

WORK AND SITE CONDITION

SECTION - 2**WORK & SITE CONDITION.****INDEX**

SR. 1	PARTICULARS. 2
01.	Introduction.
02.	Location.
03.	Communication.
04.	Brief description of work.
05.	Labour.
06.	Housing.
07.	Water supply.
08.	Drainage.
09.	Camp regulations.
10.	Medical aid.
11.	Electric power.
12.	Roads.
13.	Post, Telegraph or Telephone.
14.	Bank facility.
15.	Supply of Petrol & Diesel.
16.	Materials.
17.	Photography of site & work

WORK AND SITE CONDITION

1.0 Introduction :-

General Features of the Project :-

Bhadar Irrigation Scheme is constructed across river Bhadar near village Nilakha of Taluka Gondal of District Rajkot. It is essential to Construction of Fencing at Down Stream of Bhadar-1 Irrigation Scheme Dam Site

2.0 Location :-

The work is situated near villages Nilakha of Taluka Gondal of District Rajkot.

3.0 Communication :-

The nearest place of ordinary marketing is Gondal Taluka & Rajkot District.

4.0 Brief Description of Work :-

(i) Work to be executed / scope.

Supplying, Installation, Testing, Commissioning Operation and Mainanance of Real Time Structural Health Monitoring Instrument System at Bhadar-1 dam Site.

1. Supplying, installing, testing, and commissioning of an Automatic Total Station.
2. Providing and fixing Circular Prism suitable for use with Total Station of 0.5" angular accuracy.
3. Providing, installing and commissioning permanent Ground Control Point (GCP) Settlement Marker comprising MS base plate (250×250×5 mm conforming to IS 2062)
4. Conducting detailed topographic and elevation survey for Settlement Markers.
5. Supplying, installing, testing, and commissioning of a mechanical flow measuring device (V-Notch & rectangular weir) for measuring low flow seepage in dams.
6. Supplying, installing, testing, and commissioning of a Wireless MEMS Triaxial Tilt meter.
7. Supplying, installing, testing, and commissioning of an Infrared Camera.
8. Supplying, testing, and commissioning of portable Water Level Sounder
9. Supplying, installing, testing, and commissioning of a Vibrating Wire Type Piezometer.
10. Supplying, installing, testing, and commissioning of a Multi-Point Vibrating Wire Piezometer for dam instrumentation.
11. 100 mm Diameter Borehole Drilling in Earthen Embankment Dam.
12. Burden Tube pressure gauge Providing and installing pressure gauge.
13. Cleaning and Drilling of Drainage Holes in Dam Gallery through Hard Rock/Concrete
14. Supplying, installing, testing, and commissioning of a Wireless Data Logger, Vibrating Wire Wireless Nodes, Wireless Mesh Repeater Node.
15. Supplying, installing, testing, and commissioning of Server-Based and Cloud-Integrated Software for Data Logger, integrated for real-time monitoring.
16. Supply of portable readout unit for vibrating wire and analogue/digital geotechnical instruments.
17. Providing, supplying, installing, and commissioning Desktop PC.
18. Supply and Installation of Multi-Function Laser Printer with Wired and Wireless Connectivity.
19. Providing, Supplying, Laying, Fixing, Testing and Commissioning of 4 and 40 Core Cable from Dam Instrument to Junction Box.
20. Operation and Maintenance (O&M) of installed instruments.
21. Providing and Installing LED Screen 55".
22. Civil or other work for above all item.

(ii) Principal details of work:

Works to be performed for the various items are in Schedule-B. The above information only general out line and does not in any way limit, the performance of all work and supply of plant machinery, all labours and materials necessary for completing the work as shown in approved working drawing and mentioned in specifications. The set of drawings supplied with tender are only the general drawing to indicate nature of work, construction details for various cross drawings, work and canal earth work will be applied in course of execution. No extra payment or claim on account of any additional or alternation in working drawings shall be admissible.

5.0 Labour :-

Availability can be good except showing and harvesting period. However, there may be shortage of skilled labour like masons, carpenters, operators, mechanics, etc. The contractors shall have to make own inquiries in this regard and quote his rates.

6.0 Housing :-

Area being highly rural there is no local housing arrangements available and contractor will have to make his own arrangements for his staff and labour etc. in the area as may be available on rental basis as per clause 54 of the tender.

7.0 Water Supply :-

The contractor shall have to make his own arrangements of water supply for this work. Use of fresh water for work will be allowed free of cost of the contractor from the river length flowing in construction area and area transferred Water Resources Department. Pumping, purification, storage tank, pipe line etc. for the said purpose will be arranged by the contractor at his own cost.

8.0 Drainage :-

Suitable and adequate arrangements shall have to be made by the contractor for drainage of drain water around his colony and work spots. The contractor shall also have to install and maintain at his own cost suitable drainage system to dispose off sewage and seepage from his colony. The labour layout system shall be got approved from the Engineer-in-charge.

9.0 Camp Regulations :-

The contractor shall be responsible for maintaining law and order in his camp and on his work and shall employ such officers, watchman or other persons shall be excluded from the camp & the work. If in the opinion (which shall not be questioned) of the Engineer-in-charge any employee or agent of the contractor in miss behavior and / or causes obstructing in the proper execution, the contractor shall on receipt of the instruction of do so remove him from the premises.

10.0 Medical Aid :-

There is no dispensary on project site, however, there is a Government hospital in Jetpur about 25 Kms from work site. The services of this hospital will be available to contractor's staff and labour on payment of required charges may be required to be paid.

11.0 Electrical Power :-

The contractor at his or her own cost shall arrange power supply. The department guarantees no power supply.

12.0 Roads :-

The contractor shall construct and maintain the inspection roads and roads for all purpose required during construction at his own cost. There will however, be no change for any reasonable use of any road constructed by Government of site of work.

13.0 Post Telegraphs and Telephone :-

A post office is available in Jetpur 25 Kms from Canal site. Contractor shall make their own arrangement for telephone if required.

14.0 Bank Facilities :-

Branches of State Bank of India, and Schedule Bank are available at Jetpur.

15.0 Supply of Petrol & Diesel :-

There is petrol pump near village Jetpur.

16.0 Materials :-

(i) Rubble Quarry :-

Rock strata is available within a lead of 15 Kms from site of work. These quarries are supposed to yield adequate quantity of rubble required for the proposed work.

(ii) Sand :-

Sand is available in river BHADAR with in 15 Kms from construction site. The sand is found quite suitable and it is expected that sufficient quantity of sand required for the work will be available.

