ensure uniform and continuous membrane on the concrete surface. The coverage shall be at the rate specified by the manufacturer or at the rate of 4 to 5 Sqmt per liter. Field trials shall be conducted to decide effective coverage rate which depends upon surface finish. If the effective coverage rate works out to less than that specified by the manufacturer or the rate specified above, no compensation whatsoever shall be paid to the Contractor for less coverage. Before applying the curing compound the concrete surface shall be cleaned by brooms or other means not to disturb, damage or any foot impression on concrete. With a view to ensure thorough and complete coverage, in each coat approximately one half of the compound for a given area should be applied by moving the spray gun back and forth in one direction and the remaining half at right angles to this direction. The curing compound shall be applied as soon as the bleeding water or shine disappears, leaving dull appearance. Equipment for spraying curing compound shall be of pressure tank type (5 to 7kg/cm²) with provision of continuous agitation. Spraying on concrete lining shall be done in such a way that the green concrete is not disturbed or damaged or any foot impressions left. Necessary schemes or spraying by mechanised means shall be got approved from the Engineer-In-Charge. However, in emergency for very small areas (patches) it can be applied with brush as per the direction of the Engineer-In-Charge. Such compounds shall be used on the work only after production of test results and approval of the schematic plan of spraying curing compounds. Adequate care shall be taken to prevent any movements on cured surface up to 28 days after application of curing compound.

Under unavoidable circumstances, created by non-availability or short supply of specified curing compounds, the Contractor may be allowed to resort to water curing of concrete lining on slopes after obtaining prior approval of the Engineer-In-Charge in writing. Such water curing shall be restricted to only a short reach and for a very short period and will in no case be construed as a general relaxation. It shall be carried out without any extra cost to DEPARTMENT and in accordance with the following specifications.

The concrete lining on slopes including curvature portion at junction of slope and bed lining shall be moist cured with hessian cloth strong canvas coat of hemp or jute tied and spread over the slope. Soon after that the concrete is initially hardened and shall be kept moist with light water spray. The hessian cloth shall be kept continuously wet for at least 28 days by supplying water through perforated pipe laid along the top edge of the canal lining or by any other method approved in writing by Engineer-In-Charge. Adequate care shall be taken to ensure that the perforations in the pipe do not get choked. Before applying the membrane curing

compound, necessary test shall be carried out.

12 Testing of Concrete & Acceptance of Work:

12.1 General

Testing of concrete shall be carried out at the cost of the DEPARTMENT on representative samples taken at the site of laying the concrete in accordance with relevant Indian Standard Specification.

12.2 Sampling Procedure and Frequency

(a) Sampling Procedure: A random sampling procedure shall be adopted to ensure that each concrete batch has a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and should cover all mixing units.

(b) Frequency: The minimum frequency of sampling of concrete of each grade shall be in accordance with the following.

Quantity of concrete m3	Number of Set (Six Samples)
Up to 5	1
6 to 15	2
16 to 30	3
31 to 50	4
51 and above	4 Plus one additional sample for each additional 50 m3 or part thereof.

12.3 Test Specimen

Three test specimens shall be made from each set for testing at 28 days. Additional cubes may be required for various purposes, so as to determine the strength of concrete at 7 days or at the time of striking formwork, or to determine the duration of curing or to check the testing cubes cured by accelerated methods as described in IS: 9013-1978. The specimen shall be tested as described in IS: 516-1959.

12.4 Test Strength of Samples/specimen

(a) The test strength of the samples shall be the average of three specimens. Individual variation shall not be more than 15 percent of the average.

(b) Contractor shall provide necessary unskilled labour for collection of samples/cores etc. and facilities for immediate transport of collected samples, cores, etc. from site to laboratory and shall remain present at the time when the samples, cores, etc. are taken. Testing shall be carried out at the testing laboratories set up at the site or at any other laboratory that the Engineer-In-Charge may decide upon and the results given thereby shall be considered as correct and authentic and acceptable to the Contractor. The Contractor shall be given access to all operations and tests that may be carried out as a fore said. Minimum 10% results will have to be tested in GERI

12.5 Acceptance Criteria

(a) The average strength of the group of cubes cast for each day shall not be less than the specified cube strength for the work. About 20 percent of the cubes

cast for each day may have values less than the specified strength provided the lowest value is not less than 85% of the specified strength.

(b) In case the concrete does not conform to the acceptance criteria for strength as specified above, the hardened concrete may be accepted after carrying out the destructive or non-destructive test as specified Para-17 of IS 456-2000. The Engineer-in-Charge may decide the type of testing & acceptance of concrete on the basis of test result so obtained. Whenever necessary for the purpose of obtaining economy, workability, density, impermeability, durability or strength on account of variations of the quality and gradation of aggregates or other materials, the Engineer-In-Charge shall after testing, make necessary changes in the proportion of mix. Contractor shall have to effect these changes, and shall not be entitled to any compensation on account of such changes.

