

Name of Work- Repairing of lining of Manpura Sub Branch Canal of Radhanpur Branch Canal. (MSBC Ch. 5400 to 14876 m) (Package-2)

Item Wise Detail Specification

ItemNo:-1

Dismantling the existing foundation concrete including sorting out the dismantled stuff and stacking the useful material, removing the debris and making good the damages etc. complete as and where directed.

Cement Concrete.

General

The damaged C.C. work shall be dismantled properly as directed with all lead and lifts. Utmost care shall be taken while dismantling, so that only demarked / directed portion shall be removed and no damage shall occurred to the good work. Suitable breaking tools shall be used as directed. No blasting shall be allowed. The contractor shall clean the site by removing the loose materials, debris deposited on or near the damaged portion for repairing the same and the removal of loose material shall be disposed off with all leads and lifts as directed. No extra payment shall be made for removal of demolished concrete.

If, any damage to the good work occurs while breaking the damaged concrete, the contractor shall have to repair the damage caused to the good concrete at his own cost.

CONVEYANCE & DISPOSAL OF DISMANTLED MATERIAL:

The damaged cement concrete debris shall be disposed off at the specified place i.e. from MSBC to out side the canal bank with all lifts and leads including disposed off unserviceable material as and where directed.

SPECIAL CARE:

The contractor shall exercise special care to avoid damage to good C.C. work. The contractor shall not adopt any blasting for demolishing the damage concrete.

MEASUREMENT AND PAYMENT (Item No-1)

Measurement and payment for item shall be made on cubic meter basis. The average length, width and depth shall be measured in case of uneven shape of work area.

The payment of item shall be made at the quoted rate in BOQ

The rate shall include the cost of demolishing, removing and disposing off demolished concrete & stacking the useful material, removing the debris and making good the damages etc.with all lead and all lifts including disposed off unserviceable material as and where directed.

Item No :- 2

Dewatering the foundation trenches during excavation, laying foundation concrete, masonry etc. till completion and diversion of surface and sub surface water etc. complete as directed.

General

The Work under this Section consists of performing all operations pertaining to the dewatering of Work areas or diversion of surface and subsurface water flows for excavation and backfill during construction operations.

Material

Contractor shall be responsible for the Dewatering Plan preparation, selection of materials and equipment, mobilization, operation, maintenance, removal of pumping facilities, piping, mud pump etc. used in dewatering operations.

Construction

The foundation area/pits/trenches/canal shall be kept dry by deploying required capacity and numbers water pumps diesel engine or electric motors. Contractor has to make his own assessment for quantum of dewatering i.e. impounding water and water coming through seepage from surrounding as well as ground water condition etc. And contractor should deploy pumping capacity accordingly. The department will not be responsible for any variation in quantum of water and inflow of water if any. Department will not be responsible for providing electricity at site of work. So contractor has to make his own arrangement for electric power, if he wants to use electric motors.

The work area shall be kept dry by continuous dewatering if required. the works includes providing and operating pumping machinery with driving force, pipe lines and other accessories, labours and mechanics and other materials with all leads and lift. A record shall be maintain in prescribed format by the Contractor for Hp power deployed and actual run on site and Hours of machineries actually run on site. And it shall be consider final for the payment. Contractor has to make arrangement for stand by machineries for continuous dewatering in case of failure of power supply.

Measurement and Payment (Item No-2)

Measurement shall be paid on HP per HR basis as per rate quoted by Bidder for Item No.2 of Bill of Quantities Payment shall be made under the following unit:

MONSOON DAMAGES

Monsoon Damages

The responsibility of desilting 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 working 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 monsoon to prevent entry of flood water of drains, nallas other area. However any damage done to the work or silting or slush caused shall have to be attended by the contractor without any extra cost to SSNNL and no time limit sanction shall be enter for the work.~~

~~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 in duration caused due to construction of canal in surrounding fields, roads etc. So that the public traffic can be maintained with least possible damage to public and natural drain / nalla / Nigam's property.~~

~~The cost for such operations, shall not be paid separately and deemed to be included in the rates quoted in respective Items of BOQ~~

Item No:- 2

Desilting of canal/drain with lead upto 50 meter and lift upto 3.0m including dewatering if any required for following depth etc. complete as directed

Slushy & Muddy Condition of Canal / Drain

(c)For canals between (20 to 250 Cusecs) 0.56 to 7.0 cumecs.

Clearing canal Syphons/Bed

- a) After clearing the site and vegetation, undesirable foreign material etc. as per site condition must be removed.
- b) The contractor shall clear the silt deposited from canal structures/Bed in dry or wet condition what so ever case may be and dispose-off the same for Branch (lead 50m & lift 3.00m to 4.50 m) Distributaries (lead 50m & lift 1.50 m to 3.00 m.) Minors (lead 50m & lift 1.50 m to 3.00 m) by labors / machines / mud pump whichever is required as directed by the Engineer-in-charge. No time for drying of silt shall be permitted to the contractor.
- c) During removal of silt operation, the contractor shall take extra care and precaution to protect the canal lining & structure work. If during removal of silt operation, any damaged occurs to the existing canal lining/structure concrete, the same shall be made good by the contractor at his cost. No extra payment shall be made on this account.
- d) During desilting operation, contractor may have to carry out dewatering; the same shall be resorted to by the contractor. The rate for the item is deemed to have been included in the cost towards dewatering. No extra claim for dewatering will be entertained.
- e) During removal of silt operation, the contractor shall take extra care and precaution to labours from poisonous insects by providing gumboots. & safety tools No extra payment shall be made on this account.

Conveyance and disposal of excavated materials.

The excavated silt materials shall be used to strengthen the embankment on either side of the canal or deposited in low areas on either side of the canal, to fill up local depression or otherwise stacked in spoil banks in regular shape with suitable slopes or spread on other approved location and manner as

directed by the Engineer-in-charge for Branch (lead 50m & lift 3.00m to 4.50 m) Distributaries (lead 50m & lift 1.50 m to 3.00 m.) Minors (lead 50m & lift 1.50 m to 3.00 m)

Measurement and payment (Item No-2)

- a) The payment for the item shall be made for the item at unit tendered rate on volumetric basis **(Cum)**. The rate includes removal of silt / debris in dry or wet condition, conveyance & disposal off all such materials for all leads and lifts as directed. The rate shall also include all labours, tools, plants, equipment etc. incidental operations & other charges.
- b) The rate is also deemed to have been included of the cost of dewatering, if any required to be done during removal of silt. No claim on account of drying of silt etc. will be entertained.
- c) It shall be well understood that during the irrigation, the silt / debris, vegetation like bushes, stumps, roots of trees etc. may get accumulated in the canal structures, the same shall have to be cleared without any extra cost and maintained the canal throughout the contract period. No damage shall occur to canal due to accumulation of such silt / debris / vegetation like bushes, stumps, roots of trees etc. No extra payment shall be made on this account.

ItemNo:-3

Dismanting of C.C. Lining including disposing off the dismantled materials as directed etc. complete.