(iii) Coarse Aggregate :-

The coarse aggregates i.e. kapachi for foundation concrete and R.C.C. work and for canal lining work will be obtained by crushing rock and crusher plant.

(iv) The contractor shall have to make his own inquires availability of Required materials and other materials required for construction of work and accordingly he shall quote the rates.

17.0 Photography of site & work:

17.1 Per Rs.10,000.00 estimated cost of work or part thereto one set of Photograph shall be taken before starting of work and another after Completion of work for same location by and at the cost of contractor.

17.2 Photograph shall be provided in two copies of minimum size 4 inch x 6 Inch along with a C.D.

17.3 The locations of the photographs shall be decided by Engineer-in-charge.....

17.4 Initial photograph shall be provided before first R.A. bill and final photograph shall be provided along with the final bill.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

GENERAL CONDITION

GENERAL CONDITIONS
INDEX

Sr. No.	Item
1.	DEFINITIONS OF TERMS
2.	CONTRACTOR'S OBLIGATIONS
3.	CONTRACT
4.	GOVERNMENT AUTHORIZED TO WITH HOLD PAYMENT DUE TO THE CONTRACTOR
5.	AUTHORITY OF THE ENGINEER-IN-CHARGE
6.	CONTRACT DRAWINGS AND SPECIFICATIONS
7.	DATA AND DRAWINGS TO BE FURNISHED BY THE CONTRACTOR
8.	USE OF SITE
9.	BASE LINES AND GRIDS
10.	FENCING AND LIGHTING
11.	LIABILITY FOR ACCIDENTS TO PERSONS
12.	ACCESS TO SITE AND WORK ON SITE
13.	OPENING OUT WORK
14.	CONTRACTOR TO KEEP INVENTORY OF PLANT ETC.
15.	PROGRESS SCHEDULE
16.	REPORTS REGARDING LABOUR
17.	OTHER CONTRACTS FOR THE WORK
18.	INTEREST ON MONEY DUE TO THE CONTRACTOR
19.	CONTRACT DOCUMENTS AND MATTERS TO BE TREATED AS CONFIDENTIAL
20.	GUARANTEE PERIOD
21.	PATENTS RIGHTS
22.	PERSONNEL OF THE CONTRACTOR
23.	TRAINING OF GOVERNMENT'S PERONNEL
24.	CO-OPERATION WITH OTHER CONSTRUCTION AGENCIES
25.	RESIDENTIAL ACCOMMODATION AND SANITARY AND MEDICAL ARRANGEMENTS TO BE PROVIDED FOR THE LABOUR EMPLOYED BY THE CONTRACTOR
26.	NOTICE-HOW TO BE GIVEN
27.	COST OF FACILITIES AND INCIDENTAL WORKS
28.	DAMAGE BY FLOOD SOR ACCIDENTS
29.	TREASURETROVE
30.	INDEMNITY
31.	PROGRESSIVE MEASUREMENTS OF MATERIALS AND WORKS
32.	LABOUR CONDITIONS
33.	WORK ORDER BOOK
34.	RELATIONS WITH PUBLIC AUTHORITY
35.	INSURANCE OF LABORERS
36.	TITLE OF CLAUSES
37.	JURISDICTION
38.	CONSTRUCTION OF THE CONTRACT

GENERAL CONDITIONS

1. DEFINITIONS OF TERMS:

In general conditions and contract documents, the following expressions shall have the meaning herein assigned to them unless there is something in the subject or context on consistent with such construction.

- (i) The **"Government"** shall mean the Governor of Gujarat and shall unless excluded by repugnant of the context, include his successors in offices and accepted assigns.
- (ii) The **"Contractor"** shall mean the tenderer whose tender shall have been accepted by the Government and shall include the tenderer's legal personal representative successors and assigns. The **"Sub-Contractor"** shall mean the person named in the contract for any part of has been sublet with the consent in writing of the Engineer and the legal representatives, successors and assigns of such person.
- (iii) The **"Engineer"** or Engineer-in-charge or the **"Executive Engineer"** shall mean the Executive Engineer, Rajkot Irrigation Division, Rajkot, for the time being or such other officer as may be duly authorized and appointed in writing by the Government to act as the Engineer for the purpose of the Contract.

The Engineer where named as final authority for decision shall mean the Superintending Engineer, Rajkot Irrigation Circle, Rajkot up to whom the contractor shall have a right of appeal when the contractor is not satisfied with decisions of the Executive Engineer.

- (iv) The **"Chief Engineer"** shall mean the Chief Engineer (Central Gujarat) & Additional Secretary, N.W.R.W.S. & Kalpsar Department, Gandhinagar.
- (v) The **"Contract"** shall mean and include the invitation for tenders, work and site conditions general conditions, printed **SBD** form with all its appendices, special conditions and detailed specifications, the contract drawings and any letters issued modifying the conditions of contract and the contract between the contractor and the Government.
- (vi) The **"Specifications"** shall mean the specifications annexed to these general conditions, and the schedules there to (if any), and as laid down or implied in the contract documents.
- (vii) **"Site"** shall mean the lands and other places on, under, in or through which works are to be executed or carried out or any other lands or places provided by the Government for the purpose of the contract and includes such other areas as approved by the Superintending Engineer, Rajkot Irrigation Circle, Rajkot.
- (viii) **"Construction Plant"** shall mean all appliances, machinery, equipment, livestock or things of whatsoever together with necessary supplied or up keep and maintenance required in or about the proper execution, completion or maintenance of the works or temporary works, but does not include materials or other things intended to form or forming part of the permanent works.
- (ix) **"Temporary Work"** shall mean all temporary works of every kind required for the proper execution completion or maintenance of the work.
- (x) **"Month"** shall mean the calendar month.
- (xi) **"Writing"** shall include any manuscript, typewritten, computer print or printed statement under or over signature and seal as the case may be.
- (xii) **"Tendered rates"** shall mean the rates entered in words in **Schedule "B"** of the tender by the contractors.

2. CONTRACTOR'S OBLIGATIONS:

- (i) The contractor shall be deemed to have carefully examined the work and site

conditions, the general conditions, the special conditions, the specifications, schedules and drawings and shall be deemed to have visited the site of works and to have fully informed himself regarding the local conditions. The work should be completed within stipulated time limit.

If he shall have any doubt as to meaning of any portion of these general conditions or the special conditions or the scope of work or the specifications or any other matter concerning the contractor, he shall get clarified in good time before submitting his tender set forth the particulars thereof, and submit them to the Engineer in writing in order that such doubt may be removed.