(c) In case of doubt regarding the grade of concrete used, either due to the poor workmanship or bases on results of cube strength test, the hardened concrete may be accepted after carrying out the destructive or non destructive test as specified in Para-17 of I.S. 456-2000. The Engineer-In-Charge will decide the type of test and acceptance of concrete on the basis of test results so obtained. The Engineer-In-Charge will carry out the test in the presence of authorized person of the Contractor. All the facilities for carrying out such test shall have to be provided by the Contractor without any extra cost to the DEPARTMENT.

13.0 JOINTS

Transverse joints and longitudinal joint shall be spaced as directed by Engineer-in-charge. The joints shall be cut up to 1/3 thickness of lining i.e. 25 mm to 27 mm. Joints are to be filled up with bitumen for which no extra payment will be made available to contractor.

1.0 Item shall consist of filling of grooves kept in lining for expansion joints with the mixture of asphalt, fine sand or with mastic asphalt as approved by Engineer-in-Charge. Transverse joints shall be uniformly spaced at an interval 3 m C/C or as directed by Engineer- in- Charge.

1.1 Item shall be executed after specified period of curing of concrete for lining is over and concrete has strengthened well.

1.2 Asphalt, fine sand or mastic asphalt whichever are to be used shall be got approved from Engineer-in-Charge prior to their use.

1.3 Grooves kept in lining for expansion joints shall be opened well, cleaned, washed and dired well before filling.

1.4 When asphalt, fine sand dust are used for filling joints, they shall be mixed in proportion as mentioned by the Engineer-in-Charge. While mixing care shall be taken to keep the mixture free from foreign substances.

1.5 Mixture of asphalt, fine sand and asbestos or mastic asphalt shall be filled in grooves kept in lining carefully and pressed hard to have no cavities or hollows in joints. Joints shall be finished flush with the top surface of the lining.

1.6 Joints dully filled and finished shall be allowed to set and strengthen without any disturbance or damage for the period as directred by the Engineer-in-Charge.

1.7 Care shall be taken by the contractor to prevent distortion of groove's or joints shape and damage to the concrete lining.

14.0 DEWATERING

In canal reaches where sub soil water is met with dewatering shall be resorted to and continued during preparation of sub-grades for providing and placing of concrete for lining till such period the concrete attains necessary strength. No separate payment shall be made for dewatering operations as the same is deemed to have been included in rate of related item in Schedule B.

15.0 MODE OF MEASUREMENT AND PAYMENT:

Payment shall be made at the rates for completed items of work tendered therefore in schedule-B on square meter basis of actual work done. The rates shall include all expenditure on labour, materials, equipments required for carrying out satisfactory work. The rate of items includes the cost of transporting, dewatering, smooth finishing, curing etc. complete. No extra payment shall be made for Applying Membrane Curing Compound in Canal slope as well as Canal Bed.

Item No. 15

Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials.etc complete

Item includes weather proof Exterior Emulsion paint on wall. Surface to be painted should be thoroughly brushed and shall be free from dirt, dust, oil etc. The paint shall be applied with a brush on the clean and dry surface. The surface shall be finished as uniformly as possible leaving no brush marks. Exterior Emulsion paint shall be of standard quality and make. Item includes all lead and lift and scaffolding etc. required for work. All the work shall be carried out as per instruction of Engineer-in-charge.

The payment shall be made as per Square Meter of actual work completed and followed by Standard specification booklet.

Item No. 16

Providing and Erecting a "W" metal beam CRASH BARRIER comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level fixed on ISMC series channel vertical post, 150 x 75 x 5 mm space 2.00 m centre to centre 1.80 m high 1.10 m below ground/road level fixing at site shall be in C.C. M-20 block of size 50 x 50 x 100 cms for each post. All steel parts and fittings to be galvanized by hot dip process, all fitting to conform IS: 1367 and IS: 1364 metal beam rail to be fixed on the vertical post with a spacer of section 150 x 75 x 5 mm 3.30 m long complete as per MORTH Clause 810. Rates including providing and fixing 3 mm thick ACM type reflector 100 mm wide, type 4, class-B, High intensity grade sheeting between two "W" metal beam through and reflective unit at the top of vertical post as

per IRC:67-2012 etc. complete as per detailed drawing and directed by engineer-in charge.(Metal beam crash barrier for approach)

1. Scope of Work

This work shall consist of providing and erecting a W-beam type metal crash barrier on road approaches or medians, as per specifications, detailed drawings, and as directed by the Engineer-in-Charge.