(a) 7.5 cm thick

General

The damaged canal lining shall be dismantled properly or as directed by the Engineer-in-charge. Utmost care shall be taken while dismantling so that only demarcated portion of lining will be broken and no damage shall occurs to adjoining lining work. Suitable breaking tools shall be used as directed by the Engineer-in-charge. The contractor shall first carry out cleaning of the site by removing the silt or loose materials deposited on or near the damaged portion and the removed silt or loose materials shall be disposed off with all leads and lifts outside the canal banks as directed by the Engineer-in-charge. No extra payments will be made for removal of silt / loose material.

Conveyance & Disposal of Dismantled Material

The dismantled material from the damaged CC / RCC lining from bed, slide slopes and curvature of canal shall be disposed off at the specified place outside the canal bank with all lifts and lead up to 200 m as directed by Engineer-in-charge. The dismantled material shall be disposed off as per instruction of Engineer-in-charge.

Special Care

The contractor shall take special care to avoid damage to adjoining good lining already completed. The contractor shall not adopt any blasting for dismantling of damaged CC / RCC lining, which is to be removed from the canal.

If during the dismantling of damaged lining, the damage will occur to good lining work, the same shall have to be made good by the contractor at his cost and no extra payment will be made for such work.

Measurement and payment (Item No-3)

Measurement of dismantling work (item No:-3) will be made on **square metre** basis of area of lining to be dismantled and the payment for the same shall be made at the quoted tendered rate in BOQ on square meter basis. The rate shall include the cost of demolishing lining, removing dismantled material and disposing off the same at the specified place outside the canal banks with all lifts & lead up to 200 m as directed by the Engineer-in-charge. The rate shall also include cost of all labours, materials, tools & plants, equipment's and all other incidental operations for carrying out the work in accordance with the specifications.

Item No:-4

Providing and laying vertical non metallic pressure release valves including excavation of pits and refilling the same with filter materials as per design and drawing at required intervals etc. complete as directed

(b) 150 mm dia

General

(a) Vertical PVC (poly vinyl chloride) pressure release valves of 150 mm outer dia as shown on the drawing shall be provided and fixed in position. The item includes excavating pits and refilling the same with filter materials, where necessary, as per drawing or as directed by the Engineer-In-Charge.

(b) The vertical PVC pressure release valves shall be procured by the contractor at his own cost as per requirements and after the make is got approved by the Engineer-In Charge These valves shall be fixed in bed as well as in slopes as per the drawings supplied by the SSNNL or as per the instructions of the Engineer-In-Charge. Filter material to be used shall be of approved quality of sand and gravel in required gradation. Graded filter as shown on the relevant drawings, shall be carefully placed with help of GI Box as approved by Engineer-In-Charge and compacted to form an even bedding upto the elevation of bottom of canal lining. Tar paper or any other suitable material, approved by the Engineer-In-Charge shall be placed over the entire surface of the gravel fill to prevent water from concrete entering the fill. The under drainage arrangements shall be in conformity with IS: 4558-1983 in general. When placed in the positions, the individual lid of required depth & diameter of PVC shall be placed on top of PRV without any extra cost to SSNNL. Before handing over of the entire work, the contractor shall remove this lid & replace with the lid as specified in the drawing.

(c) As an alternative to graded filter around PRV, geofabric of approved quality and design shall be used without any extra cost to the SSNNL.

Measurement and Payment (Item No-4)

Measurement and payment for the PVC pressure relief valves shall be made on the basis of **numbers** at the unit rate quoted in BOQ. The rate shall include the cost of providing and fixing pressure relief valves, excavating and refilling, with filter material inclusive of materials, placing of lid removing & replacing the lid as per drawing and labour required thereof and all incidental operations necessary to execute the work as per the specifications.

MONSOON DAMAGES

Damages due to rain or flood either in cutting or in banks or in foundation of structure shall have to be made good by the contractor till the final section is handed over to the SSNNL. The responsibility of desilting 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 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 monsoon to prevent entry of flood waters of drains, nallas and other area. However any damage done to the work or silting or slush caused shall have to be attended by the contractor without any extra cost to SSNNL and no time limit sanction shall be entertained for the work. 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 of canal in surrounding fields, roads etc. so that the public traffic can be maintained with least possible damage to public and natural drain / nallas / Nigam's property. The cost for such operations shall not be paid separately and deemed to be included in the rates quoted in respective Items of Bill of Quantity.

ItemNo:-5

Trimming of the canal section manually for preparing subgrade for laying cement concrete lining in all sorts of soil and murrum including watering and compacting bed etc. complete.

The provision of this item applies for trimming and preparation of sub-grade upon which concrete lining is to be placed.

The work of trimming the canal section up to the underside of concrete lining and preparing sub-grade for concrete lining includes removal of proud equivalent to thickness of the lining. The excavation for trimming for preparing the base of lining shall be carried out immediately prior to laying of the lining but in no case the time interval should exceed 3 days in normal weather and 2 days in adverse weather conditions. All along the canal alignment the rain cuts on the banks shall be filled up with approved excavated material and shall be compacted adequately to require line and level. The bed and side slopes shall be trimmed to the required section manually. The canal bed / side slopes shall be dressed,

watered and compacted by manually hand rammer. Excavated profile provides the final base for lining and any tolerances of quantities shall not be paid to the contractor. If at any point the material has been excavated beyond the pay line required to receive C.C. lining, the excess excavation shall be refilled in layers not exceeding 100 mm in thickness with selected material moisture, if required and compacted.

Measurement and Payment (Item No-5)

Measurement for payment for the trimming and preparing of sub-grade shall be made on the basis of **square metre** of the surface of the canal prism trimmed over which cement concrete lining is to be placed. The rate includes cost of labour, equipment, watering, compaction of bed and side making good of over cuts, under cuts and all incidental works to complete the work as per specifications. The unit rate of trimming also includes the cost of bringing existing canal section to design canal section by back filling with suitable earth wherever required with watering and due compaction and desilting if required.

Item No: 7

Providing and Fixing MS Welded Wire Mesh of size 150mmx150mmx3.8mm dia including cutting in required size, fixing in canal prism including cover block & binding wire etc complete as directed.

General

(a) The Item includes Providing and Laying in position Mild Steel Welded Mesh jail of 3.8 mm Dia., 150 mm x 150 mm C/C Both Directions. The Welding must have been done in Factory with BIS Specified Welding Rods and Shop Welding Method. The Engineer In Charge shall inspect the Welded Wire Mesh on Site and before Supply in Factory and confirm as to whether the manufacturing is as per BIS Approved Material and Method. On his satisfaction he shall approve the Welded Wire Mesh and it shall be allowed to be used on Site.

(b) The Length of Welded Wire Mesh shall be 8m as the Panel of Concrete Lining is to be made of 8m Length approximately and its width shall be equivalent to Periphery of the Canal Cross Section plus necessary embedding for the Dowel.

(c) The Item includes Laying and Placing the Welded Wire Mess with 25 mm Clear cover from the bottom and cost of cover shall be included in the Item.

(d) The Item also includes fixing the Wire Mesh in position as per Drawing and as directed.