- (ii) The contractor shall, unless in cases specially provided for, make all payments at his own expenses under take to do all things and supply all Labour, materials, construction plant, equipment, temporary works, transport, supervision and everything whether of a temporary nature or a permanent maintenance of the works, and for performing the obligations of the contract or under the contract, or which the N.W.R.W.S.&K.D. would have to under take to do or supply had the N.W.R.W.S.&K.D. carried out the construction completion and maintenance of works.

3. **CONTRACT:**

After the contract has been accepted by the Government all orders or instructions to the contractor shall except as herein otherwise provided be given by the Engineer-in-charge on behalf of the Government.

4. **GOVERNMENT AUTHORIZED TO WITH HOLD PAYMENT DUE TO THE CONTRACTOR:**

The Government shall have lien on and over all money payable to the contractor under this contract, and also over this security deposits withhold or recoveries made under relevant clauses of this contract, in respect of any Government by the contractor wither alone or jointly with another person under the provisions of the Government Acts, or any other statutory enactments in force in modification or substitution thereof. Government shall at all times be entitled to deduct the said sum or tax from contractor from the moneys, securities or deposits which may become payable or returnable to the contractor under this contract.

5. **AUTHORITY OF THE ENGINEER-IN-CHARGE:**

So far as it is legally or physically impossible, the contractor shall execute, complete and maintain the works in strict accordance with the contract under the directions and to the entire satisfaction of the Engineer-in-charge and shall comply with and adhere strictly to the Engineer-in-charge's instructions and directions on any matter whether mentioned in the contract or not. The Engineer-in-charge shall decide all questions and work executed, manner of execution, rate of progress of the works, interpretation of plans and specifications and acceptable fulfilment of the contract on the part of the contractor. He shall determine the amount and quality of work performed and materials furnished and his decision and measurements shall be final. In all such matters and in any technical questions which may arise touching the contract, his decision shall be binding on the contractor.

The Engineer-in-charge shall have to the power to enforce such decisions and orders if the contractor fails to carry them out promptly. If the

contractor fails to execute the work ordered by the Engineer-in-charge, the Engineer-in-charge may give notice to the contractor specifying a reasonable period therein and on expiry of that period, proceed to execute such work as may be deemed necessary and recover the cost thereof from the contractor.

6. **CONTRACT DRAWINGS AND SPECIFICATIONS:**

- (a) Supply of sets of contract drawings and certified copy of accepted tender will be governed as per Section 5 technical specification and Section 9 for Drawings.
- (b) The drawings which form part of these specifications show the work to be done in as much details as is possible at the present stage. They will be supplemented or superseded by such additional detailed drawings as may be necessary as the work progresses. The contractor shall perform the work on these features and in accordance with these additional or revised drawings, as the case may be and at the applicable rates as per the contract. Revised and / or additional drawings will be available for inspection in the office of the Executive Engineer, Rajkot Irrigation Division, Rajkot and if copies of the same are required by the contractor three sets of such revised and / or additional drawings will be given free of cost on request. Additional copies of the same will be supplied at Rs.50 (Rupees fifty only) per each of such additional copies of each drawing.
- (c) The Contractor shall check all drawing score fully and advise the Engineer immediately of any errors or omissions discovered. The contractor shall not take advantage of any kind of any error or omission in the drawings supplied. If the contractor does not point out any mistake, he shall have to face the consequence thereof and bear extra cost, if any incurred by him on this account.

7. **DATA AND DRAWINGS TO BE FURNISHED BY THE CONTRACTOR:**

The contractor shall submit to the Engineer for approval within two months from the date of receiving notice to start work, plans showing layout of construction plant and equipment, roadways, temporary bridges, unloading facilities and storage yards, offices, colony including its services and housing facilities, drainage and water supply amenities which he proposes to put up at site etc. He shall also submit on completion of work plans of above as actually adopted during execution for incorporation in the completion report. He shall also indicate program of such works etc.

8. **USE OF SITE:**

- (a) The contractor shall be permitted to use without any charge the site and all lands required for the permanent occupation of the works. He will also be allowed during the period of his contract the use of any other lands at the rates of tender in the vicinity of the works as and when the Engineer may consider such use to be necessary for bonafide purpose of works. The contractor shall not commence any operation on such lands except with prior approval of the Engineer -in-charge.
- (b) All areas of operation, including those for his staff and Labour colonies handed over to the contractor shall be cleared and handed back in good condition to the Engineer except are as under works constructed as per this contract or those for which specific approval has been obtained from the Engineer. The contractor shall make good, to the satisfaction of the Engineer-in-charge, any damage or alterations made to areas which he has to hand back or to other property or land handed over to him for purpose of this work.

- (c) Temporary structures may be erected at his own expense by the contractor for storage sheds, offices, residences etc. for non-commercial use on the land handed over to him and with the permission of the Engineer. These structures shall comply with all regulations that may be in force and/or specified by the Engineer with regards there to. For such non-commercial use of land and rent shall be charged at the rate of Rupees 5 per month per every hectare or fraction thereof.
- (d) The contractor shall preserve all existing vegetation such as trees on or adjacent to the site which does not interfere with constructions as determined by the Engineer. The contractor shall take all possible precautions in felling trees authorized for removal to avoid any unnecessary damage to vegetation and trees not to be felled and to structures under construction or to workmen and shall be responsible for any damage if it occurs in such operations. All produce from cutting of trees, grass etc., shall be the property of Government and shall be stacked at the place specified by the Engineer. No claim shall be made for such cutting and stacking of trees or grass etc., by the contractor.
- (e) The lands shall, as herein before mentioned, be handed back to the Engineer, within six months after the completion of the work under this contract. Also no land shall be held by the contractor longer than the Engineer shall deem necessary and the contractor shall on due notice by the Engineer, vacate / return the land which the Engineer may certify as no longer required by the Contractor for purpose of the work.

9. **BASE LINES AND GRIDS:**

- (a) Permanent base lines and cross-lines shall be established at sufficiently close intervals with benchmarks at all corner points to serve as "Reference Grid". The contractor shall provide at his expense all templates pillars, stakes, equipment, materials and Labour for establishing the Grid lines and pillars shall be responsible for their proper maintenance during the whole period of construction. These shall be laid out with prior approval of land and checked by the Engineer. No base line or bench or reference mark shall be used as reference line, mark or level for the work without prior approval of the Engineer-in-charge. The contractor shall maintain a certified copy of such reference grid and he shall not remove any of them without the prior approval of the Engineer-in-charge.
- (b) The contractor shall layout the work from these reference base lines in consultation with the Engineer-in-charge and shall be responsible for the correctness of all measurements and levels in connection therewith, not with standing the fact that the same might have been checked by the Engineer's staff.
- (c) The contractor shall be responsible for proper execution of the work to such lines, grades as may be specified in the drawings or established or indicated by the Engineer.