2. Material Specifications

a) W-Beam Rail (Corrugated Sheet Metal Beam)

Type: "W" shaped corrugated metal beam.

Thickness: 3.0 mm (minimum)

Height from road/ground level: 70 cm

Length: 3.3 m standard panel

Material: Steel conforming to IS: 5986 or equivalent.

Surface Treatment: Hot-dip galvanized as per IS: 2629 and IS: 4759.

Minimum Zinc Coating: 550 gm/m².

b) Posts (Vertical Support Members)

Type: ISMC Channels

Size: 150 mm x 75 mm x 5 mm

Spacing: 2.0 m centre to centre

Height: 1.80 m total, with 1.10 m below ground and 0.70 m above ground

Material: Structural steel confirming to IS: 2062 Grade A.

Surface Treatment: Hot-dip galvanized.

c) Spacers

Section: 150 mm x 75 mm x 5 mm (ISMC)

Length: As required (typically 330 mm or matching vertical height)

Function: To maintain proper spacing between beam and post

Galvanization as above.

d) Fasteners & Fittings

All bolts, nuts, washers: To be of appropriate size conforming to IS: 1363, IS: 1364, IS: 1367

Material: Mild steel or equivalent

Finish: Hot dip galvanized

3. Foundation for Vertical Posts

a) Concrete Block

Size: 50 cm x 50 cm x 100 cm (Depth)

Grade: M-20 concrete (1:1.5:3 mix)

Post embedment depth: 1.10 m

Curing: Minimum 7 days

Backfilling: Approved soil or granular material compacted properly.

4. Reflectors

a) ACM Reflective Strip

Material: Aluminium Composite Material (ACM)

Thickness: 3 mm

Width: 100 mm

Placement: Fixed between two W-beam rails

b) Reflective Sheeting

Type: High Intensity Prismatic Grade

Specification: Type IV, Class B as per IRC:67-2012

Certification: Must conform to ASTM D4956 or equivalent.

Colour: White / Red / Yellow (as per drawing/site conditions)

c) Reflective Units on Post Top

Shape: Circular or rectangular reflective unit

Material: Retro-reflective type

Mounting: Firmly fixed on top of each post

5. Installation and Erection

Posts shall be fixed vertically and true to line and level.

W-beam shall be mounted at a uniform height of 700 mm from ground using galvanized bolts and spacers.

End terminals, if required, shall be crash-worthy and as per MORTH standard drawings.

Joints between two rails shall be overlapped and bolted properly.

Reflective sheeting must be clean, firmly bonded, and visible from a distance as per IRC-67 visibility standards.

6. Standards and References

Component	Standard
Structural Steel	IS: 2062
Galvanizing	IS: 2629, IS: 4759
Fasteners	IS: 1363, 1364, 1367
W-Beam Rail	MORTH Clause 810
Reflective Sheeting	IRC:67-2012, ASTM D4956
Crash Barrier Design	As per MORTH & IRC SP:87
Concrete	IS: 456:2000 for M-20 grade

7. Measurement & Payment

Unit: **Running Metre (RM)**

Includes: Supply, transport, erection of crash barrier including posts, spacers, concrete blocks, all fittings, reflectors, and associated labor & materials.

Item No. 17

Providing & fixing in position sign board of standard size of 1.20mx0.90m with M.S angle 40mmx40mmx6mm with 3mm thick iron plate including fixing in 1:5:10 prop. Concrete block size 40cmx40cmx75 cm including painting existing data on the board etc. complete as directed.

1. Sign board shall be of good quality as approved by Deputy Executive Engineer
2. Sign board shall be 1.20 mt x 0.90 mt in size and finishing smooth surface on one side.
3. Engraving and painting of figures shall be done as per instruction it engineer-in-charge size of letter and mater to be display shall be directed by engineer-in-charge.
4. Sign board shall be fix at appropriate place as directed by engineer-in-charge contractor shall bear all cost of materials, labour & fixing plate in position.

MEASUREMENTS AND PAYMENTS

The measurement and payment shall be paid No. basis.

Item No. 18

Providing videography on the occasion of function or for ongoing construction work including dubbing, titling etc. complete including cost of cassate/CD. (b) up to 4.0 hours

Workmanship:

Videography shall be taken before, after and ongoing execution work and at other stages as instructed by concerned Deputy Executive Engineer.

Videography shall be clear enough to represent nature of work done. nos of video cassettes/Compact disc shall be taken or made as per the instruction of Engineer-in-charge.

MEASUREMENTS AND PAYMENTS

The measurement and payment shall be paid Hourly basis.

Executive Engineer
K.R.B.C. Division
Surat