Cutting, Bending and Binding

The Contractor shall be responsible for the accuracy of the Cutting, Bending and Placing of the Welded Wire Mesh shall be inspected for compliance with the Requirements as to grade, size, shape, length, splicing and locations after it has been placed. No concreting shall start unless the reinforcement as placed if the Work is finally checked, recorded and certified by the Engineer In Charge. Before the Welded Wire Mesh is placed, the surface of the Wire Mesh shall be cleaned of the rust, scale dirt,

grease and other objectionable foreign substances. After being placed, the Welded Wire Mesh shall be maintained in a clean condition until they are completely embedded in the Concrete.

The Wire Mesh 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. Wire for Binding Wire Mesh 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 minimum diameter of 3.80 mm. Chairs, hangers, spacers and other approved arrangement shall be provided to support the Wire Mesh. Wire used for binding reinforcement shall not be measured for Payment.

~~Care of Placed Reinforcement and Concrete.~~

Where Wire Mesh are bent aside at Construction Joints and afterwards bent into their Original Position.

~~Overlapping of Wire Mesh~~

Sufficient Overlap i.e. Square Size of Wire Mesh should be provided. For jointing the Wire Mesh, G.I. Binding Wire should be used. No Extra Payment will be made for the overlapping area of Wire Mesh, jointing Work and Material used for jointing.

Measurement and Payment. (Item No-7)

Payment shall be made at Unit Tendered Rate on **Square Meter** Basis of completed Item. The Rates includes Tools & Plants required for carrying out Work.

Item No.:-6

Providing and laying plain/reinforced cement concrete lining of M 15 (MSA 20 mm) in bed, side slopes and curvature including batching, mixing, transporting, placing, vibrating, smooth finishing, curing including dewatering where required.

(MACHINERY BASED by "BATCH MIX PLANT & TRANSIT MIXER" - WITHOUT PAVER WATER CURING)

(a) 7.5 cm thick lining in bed/slope

Item No.:-7

Providing and laying CC 1:2:4 grade using cement, sand & crushed metal including providing & erecting necessary form work, centering, vibrating, smooth finishing, watering & curing as directed with all leads & lifts etc. complete.

(b) Super structures

SPECIFICATION FOR MATERIALS

M - 1 CEMENT :-

- 1.0 Only Ordinary Portland Cement of grade 43 or 53 shall be used conforming to I.S. 8112 - 1989 and I.S. 12269 - 1987 respectively (or it's latest version) for the entire work under the tender in all respects and shall be procured in bulk / 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 are found OK till the receiving of test results from approved lab. of SSNNL.

- 1.1 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 barring 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 this records update to enable to Engineer-in-charge of the work or his authorized to apply the check may desire to impose.

- 1.2 The cement brought by the contractor at the site, department shall be done sampling as per I.S. 3535 (or latest version of I.S.) & sending it in approved lab. of Depptt. for testing as per I.S. 4031, 4032 (or latest version of I.S.). The contractor shall be arrangement for sampling work & it's submitted to the Government Laboratory or Govt. approved laboratory at his own cost. All testing charges shall be borne by the contractor. The testing shall be done for each consignment received at the site. The cement consignment shall be more than 50tons or part thereof; each consignment shall be stacked separately.
- 1.3 The cement not satisfying the criteria as per I.S. 8112 for grade 43 and I.S. 12269 for grade 53 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.
- 1.4 The samples of cement older than 90days shall be tested by the Quality control Unit of GERI at Gandhinagar or Baroda at the contractor's cost. If the test results are in accordance with I. S. specification then and only then the Engineer-in-charge will permit to use such cement. The cement older than 180 days shall not be permitted to be used for the work.
- 1.5 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 / mortar.
- 1.6 Frequency for Cement testing (physical properties) is as under, as per IS:3535- 1986.

Weight of lot in tonne	No. of Sample to be taken	Remarks
Up to 50	1	(1) For sample (15kg. of cement) taken from 2%
51 to 100	2	

101 to 200	3	bag out of total bag of consignment.
201 to 300	4	
301 to 500	5	
501 to 1000	6	
1000 to 1300	7	

1.7 The following Test with required results are required for Physical properties of Cement.

Requirements of Test		Requirements for Test Results	
		43 Grade Cement (IS-8112)	53 Grade Cement (IS12269)
A. Physical Test (as per I.S. 4031 – 1988)			
Specific Surface area (in m ² /Kg)	Fineness	Min.225	Min.225
Standard Consistency (in %)		Above 30	Above 30
Setting Time (in minutes)	Initial	Not less than 30	Not less than 30
	Final	Not more than 600	Not more than 600
Soundness	(a)By Le-Chateller (in mm)	Not more than 10	Not more than 10
	(b)By autoclave (in %)	Not more than 0.8%	Not more than 0.8%
Compressive strength (in N/mm ²)	03 days	Not less than 23	Not less than 27
	07 days	Not less than 33	Not less than 37
	28 day	Not less than 43	Not less than 53

Rejection :- Cement shall be rejected if it does not comply with any of requirement of above specification.

M – 2 FINE AGGREGATES (Sand)

All the fine aggregates shall conform to IS: 383-1970 or its latest version and as directed by the Engineer-in-Charge. Sand to be used shall be natural as obtained from the river bed and the maximum size shall be limited to 4.75mm. The Sand shall be obtained from Banas river bed or from any other suitable sources as approved by Engineer -in -charge.

- 2.1 The sand shall consists of hard, dense, durable, uncoated siliceous gritty materials. It shall be free from injurious materials of dust, lumps, soft and flaky particles, shale, alkali-organic matter, loam, mica, earth, clay and other deleterious substances. The maximum size of sand particle shall be limited to 4.75mm. The F.M of the sand to be used in concrete / masonry shall be ranging between 2.20 to 3.0.

The maximum percentage of each of the deleterious substances in sand as delivered to the mixer for use in concrete, mortar etc. shall not exceed the following values.

(a) Limits of deleterious materials.

I	Coal & lignite	1% by weight
II	Clay lumps	1% by weight
III	Material finer than 75 micron I.S. sieve	3% by weight
IV	Shale	1% by weight
V	Total percentage of all deleterious material (except Mica)	5% by weight

(b) Sand shall be free from injurious amount of organic impurities. Sand that are producing a colour (obtained by dissolving 9 grams of chemically pure (c.p.) ferric chloride and 1 grams of c.p. cobalt chloride in 100 ml of water to which one-third ml of hydro-chloric acid has been added) darken than the standard in the test (organic test) for organic impurities shall be rejected.

- 2.2 Fine aggregates shall be tested for their gradation, fineness modulus, specific gravity, water absorption, soundness, deleterious constituents, petrographic analysis and alkali aggregate reactivity.

The following testing frequencies shall be maintained for the same source of fine aggregates.

Sr. No.	Name of test	Minimum number of test specified
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1	Gradation for Fineness Modulus (F.M.)	Daily one test If the variation of daily F.M. values is more than 0.1, then frequencies may be increased.
2	Silt Content	Daily one test
3	Moisture Content	Daily one test
4	Sp. gravity, water absorption, Soundness	Once in a concreting working season.