10. **FENCING AND LIGHTING:**

- (a) The contractor shall unless otherwise specified, be responsible for the proper fencing, lighting, ventilation, guarding and taking of the necessary safety measures for all works comprised in the contract and for the proper provision of temporary roadway, for passengers or other traffic and of owners and occupiers of adjacent property and of the public and shall remain responsible for any accidents that may occur on account of his failure to take proper and timely precautions.
- (b) **Lighting:**
All the works, approaches shall be adequately illuminated with electric lights to the Government authorized under the Indian Electricity Act. Any addition and alteration or omission shall be got approved from the Engineer and got certified from the Electrical Inspector. Work spots such as faces of excavations, concreting, masonry work etc. shall be adequately provided to the satisfaction of the Engineer-in-charge.

Wherever more than one agency is working in the same area, the contractor who has already provided lighting arrangements shall extend the facilities to the other contractor who shall pay for such facility at mutually agreed rates. In case of dispute, the matter shall be decided by the Engineer-in-charge whose decisions shall be final.

- (c) All the arrangements made for fencing & lighting shall be maintained by the contractor throughout the pendency of the contract till physical taking over of the work by the Department.
- (d) If after all the work under this contract is completed and accepted as such and in case the Engineer so directs, the contractor shall maintain the lighting, drainage, communication facilities etc., up to a date determined by the Engineer.

No payment for such services maintained on direction after the completion and acceptance of the work under this contract shall be made. The maintenance of these services during the pendency of the work is however the contractor's responsibility and at his cost except where other specified.

11. LIABILITY FOR ACCIDENTS TO PERSONS:

Responsibilities and liabilities of the contractor under Workmen's Compensation Act are given in Clause 33 of SBD. In addition, following shall also apply: -

- (a) On the occurrence of an accident which results in death of workmen employed by the contractor or which is as serious as likely to result in death of any such happening of such accidents intimate in writing to the Engineer the fact of such accident. The contractor shall indemnify Government against all loss or damage sustained by the Government, resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines, if any, payable by the Government as a consequence of Government's failure to give notices under the workmen's Compensation Act other wise to conform to the provisions of the said Act in regard to such accident.
- (b) In case of an accident in respect of which compensation may be come payable under Workmen's Compensation Act whether by the contractor or by the Government principal, it shall be lawful for the Engineer to retain out of money due and payable to the contractor, such sum or sums of money as any in the opinion of the Engineer be sufficient to meet such liability. The opinion of the Engineer shall be final in regard to all matters arising under this clause.

12. ACCESS TO SITE AND WORK ON SITE:

The Engineer, may, if he considers fit from time to time enter upon any lands which may be in possession of the contractor under this contract, for the purpose of executing any works not included in this contract and may execute such works not included in his opinion and the contractor shall in accordance with the requirements of the Engineer, afford all reasonable facilities for execution of the work including occupation of lands by structure or otherwise for any other contractor employed by the Government and his workmen or for the workmen of the Government who may be employed in the execution on or near the site of the work not included in the contract, or of any contract in connection with or ancillary to the work and in default, the contractor shall be liable to the Government for any delay or expense incurred by reason of such default. Provided always that if the exercise of these powers shall cause any damage to the contractor he may within fifteen days of such damage arising make a statement of the same to the Engineer who shall from time to time assess the

value in his judgment of such damage and the Government shall from time to time pay to the contractor the amounts (if any), accepted as justified by the Engineer.

13. **OPENING OUT WORK:**

Should the Engineer consider it necessary in order to satisfy himself as to the quality of the work, the contractor shall at any time during the continuance of the contract pull down or cut in to any of the work, and make such of things into and to such extent though the same, as the Engineer may direct and contractor shall make good the same at his cost to the satisfaction of the Engineer.

14. **CONTRACTOR TO KEEP INVENTORY OF PLANT ETC.:**

The contractor shall prepare and maintain an inventory of all materials, temporary rolling stock, plant purchased or hired for use or employment or for any of the purpose of this contract and such inventory or a copy thereof shall at all-time be available for inspection by the Engineer. A complete and up to-date copy of the inventory shall be submitted to the Engineer in the beginning. Changes in the interim period if any shall be communicated within ten days.

15. **PROGRESS SCHEDULE:**

- (a) The contractor shall furnish within one month of the order to start the work, a progress schedule in quadruplicate indicating the date of start, the monthly progress expected to be achieved, and the anticipated completion date of each major item of work to be done by him, also indicating dates of procurement and setting up of materials, plant and machinery. The Schedule should include a statement of proposed general and detailed arrangements for carrying out works, and of time, order and manner in which it is proposed that these shall be executed. The Schedule should be framed keeping requirement of **Clause 27 of SBD** form in view and be such as is practicable of achievement towards completion of the work in the time limit and of the particular items on due dates specified in the contract and shall have the approval as in this schedule shall be adhered to.

In case it is found necessary at any stage to alter the schedule, the contractor shall submitting good time a revised schedule, incorporating necessary modifications proposed and get the same approved by the Engineer. No revised schedule shall be operative without such acceptance in writing.

Detailed schedules for each working season showing the progress proposed to be achieved month by month for each major item and quarterly for other items shall be submitted to the Engineer not later than the prescribed date by the Engineer-in-charge proceeding the working season, and got approved.

The Engineer is further empowered to ask form ore detailed schedule or scheduls, say week, for any item or items, and the contract or shall supply the same as and when asked for.

- (b) The Engineer shall have, at all times, the right without in any way vitiating this contract or forming grounds for any claim to alter the order of the work or any part thereof and the contractor shall after receiving such direction, proceed in the order directed. The contractor shall also revise the progress schedule

accordingly and submit four copies of the revised schedule to the Engineer within seven days of the Engineer's direction to alter the order of works.

- (c) The contractor shall furnish sufficient plant, equipment and Labour and shall work such hours and shifts as may be necessary to maintain the progress of the work as per approved progress schedule. The working and shift hours shall comply with all government regulations in force, and shall be such as may be approved by the Engineer. That shall not be varied without the prior approval of the Engineer.
- (d) The contractor shall from time to time as may be required by the Engineer furnish the Engineer with a statement in writing of the arrangement the purposes to adopt for the execution of this contract and the Engineer may if he consider necessary at any time, advise alteration in the same which the contractor shall adopt on notice there of.
- (e) The progress schedule shall be in the form of progress charts, forms, statement and / or reports as may be approved by the Engineer. The contractor shall submit four copies showing the progress of the work in forms and charts etc. at periodical intervals as may be specified by the Engineer.
- (f) The approval of the progress schedule by the Engineer shall not relieve the contractor of any of his duties and responsibilities under the contract. The adoption of any modification in the schedule required by the Engineer shall not entitle the contractor to any extra payments.

16. REPORTS REGARDING LABOUR:

The contractor shall submit the following reports to the Engineer-in-charge.

- (i) A daily in af orm as may be prescribed of the strength of Labour, both skilled and unskilled, employed by him on the works. The contractor shall increase or decrease the strength both skilled or unskilled if directed by the Engineer-in-charge. The submission of such reports shall not however, relieve the contractor of his responsibilities and duties regarding progress or any other obligations under the contract.
- (ii) A classified weekly return in the prescribed form of the number of persons employed on the works during the preceding week.
- (iii) A weekly medical report in the prescribed form showing the health of the contractor's camp, the number of person sill or in capacitated and the nature of the irillness.
- (iv) A report of any accident which may have occurred to be sent within 12 hours of the occurrence.
- (v) Such other reports as may be prescribed.

17. OTHER CONTRACTS FOR THE WORK:

Government has the right to split up the corporate work detailed in the work and site conditions into distinct items and this contract shall apply only to these items which shall have been specified in this contract.

Should the Government enter into other contract for specified items of the corporate, each contractor shall co-operate with others to the fullest extent and shall allow to each other every facility and co-ordination for execution of their works simultaneously and satisfactorily, as intended in these designs, specifications and drawings.

Should there be a dispute or disagreement between, the contractors for any cause whatsoever, same shall be referred to the Engineer, whose

decision regarding the co-ordination, co-operation and facilities to be provided by any of the contractors to the others shall be final and binding on all parties and such a decision or decisions shall not vitiate any contract, not absolve the contractor of his responsibilities under the contract from the grounds for any claim or compensation.

18. INTEREST ON MONEY DUE TO THE CONTRACTOR:

1. No omission by the Engineer to pay the amount due upon measurements or otherwise shall vitiate or make void the contract.
2. The contractor shall not be entitled to interest upon any guarantee, fund of payment in arrears or upon any balance which may be due to him on the final settlement of his account.

19. CONTRACT DOCUMENTS AND MATTERS TO BE TREATED AS CONFIDENTIAL:

All documents, correspondence, decisions and other matters concerning the contract shall be considered as of confidential and restricted nature by the contractor and he shall not divulge or allow access thereto any unauthorized persons of any kind.

20. GUARANTEE PERIOD:

Not with standing what is mentioned in Clause 33 of SBD, during the period of 36 months from the date of putting the plant or works into commercial use, the contractor shall be liable for the replacement of any part of the plant or works found defective from the causes arising from faulty materials, workmanship or other causes for which in the judgment of the Engineer, the contractor is responsible for making good any damage arising here from.

The guarantee period in respect of plant or work for which replacement of any part has been made for the above reasons shall be extended until the expiry of the 36 months after the replaced part shall have been put into commercial use.

21. PATENTS RIGHTS:

In the event of any claim or demand, being made or action being brought against the Government for in fragment of letters patent, registration of design or trade mark in respect of any machine, plant, work material or thing used or supplied by the contractor under this contract or in respect of any method of using or working by the Government of such machine, contractor he shall indemnify the Government against all costs and expenses arising from or incurred by reason of any such claimismade, and that the contractor shall be at liberty if he so desires, with the assistance of the Government, if required, but at the contractor's expenses to conduct all negotiations for the settlement of the same or any litigation that may arise there from and provided that no such machine, plan, work, material, or thing shall be used by the Government for any purpose or in any manner other than that for which they have been supplied by the contractor and specified under this contract.

22. PERSONNEL OF THE CONTRACTOR:

- (a) The contractor shall, at all times, maintain on the work, a staff of qualified Engineers and supervisors of sufficient experience of similar other jobs, to assure

that the quality of work turned out shall be as intended in these specifications. The contractor shall also maintain at the work, a works manager of sufficient status, experience an office and duly authorize him to deal with all aspects of the day to day work. All communications to and commitments by this works manager shall be considered binding on the contractor.

- (b) The contractor shall supply to the Engineer, details of names, qualifications and experience in regard to all supervisory staff employed by the contractor and notify changes when made, and satisfy the Engineer regarding the quality and sufficiently of staff thus employed.
- (c) The Engineer will have the unquestionable right to ask for changes in the quality and numbers of the contractor's supervisory staff, and to order removal from the work, and any connection there with of any of such staffs. The contractor shall comply with such orders and effect replacements to the satisfaction of the Engineer -in-charge.

23. **TRAINING OF GOVERNMENT'S PERONNEL:**

The contractor shall, if and as directed by the Engineer - in - charge provide, free of any charge, adequate facilities to the Government for training of Government officers, supervisors, foremen, skilled workmen etc., not exceeding twelve in number at any one time on the contractor's works. They will work with the contractor's staff and remain under his control. The irsalaries etc., will be borne by the Government and training scheme will be arranged by the Engineer - in - charge, in consultation with the Contractor.

24. **CO-OPERATION WITH OTHER CONSTRUCTION AGENCIES:**

The contractor shall in accordance with the requirements of the Engineer-in-charge afford all reasonable facilities for any other contractors or piece workers employed by the N.W.R. W.S. & K. Department and their workmen and for the workmen of the N.W.R.W.S.&K.Department and of any other properly authorized authorities or statutory bodies who may be employed on the execution on or near the site of any work not included in the contract or of any contract which the N.W.R. W.S. & K. Department may enter into connection with ancillary to the works.

The contractor shall conduct his work so as not to interface with or hinder the progress or completion of the work being performed by other contractors or piece workers or by the N.W.R.W.S. & K. Department and shall as far as possible arrange this work and shall place and dispose of materials being used or removed so as not to interfere with the operations of the contractors, piece workers or the N.W.R. W.S. & K. Department. He shall join his work with that of others in an acceptable manner and shall perform it in proper sequence to that of others.

The Contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and save government from any and all damages and claims that may arise because of in convenience, delay or loss experienced by him because of the presence and operations of others working on or near the site. He shall assume all responsibility for all works not completed or accepted because of the presence and operations of other contractors or piece workers or of the Public Works

Department.**25. RESIDENTIAL ACCOMMODATION AND SANITARY AND MEDICAL ARRANGEMENTS TO BE PROVIDED FOR THE LABOUR EMPLOYED BY THE CONTRACTOR:**

- (a) Before opening a Labour camp, the contractor shall obtain and follow the advice of the concerned Assistant Director of Public Health regarding the camp site, accommodation water and food supply, sanitary, arrangements etc.
- (b) The contractor shall build sufficient number of huts for the Labour on a suitable plot of land according to the following specifications:
A good site shall be selected. High ground removed from jungle but well provided with trees shall be chosen wherever it is available. The neighborhood thick jungle, grass or weeds should be particularly avoided. Camps should not be established close to large cuttings or earthwork. When a good natural site can not be procured, particular attention should be given to drainage.
 - (i) The lines of huts shall have open space of at least 10 Mts .between rows.
 - (ii) Huts of bamboos and grass may be constructed.
 - (iii) There should be no over crowding. Floor space on a scale of 10Sq.Mts. per head shall be provided.
 - (iv) Care shall be taken to see that the huts are kept lean and in good order.
 - (v) The contractor must find his own land. If he wants Government land, he should apply for it and payment for it.
- (c) The contractor shall provide an adequate supply of pure and whole some water for laborer sata rate of not less than ten gallons per head per day. No provision need be made if there is suitable nalla, river, well or adequate tap water arrangement within a half kilo meter of the camp.
- (d) The contractor shall construct trench or semi-permanent latrine for laborers on a scale of not less than five for every 100 persons or part there of. Separate latrine shall be provided foramen and for women. The laborers may be at their option allowed to use either the trench system or the latrine system.
- (e) The contractor shall construct:
 - (i) Screened bathing places on a scale of not less than one for every 20 persons or part there of. Separate bathing places shall be provided for men and women.
 - (ii) Washing places for washing clothes on scale of not less than one for every 30 persons or part there of.
 - (iii) An efficient drainage arrangement for removing ludge water bathing and washing places and for its disposal without causing nuisance.
- (f) The contractor shall provide the necessary staff for effecting conservancy, sanitation and clean liness to the satisfaction of the Engineer-in-charge. Sweepers shall be employed on a scale of not less than one sweeper for every 200 persons or part thereof.
- (g) The contractor shall arrange for all anti-malaria measures for the Labour employed on the work as directed by the Assistant Director of Public Health.
- (h) The contractor shall take suitable measures for fire prevention and control to the satisfaction of the Engineer-in-charge.

26. NOTICE-HOW TO BE GIVEN:

Where any legal or other notice or any other document or any direction is

to be given to or served upon the contractor it shall be deemed to be duly given or served, if it shall have been either delivered to him personally or to his recognized agent (including in the case of Company, the Secretary of such Company) or delivered at, or sent through the post addressed to the contractor at the contractor's office on the site or sent through the post addressed to the last known place of business or address of the contractor or in the case of a company, to its registered office and in the case of a firm of contractors a notice or other documents, which shall be so given or so deemed to have been given to or served on all of them.

27. **COST OF FACILITIES AND INCIDENTAL WORKS:**

The cost of all the facilities or any other incidental works etc. as described in various clauses that may have to be provided by the contractor for the purpose of this contract shall be borne by the contractor and no payment shall be made for the same unless specifically mentioned or stipulated.

28. **DAMAGE BY FLOODS OR ACCIDENTS:**

The contractor shall take all precautions against damage to the works by floods & waves of tides or from accidents. No compensation shall be allowed to the contractor for his plants or materials or damaged by floods & waves of tides or from other cause. The contractor shall be liable to make good any damage to the work or the plant or material of N.W.R. W.S. & K. Department lost damaged by floods & waves of tide or from any other cause, while in charge of the contractor.

29. **TREASURETrove:**

In the event of discovery by the contractor or his employees during the progress of work, of any gold, silver, oil or other minerals of any description and precious stones, treasures, coins, antiquities, relics, fossils or other articles of value or interest, whether geological, archaeological or any other such treasure and other things shall be deemed to be the absolute property of the Government and the contractor shall duly preserve the same to the satisfaction of the Engineer-in-charge, from time to time deliver the same to such person or persons as the Engineer may appoint.

The contractor shall take all reasonable precautions to prevent his workmen or any other persons from removing or damaging any such articles or things, shall immediately after discovery any carry out his orders for disposal of the same.

30. **INDEMNITY:**

The contractor shall indemnify the N.W.R.W.S. & K. Department against all actions, suits, claims and demands brought or made against N. W. R. W. S. & K. Department in respect of any matter or things done or omitted to be done by the contractor with execution of or in connection with the works of this contract and against any loss or damage to the N.W.R.W.S. & K. Department in consequence of any action or suit being brought against the contractor for any thing done or omitted to be done in execution of the works of this contract.

31. **PROGRESSIVE MEASUREMENTS OF MATERIALS AND WORKS:**

If, in the opinion of the Engineer, the progress of work achieved by the

contractor is not adequate, the period between two successive progressive measurements as May at the discretion of the Engineer, be extended.

32. **LABOUR CONDITIONS:**

While employing skilled or unskilled laborers, the contractor shall give first preference to the persons certified to him by the engineer or his duly authorized agencies.

33. **WORK ORDER BOOK:**

An order book shall be maintained on the work and the contractor shall sign the orders given by the Engineer-in-charge or his agent and shall carry out properly to the directions.

34. **RELATIONS WITH PUBLIC AUTHORITY:**

The contractor shall comply with all proper and legal orders and direction given from time to time by any local or public authority and shall payout of his own money any fees or charges to which he may be liable.

35. **INSURANCE OF LABORERS:**

The contractor shall be responsible to arrange for insurance of all laborers skilled and unskilled workers, supervisors etc. employed by him as per Labour regulations of the State.

36. **TITLE OF CLAUSES:**

The titles of the clauses do not form part of the same and shall not affect their legal construction.

37. **JURISDICTION:**

The contract shall be governed by the laws of India for the time being in force and be subject to the jurisdiction of Indian courts.

38. **CONSTRUCTION OF THE CONTRACT:**

The contract shall in all respects be construed and operated as a contract as defined in the Indian Contract Act, 1872 and all payments made there under shall be made in rupees unless otherwise specified.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

116

SUB SECTION

SECTION-2

SPECIAL CONDITION

SECTION - 2
SPECIAL CONDITIONS
INDEX

Sr. No.	Item
1.	Accuracy of Line, Level & Grades
2.	Testing of Materials
3.	Supply of Materials
4.	Admixture
5	Other Materials
6.	Loans of Govt. Tools & Plants and Machinery
7.	Assistance in...etc.
8.	Security Measures
9.	Applicability of Specifications
10.	Change in Design & Drawing
11.	Applicable publication
12.	Dewatering and diversion as and where needed
13.	Leads & Lifts
14	Actual Days of Execution of this work.