2.3 Due allowance shall be made if; the sand is wet at the time of mixing, the exact extent of such allowance or bulkage shall be depend upon the quantity of moisture in sand and it shall be decided by the Engineer-in-Charge.

2.4 Gradation :-

(a) Sand shall be well graded so as to impart good workability and good finishing. Sieve analysis of natural sand shall confirm to the following limits of gradation.

IS Sieve	Cumulative percentage of weight passing through sieve	
	Zone – II	Limited to
10 mm	100	100
4.75 mm	90 -- 100	92 -- 100
2.36 mm	75 -- 100	75 -- 92
1.18 mm	55 -- 90	55 -- 82
600 micron	35 -- 59	30 -- 64
300 micron	8 -- 30	10 -- 40
150 micron	0 -- 10	3 -- 10

(b) Deviations from the prescribed limits of cumulative percentage retained on 10mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300micron and 150 micron IS sieves shall be permitted provided total of such deviations do not exceed 5%. (c) No deviation from the prescribed limit shall be permitted for cumulative percentage passing through 600 micron IS Sieve.

Fineness Modules:-

(a) The sand shall have a fineness modules ranging between 2.20 to 3.0 subject to the gradation specified in the preceding paragraph or as per mix design etc..

(b) The modules shall be computed by adding cumulative percentage of the sand retained on the standard screen from 4.75 mm, 2.36mm, 1.18 mm, 600micron, 300 micron, 150 micron IS sieves (as M.T. standard screen from 3/16" and no. 480, 120, 60, 30, 15 sieve) and dividing the sum by 100. Gradation of sand shall be so controlled that the FM of at least 9 out of 10 consecutive test samples of finished and shall not vary more than 0.10 from the average 10 tests samples.

(c) Any deviation from the specified range of gradation and fineness modules shall not be permitted to be used in work, without the written permission of the Engineer-in-charge. Any deviation from the specified range of the fineness modules will not be tested for clay, organic impurities and other deleterious substances as laid down in I.S. 383.

(d) Details regarding Fineness Modulus for sand available at different locations in river bed can be seen the same by the office of the Executive Engineer, Sujlam Suflam Division No.-1, Deesa. It may be pointed out in particular that the large quantity of sand is available in river Sabarmati. The Contractor shall procure approved quality of sand from any other source if required at their own cost. The contractor shall procure approved quality of aggregates from any other sources for which no extra claim shall be entertained.

2.5 Frequency of test shall be as per table of para 2.2 / at change of source of fine aggregate / one test for each 250 cumt. of sand or part there of.

2.6 Storage:- All sand shall be stored on the site of work in such a manner as to prevent intrusion of foreign matter.

M - 3 COARSE AGGREGATE:- (Kapachi, Grit)

Crushed aggregates are available in ample quantities from the quarries near Bhemal in Banaskantha District. These are indicative only. The contractor shall procure approved quality of aggregates from any other sources for which no extra claim shall be entertained.

3.1 Coarse aggregate shall be of machine crushed stone of black trap or equivalent and shall be hard, strong, dense, durable, clean, and free from thin elongated soft flaky pieces, vegetable matter, organic or other deleterious matter i.e. such as to reduce the strength & durability of the concrete or harmful to steel reinforcement. Predominantly flaky aggregates shall not be used. It shall have no adherent coating of clay, silt, mud or any other adherent- coating likely to prevent

proper adhesion of mortar. Aggregates shall have no deleterious reaction with cement. It shall be capable of developing good bond with cement paste and weather resisting and unaffected by water. Coarse aggregate shall be well graded and gradation shall give a dense concrete of the specified strength and consistency that will work readily into position without segregation and without the use of excessive water content.

- 3.2 Contractor shall remove all vegetations and other perishable substances and objectionable amounts of other foreign matter. All Coarse aggregates shall be washed and/or screened by the Contractor, if required, at the source approved by the Engineer- in -charge. In case the coarse aggregate brought to the site of work is not washed and screened at the source the contractor shall make necessary arrangements for washing and screening at the work site / B&M plant. The cost of washing & screening shall be born by the Contractor.
- 3.3 The size of the coarse aggregate for plain cement and ordinary reinforced cement concrete shall generally be as per the table given below and shall have a maximum size of 40mm.

Following shall be maximum size of coarse aggregate for the different items of work. However, depending on the technical requirement various size of aggregate may be required to be used in various components of the structure.

Sr. No.	Item of work	Maximum nominal Size of Coarse Aggregate (MSA)
1	Foundation floor and gravity retaining walls (mass concrete) i.e substructures.	40 mm 40mm
2	RCC cutoff walls, Transition walls , Retaining walls etc. Mass concrete cement works in superstructures , linings works , etc.	20 mm
3	R.C.C. rafts, piers, abutments, cut-off walls, breast walls, transition wall, staunching ring, pile, pile cap etc.	40mm to 20 mm
4	R.C.C. work in main and cross girders, Deck slab, wearing coat, kerb, parapet walls, approach slab, pier caps, R.C.C.	20mm
	trough, barrel, and other thin walled members and in zones of congestion caused by closely spaced reinforcement bars.	
5	For any other items of construction not covered by schedule –B etc.	As specified in the drawings or in case,

		it is not specified in drawing, as directed by the Engineer –in- Charge.
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For heavily reinforced concrete members, as in the case of ribs of main beams, maximum size of aggregate shall usually be restricted to 5mm less than the minimum lateral clear distance between the main bars or 5mm less than the minimum cover to the reinforcement, whichever is smaller, However, if required under special circumstances, the Engineer- in -charge may permit an aggregate of maximum size 25% more than this critical spacing / cover provided that proper vibration is ensured.

- 3.4 Coarse aggregates will be tested for their gradation, specific gravity, water absorption, impact and abrasion values, soundness, flakiness and elongation indices, deleterious constituents, petrography analysis and alkali aggregate reactivity. The necessary test indicated in I.S.383-1970 and 456-1970 shall have to be carried out to ensure the acceptability of aggregate.

The following testing frequencies shall be maintained for the same source of coarse aggregate. The below test shall be carried out at the starting of the work, and at the change of source of materials or / and directed by the Engineer- in -charge as required.

Sr. No.	Name of test	Minimum number of test specified (for each nominal size of aggregate)
1	Gradation	Daily one test
2	Water Content	Daily one test

3	Silt Content	Daily one test
4	Sp. Gravity, Water Absorption, Impact or Abrasion value, Density, Soundness,	Once in a concreting working season.

3.5 The grading of coarse aggregate shall be in the nominal sizes as mentioned in Table I of IS: 383-1970 reproduced as below in respect of 40MSA, 20MSA.

IS SIEVE Designation.	PERCENTAGE PASSING FOR SINGLE-SIZED AGGREGATE OF NOMINAL SIZE.		
	40mm	20mm	10mm
80 mm	---	---	---
63 mm	100	---	---
40 mm	85 to 100	100	---
20 mm	0 to 20	85 to 100	---
16 mm	---	---	---
12.5 mm	---	---	100
10 mm	0 to 5	0 to 20	85 to 100
4.75 mm	---	0 to 5	0 to 20
2.36 mm	---	---	0 to 5

Note:- (a) 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.