SPECIAL CONDITION**1.0 ACCURACY OF LINES, LEVELS AND GRADES:**

The various works shall be done true to line, level and grade. The periodical checking of these works by the 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 shall further have been 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.

2.0 TESTING OF MATERIALS AND WORKS:

2.1.0 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 is liable to be considered as unauthorized, defective and not acceptable.

The testing of material including concrete mix design which is to be used in this work shall be carried out in the Govt. laboratory before start of work at the cost of contractor. The samples of sand, metal, cement, steel, stone, water, pipes, wood or any other material required shall be supplied by the contractor at his own cost.

All testing charges for materials and concrete mix design shall be borne by contractor.

Any additional tests required to be carried out at any stage of the work as per instructions of Engineer-in-charge shall be carried out by the contractor at his own cost.

2.2.0 The day to day periodical tests to be carried out on materials mixed and placed concrete, mortar etc. shall be specified by the Engineer from time to time and the contractor shall allow all facilities and co-operation towards collection or samples etc. Unless otherwise specified else where, all labour for collecting samples for tests will be supplied by contractor free of cost to Government, testing charges will however be borne by the Government except in the following cases where testing charges will be borne by the contractor when:

2.2.1. The supply of samples and the carrying out of such tests at contractors cost is provided for or clearly intended in the contract and is carried out either at the site of work, or manufactures at a place specified in the contract documents.

2.2.2. The supply of the sample and carrying out of such tests is not provided for or clearly intended in the contract but on testing the materials is found defective and has to be rejected.

2.2.3. Any additional tests are to be carried out over and above those specified in the Technical Specifications. In all other cases, the cost of testing shall be borne by the Government. The contractor shall however supply all materials required for tests and also make good at his cost materials, mixed and core holes similar or other materials as may be directed by and to the satisfaction of the engineer. An authorized representative of the contractor shall remain present at the time when the sample or cores etc. are taken and shall authenticate the facts if so require when the contractor's agent fail to be present as aforesaid the sample or cores etc. taken by the Engineer-in-charge or his representative shall be considered to be authentic. The contractor will however, be informed about the details of such sample and cores etc. having been taken.

2.3.0 The materials mixes and cores etc. shall be tested day to day or periodically at the Government Laboratory set up at the site of work and near by regional established Government laboratory 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. It shall then be contractors responsibility to carry out the finished items to the standards based on the laboratory design and tests.

2.4.0 The methods of sampling and testing, the procedure and standards shall be as laid down by the Engineer-in-charge for the respective items.

3.0 SUPPLY OF MATERIAL:**3.1 Cement of 53 grade as per IS 12269 (O.P.C.)**

Ordinary Portland Cement shall be used as per IS 456-2000 respectively for entire work under the tender in all respect. The contractor shall have to make his own arrangement to procure the cement bearing ISI Mark directly from the manufacturer and produced from major plant only. The contractor shall arrange to cart, loads unloads the same to the site of work at his own cost. For verification of such purchase, the contractor shall have to produce all the bill of the manufacturer, along with testing details to the Engineer-in-charge. The cement brought at the site by the contractor shall be tested by the Department as per IS 456-2000 for OPC. The testing charges will have to borne by the contractor and samples for testing shall be taken to the Government Laboratory (GERI) by the contractor. Testing charges shall be paid by the Department initially and the same shall be recovered from R. A. Bill or Final Bill.

3.2 The cement not satisfying the criteria as per IS 12269 for OPC shall be rejected and contractor shall have to remove it from site immediately.

3.3 Deleted**3.4 Large stocks of cement shall not be kept at the works but only sufficient quantities shall be kept to assure continuity of the work. The contractors shall have provide and maintain efficiently water proof storage sheds for cement on the site of work. It shall be stacked on the platform 12 inches (30 Cm.) above the floor level and cement shall be covered with tarpaulin or any other impervious materials for covering in order to protect the cement bags from moistures.****3.5 The cement bags shall neatly stacked on an orderly so as to audit of easy access and count. Deteriorated cement will not be allowed for use.****3.6 A regularly day to day account of cement received and used on the work together with the particular of the work and quantity of the work in which it was used, shall be maintained in ink separately by the responsible representative of the Department and shall be signed at the end of day's work both by the Departmental representative as well as the contractor after proper verification. The accounting shall be shown to the inspecting office when asked for.****3.7 The contractor shall provide a double locking arrangement for the store and the key of one lock will remain with Engineer-in-charge of the work or his authorized agent.****3.8 The contractor shall provide at the site of work satisfactory storage for not less than 3 months average consumption of cement on work and shall keep the cement store in a manner will satisfy the engineer-in-charge.****3.9 The arrangements of storage and utilization of cement shall be such that to ensure the utilization of cement in order of its arrival at the stores and the contractor shall maintain satisfactory up to date records which would at any time shown the dates of receipts and proposed utilization of cement laying in the stores at site.****3.10 The Engineer shall at all times have access to the stores and site of the contractor and shall have authority to check and examine the method of storage, records, accounting and security provided by the contractor. The contractor shall comply with the instruction to satisfy that the cement is used for the purpose for which it is stored. The contractor shall further at all time satisfy the Engineer on demand by the production of records of books of submission of return and proforma or by other proofs that may be demanded that the cement brought being used for the purpose for which it is brought and contractor shall at all times keep his records up to date to enable Engineer to apply such as he may be desire to impose.****3.11 The Engineer or his authorised agents will have the authority to verify the stock and check on the consumption in any manner he thinks proper.****4.0 ADMIXTURES:****4.1 The Engineer shall have the authority at any time and from time to time to order the addition of any air entertaining agent or other admixtures to any mix or the concrete or mortar in such proportion of quantity or manner as he may specify and the contractor shall comply with the same. The admixture shall be supplied by the contractor at his own cost at site for the purpose of concrete or the mortar as the case may be. The resulting modification if any, to the content or proportion of cement as a consequence thereof shall be accounted for in the tendered rate for payment according to para (ii) herein**

below.