(b) However above % may be varied by the exact gradation required to obtaining a dense concrete of specified strength and desired workability shall be decided by the Engineer-in-Charge.

(c) The grading between the limits specified above shall be such as shall produce a dense concrete of the specified proportion and consistency that will work readily into without segregation and without the use of excessive water content. The material passing through the screen shall be in gradation ranging from 40mm to 4.75 mm.

(d) Coarse aggregate of a maximum size of 20mm shall be used where the minimum clear distance between reinforcing bars is 25mm.

3.6 The percentage of deleterious substance in coarse aggregate shall not exceed the following values.

Material passing 150micron screen	IS Sieve	1 Percent by weight
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Shale	1 Percent by weight
Coal and lignite	1 Percent by weight
Soft fragments	3 Percent by weight
Other deleterious substances	1 Percent by weight
Clay lumps	1 Percent by weight

The sum of the percentage of all the deleterious substances shall however, not exceed 5 percent by weight.

- 3.7 The coarse aggregates shall satisfy abrasion, soundness, crushing and alkali aggregate reactivity tests and water absorption results as laid down in IS: 383- 1970 and other relevant Indian Standard Specifications.

Sr. No.	Name of test	Criteria as per IS 383, 2386	
		For other than Wearing surface	For Wearing surface
1	Impact value (max.)	45%	30%
2	Abrasion value (max.)	45%	30%
3	Soundness (after 5 Cycle) (a) with Sodium Sulphate (max.) (b) with Magnesium Sulphate (max)	12% 18%	12% 18%
4	Flakiness Index (max.)	25%	15%
5	Elongation Index (max.)	15%	15%
6	Specific Gravity (max.)	3%	3%
7	Water Absorption in 24 hrs.(max.)	1%	1%

- 3.8 Frequency of test shall be as per table of para 3.4 / at change of source of coarse aggregate / one test for each 250cumt. of kapachi or part there of.
- 3.9 Storage (Stock piles) :-
- (a) Aggregate shall be stacked in such a way as to prevent the admixture of foreign materials such as soil, vegetable matter etc. The aggregates shall be kept free of dirt, rubbish papers, vegetable matter, bidi, etc. on the stock piles by the collection of people.
 - (b) Heaps of fine and coarse aggregates shall be kept separate. When different sizes of fine or coarse aggregate are procured separately they shall be stored in separate stockpiles, sufficiently away from each other to prevent the materials at the edge of the piles from getting intermixed. Each grade of materials shall be stacked 40mm to 20mm, 20mm to 10mm, & 10mm to 4.75mm.
 - (c) The aggregates shall be stockpiled adjacent to the mixer site so as to require minimum re-handling and labour when conveyed to the mixer.
 - (d) The aggregates shall be placed on a dry hard patch of ground if available otherwise a platform of planks or plain galvanized iron sheets or alternatively on a floor of dry bricks or a thin layer of lean concrete.
 - (e) To minimize moisture variations, the stockpile shall be spread over as large in area as possible but kept low and fairly uniform in height preferably 1.25 to 1.50 metre and the lowest layer of about 30 cm height shall be allowed to act as drainage layer and not used till the end.
- 3.10 Grit:- It shall consist of crushed or broken stone and shall be hard, strong dense, durable, clean, proper gradation and free from skin or coating likely to prevent adhesion of mortar. The grit shall have no deleterious reaction with cement. Grit shall generally be cubicle in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provision of I.S. 383. Grit shall be obtained from the best black trap or equivalent hard stone approved by Engineer -in-charge.

M - 4 WATER :-

Water used for mixing of concrete and mortar shall be clean and free from injurious amounts of deleterious materials, objectional quantity of silt and traces of oil and injurious alkalis, salts, organic metals and other deleterious metals, which will either weaken the mortar or concrete or cause effloresces or attached the steel in R.C.C. It shall be free from elements which significantly effect hydration, reaction or other unsightly deposits on concrete or mortar surface. Water shall not be salty. Water should not be too acidic or too alkaline(if tested by litmus paper, repaid change of the litmus papers indicates dangerous amount of acid or alkali present).

- 4.1 The sample of water taken for testing shall represent the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed

for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water. Frequency of test shall be one test per working season / at change of source of water / as directed by Engineer- in -charge as required.

Container for transport and storage of the water shall be reasonable clean.

In case of doubt regarding development of strength of concrete / mortar, the suitability of water for making concrete shall be ascertained by the compressive strength of concrete and initial setting time of cement, which is compared by making concrete with distilled water.

4.2 Potable water is generally considered satisfactory for mixing and curing. The PH value of water should be between 6.0 to 8.0. The turbidity in the water shall not be exceed 2000 ppm and shall be preferably a low as possible. The water shall be odourless & colourless. Hard and bitter water shall not be used for curing of work.

4.3 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 guidance, the following table represents the maximum permissible values.

	Permissible limit (maximum) (mg/l = ppm)
Organic	200 mg/l
Inorganic	3000 mg/l
Sulphate (as SO ₃)	400 mg/l
Chlorides (as CL)	2000 mg/l for concrete not containing embedded steel (P.C.C.) & 500 mg/l for reinforced concrete work. (R.C.C.)
Suspend matter	2000 mg/l
Fluoride	1 mg/l

M - 8 CONCRETE :-

1. Proportion:

The proportion of cement, sand coarse aggregates shall be cindered on volumetric basis or **Weight Basis** in the proportion as mentioned in the item.

The sand and coarse aggregates shall measured dry in suitable measuring boxes. Each cement bag shall be considered to weight 50 Kgs. and equivalent to 0.034 cum. Aggregates

proportioning is based on one bag of cement of 50 Kgs. (i.e. 0.034 Cum) In case the contents of cement bag are found loss beyond certain tolerance as decided by the Engineer -in-charge, the fine and coarse aggregates shall be reduced to that extent proportionately.

Due allowance shall be made for bulkage of sand due to moisture if at the of mixing of the sand is wet. The extract of allowance for bulkage sand depend upon the quantity of moisture in sand and it shall be decided by the Engineer-in-charge.

The proportion of fine and coarse aggregates shall vary so as to give most satisfactory dense and workable mix depending upon the voids, and gradation of the coarse aggregates the contractor shall adopt, at his cost, and such variation as directed by Engineer-in-charge. On account of such variation in proportion of Fine and coarse aggregates which required to be adopted as directed by the Engineer-in-charge no extra claim what soever from the contractor to the sum of the volume of the fine and coarse aggregates so varied shall remain equal to the sum of the volume of the fine and coarse aggregates of the original specified mix as per items the quantity for different porportion of mortar and concrete shall be decided by the Engineer-in- charge depending on the aggregates use and the item of work.

2. Batching

- (a) The **batching and mixing plant** shall be fully automatic and will automatically start the weighing operation of materials and stop automatically when designated weight of each material is reached and interlock in a manner as specified in IS:4925-1968. The wet mixing of the concrete shall be done in mixer attached with batching plant. **In no case mixing shall be allowed outside the batching and mixing plant i.e. mixing will not be allowed in transit mixture. The semi automatic or manually operated batching and mixing plant will not be allowed.**
- (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 equipment 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 is started the contractor shall provide communication facility in form of wireless, walki-talki or telephone between the batching and mixing plant and site/sites of various concrete placement and got approved by the Engineer-In-Charge.

3. MIXING:

- (a) Concrete shall be mixed in a mechanical mixer/batch mix plant and shall be as dense as possible, plastic enough to consolidate well and stiff enough to stay in place on the slopes.
- (b) Mixing shall be continued until there is uniform distribution of the materials and the concrete is uniform in color and consistency. The time of mixing shall be as shown in Table-I of IS:457-1957 Reproduced below.

Capacity of Mixer	Minimum time of mixing	
	Natural Aggregates	Manufactured Aggregates
3 m ³ or larger	2 minutes	2 ½ minutes
2 m ³	1 ½ minutes	2 minutes
1 m ³ or smaller	1 ¼ minutes	1 ½ minutes

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 overmixing 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 the consistency shall be such that the concrete will just stay in place on the slope. A slump of 60 to 70 mm shall generally be allowed. For heavier longitudinally operating slip form machines, a slump of 50 mm shall be permitted. To have a close control of consistency and workability of the concrete, the slump of concrete shall not vary more than 20 mm from the one specified above as it would otherwise interfere with the progress and quality of the work.

4. Transporting

- (a) Concrete shall be handled from the place of mixing to the place of final depositing as rapidly as practicable by use of equipment such as **transit mixers** which will prevent initial setting, segregation or loss of any of the ingredients. It shall be transported and compacted in its final position within 30 minutes of its discharge from the mixer.

- (b) If segregation occurs during transport, the concrete shall be remixed before being placed, after observing the time requirements as above.

5. Placing

- (a) Concrete shall be placed only in the presence of a duly authorised representative of the SSNNL. Concrete shall be placed and compacted before initial setting time and shall not be subsequently disturbed.
- (b) Placing of concrete shall not be started until subgrade is ready and preparation of surface upon which concrete is to be laid, have been completely inspected and approved by Engineer-In-Charge. All absorptive surfaces against which concrete is to be laid shall be moistened adequately so that moisture shall not be withdrawn from freshly placed concrete. The surfaces, however, shall be free from any water and slush.
- (c) 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 / belt conveyor to convey the concrete without allowing such separation.
- (d) The bottom of the foundation shall be trimmed and levelled as directed by the Engineer-in-charge before concrete is laid. All loose and soft materials shall be removed. The bed shall be thoroughly roughened, cleaned and slightly wetted in case of rocky foundation. In case of foundation in soil strata the same shall be well rammed and watered up to saturation. The concrete shall be placed in position in continuous horizontal layers of maximum thickness of 10 cm. each layer consolidated well. The compaction shall be started as soon as concrete is placed. The layers should follow in quick succession to have effective bond between layers.
- (e) The concrete shall not be rammed with heavy iron rammers. The thickness of concrete shall be as mentioned on the drawing or as per orders of the Engineer –in- charge of work. The surface shall be given slopes or made level as per drawing or as directed. The top of concrete shall be finished as directed.
- (f) When concreting is laid to be resumed after lapse of time, the surface on which further concrete is to be laid shall be roughened or scrubbed with wire brush to remove laitance, swept, clean, thoroughly wetted and covered with cement slurry as directed. The concreting shall be carried out continuously up to construction joint, the position and arrangement of which shall be as specified by the Engineer-in-charge. Excess of water or laitance shall be removed from the surface of concrete after it is deposited and before it is set.

- (g) The work of concreting slabs beams etc. shall be completed in one operation as quickly as possible shown as to monolithic concrete if concreting is required to be stopped for any reasons. Before the entire portion is completed it should be stopped at location specified by the Engineer-in-charge after laid adequate precaution as directed from maintaining the construction joints and bond for continuation of further work.
- (h) Laying of concrete by chute shall be done only after the approval of the Engineer -in-charge of the work with such equipment's and arrangements so as to ensure that segregation shall not take place.
- (i) All exposed concrete surfaces shall be cleaned 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. Surface irregularities, when tested with a straight edge of 1.5 metre length shall not exceed 6 mm in canal bed for bottom slab and 12 mm in that laid on side slopes.
- (j) The surface of concrete finished shall be smooth and free from projections, honeycombing and other objectionable defects.
- (k) Repairs to concrete surface and additions where required shall be made by cutting regular opening into the concrete and placing fresh concrete to the required lines.
- (l) If the area to concreted is surrounded by water before laying of concrete the same shall be kept continuously dry till concrete has sufficiently set by pumping out water as directed by Engineer-in-charge.
- (m) Pin headers or such other bonding device as approved by Engineer-in- charge shall be used where bonding with other type of concrete or masonry is necessary, Since this will be paid in respective items, not extra payment for material or labour shall be admissible.

6. COMPACTION

1. The concrete shall be thoroughly compacted during placing till it causes the mortar to cream up, In mass concrete and R.C.C. works compaction shall be done by mechanical electrical vibrators concrete shall be thoroughly work in to the edges and comer of form work and also along its faces and around reinforcement in case of R.C.C. by suitable tools such rods etc. The vibrators shall be worked to full depth at uniform distance of not more than 60 cms. It shall be worked only for such time as will allow formation of dense concrete without shrinking and segregation of the coarse aggregate, over vibration shall be avoided on account vibrator shall be work in to concrete which as coursed to the plastics. Vibrator shall be invariably used in case of plain concrete thicker than 30 cms and R.C.C. work thicker than 15 cms where due to less quantity of concrete, use for vibrator is not feasible, maximum compaction of concrete shall be done by rolling, compacting etc. after obtaining measure permission from the Engineer-in-charge. Over compaction may lead to segregation of concrete while under compaction may leave air voids in concrete consolidation shall be done by hand compaction means of rodding for thin vertical member, tamping for

R.C.C. slab, hammering for massive plain concrete and mechanical compaction by vibrator for thin section of member, of internal for R.C.C. slab, Floor, external vibrator for thin section of member surface vibrator in Road concrete.

7. CURING

The concrete after its initial shall be protected from excessive heat or sun, rain etc. By covering with wet gunny bag or simulates absorbent materials or where possible by shallow pools of water on top. After final the concrete shall be kept continuously wet for 28 days for increase both impermeability, durability of concrete.

Unformed top surface of the canal shall be kept continuously moist by covering it completely with wet burlap coarse canvass of jute as soon as the concrete has hardened sufficiently say, 4 to 6 hours after concrete placement. The burlap shall be kept continuously wet by spraying water Concrete cured with water shall be kept wet by ponding for at least 14 days. Water lost by evaporation shall be replenished periodically to keep the surfaces continuously (not periodically) submerged under water.

When the curing of concrete in the canal is not found satisfactory the Engineer-In-Charge may ask the Contractor to resort to membrane curing without any extra cost to SSNNL.

8. FINISHING

The concrete surface shall be finished by skilled workmen. All exposed surfaces shall cleaned of all unsightly incrustation of stains. The surface permanently exposed to public view shall be given cement washed if ordered by Engineer-in- charge.

The surface upon or against which backfill or concrete is to be placed or which will other wise to permanently concealed shall not be treated after removal of forms. But defective concrete depression deeper than 1 cm shall be made good as directed.

The surface of structure permanently exposed to public view and when appearance if special importance shall be finished smooth. Surface irregularities shall not 3 mm of abrupt irregularities and 6 mm for gradual irregularities. The faces shall be perfect in line and level.

The surface where accurate alignment and eveness of surface is required such as case of S.W.F. syphon and Aqueduct shall have to be finished very smooth. The gradual surface irregularities shall not exceed 6 mm. If necessary grinding and / or rubbing of uneven surface shall be done for work no extra payment will be paid.

The items does not include plastering. However where form finishing not good plastering in C.M. 1:3 is required and it shall be done without extra cost.

9. FORM WORKS

1. GENERAL

The formwork shall conform to the shape, line and dimensions as indicated on the plans. This shall be watertight and sufficiently rigid to prevent displacement or sagging between supports shall be able to resist the pressure due to tamping and vibration of concrete without deflection beyond prescribed limits. The form works shall be properly bread together so as to maintain position and shape and ensure safety to workmen, passers and departmental person. The strict shall be firmly proved.

2. DESIGN

Detailed Design of the form work and centering shall be prepared by the contractor and got approved from the department well in time. However such approval will not absolve the contractor of his responsibility for strength of formwork and any accident arising out of this.

3. Materials

The formwork shall be of timber or mate) sheets. In case of timber, the same shall be preferable partially seasoned and free from sap. Snakes, knots, wormholes. The planks and scanting shall be straight and free from warps. In case metal sheets those shall be of design gauge strengthened with frames of angles. The wooden form will have be lines with steel sheets or plywood in special cases if directed by Engineer-in-charge.

4. Clearing and treatment of form All rubbish, particularly chipping having saw dust shall be removed from the interior of the form work before concrete is placed. The formwork in contact with concrete shall be cleaned and thoroughly wetted and treated with oil and approved composition. Care shall be taken that such approved composition is kept out of contact with reinforcement. The formwork shall arranged and if necessary the joints shall be so packed with suitable packing, that cement slurry or water shall not pass through it.

10. Removal of Formwork

1. All formwork shall removed without shocks or vibration as would damage the concrete. Before the soffits and struts are removed, it shall ensure that the concrete has sufficiently hardened.

2. Form work shall be struck after expiry of following period under normal circumstances

- | | | |
|----|-------------------------------------|----------|
| a) | Vertical sides of slabs beams | 48 Hours |
| | hours | |
| | and columns. | |
| b) | Bottom of slabs upto 4.5 metre span | 10 days |
| c) | Bottom of slabs more than 4.5 span | |
| | bottom of beam upto 6 M span arch | |
| | rib bottom upto 6M span | 14 days |
| d) | Bottom of beams over 6M span and | |

arch rib bottom above 6M span

21 days.

Note: In case rapid hardening cement is used for works, the striclling period will be curtailed to 3/7 of the above period except for vertical sides of the slabs, beams and columns, which shall be retained for 24 hours.

SAMPLING AND TESTING

GENERAL

Samples of Material proposed for works shall be submitted for testing sufficiently in advance before the materials are delivered at site. Care shall be taken to ensure that samples are truly representative of particular materials. Similarly samples shall be provided of actual concrete being used in work. All the samples Materials and concrete cubes etc. shall be supplied by the contractor, at Project Laboratory at his own cost.

The contractor will provide necessary labour, materials, equipment for sampling. Preparing testifies are curing such of the tests, given below considered essential for the work. To be conducted in the laboratory at the cost of the department.

TESTING OF CONCRETE

(1) Cube Test

(a) Sampling procedure :

A random sampling procedure shall be adopted to resume 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 following:

Quantity of concrete m3	Number of samples
1 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 50m or part thereof.

Test specimen

Three specimens 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.

(c) Test strength of samples / specimen

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. The compressive Strength shall be as per I.S. and as directed by the Engineer-in-charge.

Contractor shall provide necessary unskilled labour and facilities. The results given thereby shall be considered as correct and authentic and acceptance to the contractor. Testing charges of water, cement, sand, aggregate and concrete are to be born by the contractor. Sample collection and transportation charges shall be born by contractor. No separate payment shall be made for dewatering and /of desilting for presence of water due to any reason.

Concrete shall be carried out consist of casting concrete cubes of size 15cm x 15cm x 15cm, in three separate sets and in each set, tests shall be conducted on six specimens. Out of the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days.

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 derived from tendered rate and as approved by him. 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.

In case of doubt regarding the grade of concrete used either due to the poor workmanship or based 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 IS: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 any 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 SSNNL.

The cost of sampling and testing carrying out and this clause shall be borne by the Contractor.

(2) Slump test

In order to test the consistency of the mixed content, sump test shall be made as and when required. This slump test shall be as per I.S.Specification 456-1978.

The frequency of the tests shall be one test for each working day as directed by Engineer-in-charge. Contractor shall provide all necessary facilities and materials etc. for these tests as the engineer-in-charge may consider necessary for which no separate payment shall be made. Slumps allowed shall be 2.5 to 4.00 cm.

11. TOLERANCES

- (a) The intent of this paragraph is to establish tolerances that are consistent with modern construction practice and yet be governed by the effect that permissible deviations will have upon the structural action or operational function of the structure. Deviations from the established lines, grades and dimensions shall be permitted to the extent set forth herein below provided that the SSNNL reserves the right to diminish the tolerance set forth if such tolerance impairs the structural action or operational function of the lining.
- (b) Tolerances for lining shall be permitted within the following limits.
- | | | |
|-------|------------------------------|-------------------------------------|
| (i) | Departure from established | 20 mm on straight reaches alignment |
| | Alignment | 50 mm on tangents |
| (ii) | Departure from established | 100 mm on curves |
| | grade | 20 mm on straight reaches |
| (iii) | Variation in concrete lining | 10 % of lining thickness |

thickness provided average thickness of each day's placement is not less than specified thickness.

Any departure from alignment or grade shall be uniform and no corrections in alignment be made in less than 50m. No overrun in concrete quantity shall be paid to the contractor.

12. JOINTS

In canal lining contraction joints shall be provided to accommodate contraction of the concrete or to provide continuity between the breaks in construction work. Joints shall be provided as directed by Engineer-In-Charge. Normally, in plain cement concrete lining joints shall be provided at 4 m centre to centre, whereas in case of RCC lining joints shall be provided in longitudinal direction only at 8 m centre to centre & expansion joint in transverse direction @7.5 m centre to centre. The reinforcement shall be discontinued at joint.

13. DEWATERING

1. When water is met with area of work, shall be kept free of water while the work is in progress and till concrete is sufficiently set as judged by the Engineer-in-charge of the work. Dewatering shall be done for the purpose of taking measurements of work, if necessary. Dewatering shall be done in such manner as not to disturb the concrete in any way. No extra payment shall be made for any dewatering etc. unless separately and specifically provided for in the tender.

The **Items No-6** shall include preparation of sub-grade for lining & Providing & laying the cement concrete lining in all sorts of soils in all lead and all lift.

Before laying concrete all bushes, grass, earth objectionable materials if any, contractor shall remove from canal section and deposit at out of canal limit as directed by Engineer-in-charge without any extra cost.

Relevant specification of material and section for concrete lining shall be apply as per general technical specification.

Before laying concrete sub-grade shall be correct profile of canal in line and level and grade as per drawing as directed by Engineer-in-charge by doing cutting, filling earth up to 30 cm. thick as and where required without any extra payment. The work shall be carried out during irrigation period so no any extra claim or payment shall be made for delay in work due to irrigation water.

Concrete shall be composed of cement. sand, kapachi and water shall be mix in proportion as specified in item. The proportion of cement sand & kapachi shall be varied slightly if required on the basis of laboratory test to get workable concrete of design strength. No extra payment shall be made for such variation that may have to be made. The quantity of water to be used shall be decide be by Engineer so as to get concrete of required workability.

The concrete shall be mix in automatically operated batching plant installed at site of work from such batching plant Concrete shall handle from place of mixing to the place of final deposition and placed in position as rapidly as practicable but always within period of 30 minutes after mixing.

Test of cubes 15 cm. x 15 cm. x 15 cm. shall be taken as per the schedule of testing. From each set 3 cubes shall be tested at 7 days and 3 cubes at 28 days. Sample of concrete for test cubes shall take at mixer in presence of agency and department representative with marking of location or item.

The concrete lining shall be consist of cement concrete panel laid to specified thickness. The tolerance in variation of thickness shall be allowed + 10 mm. All surface at which concrete is laid shall be thoroughly clean finish in required size, shape at every corner. No concrete shall be placed under water. All concrete shall be tamped by wooden tampers or steel tampers immediately after the tamping has been completed the surface shall be inspected. For high or low spots and any correction that may be needed shall be make by adding or removing concrete. Curing must be done up to 28 days or as per relavent IS Code. If contractor will fail to curing the work which shall be carried by department at any cost. which will be recovered from agency without any notice.

The grooves at the joints shall be 11mm. wide and depth 25mm. in 10 cm. thick CC M15 grade lining. Allowable tolerance in width and depth of grooves shall be + 1.5mm. Filling the joints. shall be taken up immediately after the curing period is over. The joints shall be coated with primer before filling then with applied sealing compound.

Curing : For curing of C.C. lining work in slope a water pool arrangement shall be provided up to 28 days for 24.00 Hrs. by making ditch on key joint in banking as well in cutting portion, so that seepage water from water pool will pass on sloping portion of lining and required strength of C.C. lining could be achieved also. Field staff should be vigilant to see that curring and watering continuously done 24.00 hrs. up to 28 days. For making ditch in earth no extra payment shall be made.

Payment shall be made on square meter basis of completed C.C. lining of 10 cm. thick for completed item of exposed area

14. MEASUREMENT AND PAYMENT

- (i) Plain Cement Concrete Lining
 - (a) Measurement of **lining** will be on the basis of **square meter** of plain concrete lining and payment will be at the unit rate quoted in BOQ Payment for lining will be made for the thickness shown on the drawings and on square meter basis of the surface area in bed and slopes including keys. The thickness of lining shall be maintained in relation to final subgrade on which lining is to be laid. The thickness shall be cross checked by volume of concrete placed from batching and mixing plant and area covered Any over run in quantity of concrete in lining shall not be paid to the Contractor.
 - (b) The unit rate for lining also includes costs of all material transport with all leads and lifts, mixing, formwork, conveying, placing, compacting, smooth finishing, curing etc. However, the rate does not include providing of bitumen sealant joints & P.R.V.
 - (c) No overrun in concrete quantity shall be paid to the Contractor.
 - (d) The unit rate quoted by the bidder for the respective item shall be deemed to have included the requirement of cement for miscellaneous operations like priming of mixer, laying cement slurry for successive lifts, finishing of concrete etc., also.
- (ii) Plain Cement Concrete
 - (a) The **concrete** rate shall be for unit of **cubic meter** of concrete unless otherwise specified. The concrete shall be measured for the length, breadth and depth as indicated on the plans or as authorized by the Engineer. Any excess which is not authorized will not be measured or paid for.
 - (b) No deduction shall be made for reinforcement in concrete for R.C.C. work, individual dimensions shall be measured concrete to one centimeter and quantity shall be worked out to two places of decimal.

MONSOON DAMAGES

Damages due to rain or flood either in cutting or in banks or in foundation of structure shall have to be made good by the contractor till the final section is handed over to the SSNNL. The responsibility of desilting 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 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 monsoon to prevent entry of flood waters of

drains, nallas and other area. However any damage done to the work or silting or slush caused shall have to be attended by the contractor without any extra cost to SSNNL and no time limit sanction shall be entertained for the work. 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 of canal in surrounding fields, roads etc. so that the public traffic can be maintained with least possible damage to public and natural drain / nallas / Nigam's property. The cost for such operations shall not be paid separately and deemed to be included in the rates quoted in respective Items of Bill of Quantity.

ItemNo: 10

Box cutting the road surface to proper slope and camber for making a base for road work including removing the excavated stuff and depositing on the road side slope as directed upto 50Mt.lead.

- 1.——This work shall consist of excavation, removal and satisfactory disposal of all materials necessary for the construction of widening carriageway in accordance with requirements of these specifications and the lines, grades and cross sections shown in the drawings or as indicated by the Engineer.
- 2.——After the site has been cleared the limits of excavation/ box cutting the road surface shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer.
- 3.——Box cutting shall be carried out in conformity with the directions laid here in under and in a manner approved by the Engineer. The work shall be so done that the suitable materials available from box cutting/ excavation are satisfactorily utilized as directed.
- 4.——The contractor shall not excavate outside the limits of box cutting. Subject to the permitted tolerances, any excess depth/ width excavated beyond the specified levels/ dimensions on the drawings shall be made good at the cost of the contractor with suitable material of characteristics similar to that removed and compacted as directed.
- 5.——Cutting shall be done in proper grade & camber as shown on drawing or as directed. Care must be taken that all slopes are evenly and truly dressed. Cutting shall be done to the exact depth required and shall be as per formation level in proper grade and the camber. If extra depth of cutting is done due to negligence of contractor the same shall be refilled with approved quality of materials duly consolidated to the satisfaction of the Engineer in charge (without extra cost).
- 6.——The stuff received from the cutting of existing crust shall be screened on site and stone aggregates shall be stacked at suitable place which shall be reused for modified sub

~~base as directed by the Engineer in charge. The unsuitable materials shall be removed from the site and same shall be used for filling and correcting side slopes of bank and earthwork for embankment as directed by the Engineer in charge with lead up to 50 mtr.~~

~~7.——The measurement of box cutting shall be taken on level basis & level shall be taken at 30 mt. interval. Volume shall be computed in cubic meters by average area method.~~

~~8.——The payment shall be made on **Cmt.** basis.~~

~~1.——The rate includes cost of all labour, machineries required, cost of carting and spreading the cutting stuff with all lead and lift and leveling the dumping ground/ embankment, rolling and consolidation of subgrade level etc. complete.~~