- 4.2 The Engineer shall have the authority to arrange for the supply of the admixture or admixtures through the contractor (by a mutual agreement) or by other agency that the Engineer may deem fit. When the admixing becomes essential and any additional expenditure to the contractor by way of additional plant equipment or mechanised operation, the same shall be paid for at Rs.1.00/Kg. of admixture.
- 4.3 The contractor shall not without the written consent of the Engineer, add the admixture to any mix of concrete or mortar and whenever such an admixture is permitted the Engineer shall determine the adjustment in price of tender rates payable if any. The decision of the Engineer shall be final and binding upon the contractor.
- 5.0 **OTHER MATERIALS:**
The contractor may if required and approved by the Engineer obtain on usual payment from the Government stores such materials as may be available and could be spared. It shall be noted that owing to difficulty in obtaining certain materials in the open market the Government has undertaken to supply materials specified in the Schedule of the tender form at rate stated therein. There may be delay in obtaining materials by Department. The contractor, is therefore required to keep in touch with the day to day position of supply of materials from the engineer and so adjust the progress of the work that their labour may not remain idle nor may be entitle to any claim due to or arising for delay in obtaining materials. It should be clearly understood that no monetary claim what so ever shall be entertained by Government on account of delay in supply materials.
- 6.0 **LOANS OF GOVERNMENT'S TOOLS, PLANTS AND MACHINERY:**
No machinery or any Tools and Plant articles are at present available with the Department. However, the machinery, Tools and Plants as and where available with the Department shall be supplied as per rules and regulations as per the provisions contained in Government P.W.D. G.R. No.MCN/167/(97)/Part-IV/H dated 01.10.1980 and as amended from time to time, it must be also noted that machineries or Equipment actually justified for use in the works and available with the Department will be given on hire. No claims for delay in procurement of such machineries or Equipments will be entertained.
- 7.0 **ASSISTANCE IN PROCUREMENT OF PROPERTIES, PERMITS, IMPORT LICENSE, EXCHANGE FACILITIES ETC.:**
In view of the general difficult position regarding the availability of Foreign Exchange, generally it shall not be released in the normal course by the Department, for the purpose of plants and machineries required for execution of the works contracted for.
- 7.1 However, the Engineer on request by the contractor will if in the opinion, the request be reasonable and is in the interest of the work and its progress assist the contractor in the procurement of necessary import license, exchange facilities etc. for importing necessary plant, machinery or materials not locally available and payment of his foreign personnel or other remittance etc. He will also assist the contractor in securing priorities for delivery, transport etc. where such are needed. The Government will not however be responsible for the non availability of any of the above facilities or delay in this behalf and no claim either in cost or time, on account of such failure or delay shall be admissible be government. 9.2 As regards import license, the contractors application will be scrutinized by the Engineer regarding the reasonableness etc. and recommendations will be made as deemed fit. The Engineer decision in this regards shall be final and claim either in cost or time on account of such decision will be admissible.
- 8.0 **SECURITY MEASURES:**
In view of the strategic importance of all the projects and Installations security restriction may be imposed by the Engineer as per directions of the security authorities and the contractor shall abide by all such instructions scrupulously. In case a system of identity cards is introduced, the contractor shall at his cost provide for his person all such identity cards with photon if necessary and get these duly signed by the Engineer or his duly authorised representative. The contractor shall also keep the Engineer informed regarding all visitors and obtain proper permits for their visits. No unauthorized visitors will be allowed on work site.
- 9.0 **APPLICABILITY OF SPECIFICATIONS:**
Considering the common and general items required in execution or Irrigation Project,

general subject wise specifications has been drawn and provided separately with the Tender. This provision suitably provides requirements of execution of each component of work in general, consistent with the present practice of the scope of work and mode of execution and standards to be observed for the work financial limitations as regards to the admissibility of work payment and acceptance of work against the tender requirement etc. is described. To avoid descriptive matter suitable reference for the relevant Indian standards or otherwise is also specified. The whole idea is to guide the tenderer regarding the execution of work so as to base his rates accordingly.

- 9.1 The general subject wise specification are further supplemented in separate chapter to cover the item wise specification of work as per schedule 'B' of the tender. These item wise specifications will cover the applicable provision of the general specification. Considering the item description as per Schedule 'B' over and above this, the specific qualifications of each item such as applicable leads, lifts, proportion of the mix, description about the execution of the item in details and other applicable aspects will be covered in such specification. Intending tenders are therefore requested to read the tender papers on above lines and quote their rates.

10.0 CHANGE IN DESIGN AND DRAWINGS:

The drawings given with tenders documents are based on the present available data. However, during execution of work, any change in design and drawings that may be warranted on account of strata met with or the material that may be available or any other reasons shall not vitiate the contract and no extra payment shall be made to the contractor. The increase or decrease in quantities under the relevant items or account of above change shall be paid only at tendered rates of the relevant items for increase or decrease in quantities up to 30% of the tender quantity. Beyond 30% increase or decrease in quantities the payment shall be made as per clause 14. in case of earthen dam introduction or deletion of any zone shall not entitle the contractors for any claims and shall be paid at the tendered rates under relevant items and as per clause 14 as above.

- 10.1 Any change in gradation and proportion of course and fine aggregates in mix design of the concrete shall not entitle the contractors for any extra claim of this account.

11.0 APPLICABLE PUBLICATIONS:

All methods or procedures for execution of different items of the work shall conform to Indian Specification listed below or its latest editions unless otherwise specified. The provision of these I. S. Standards shall be applicable for the work irrespective of whether the same is specified in specification or elsewhere in the tender documents. The reference of Indian Standard Specification are listed below.

IS OR BIS CODE NO	VERSION	SUBJECT OF CODE
EXCAVATION AND EARTH WORK		
3764	Latest	Safety code for excavation work
CONCRETE WORK		
269	Latest	Specification for OPC cement
I. S. 12269		Specification for O. P. C.
I. S. 383 - 1979		Specification for coarse and fine aggregates.
I. S. 456 - 2000		Code of practice for plain and 457 - 1957 Reinforced Concrete
I. S. 460 - 1978		Specification for test sieves.
I. S. 516 - 1991		Method for tests for strength of concrete
I. S. 1999 - 1959		Method of sampling & analysis of concrete
I. S. 4032 - 1985		Method of chemical test.
I. S. 2386 - Part 1 to VIII 1963		Different tests on aggregates for concrete
I. S. 2770 - 1967		Method of testing bound in reinforced concrete
WATER		
I. S. 3025 - 1964		Sampling & testing (physical & chemical) for water

STEEL REINFORCEMENT		
I. S. 2502 - 1963		Code of practice for binding and fixing of bars for reinforced concrete
I. S. 5525 - 1969		Recommendation for detailing of reinforcement in reinforced concrete
I. S. 2751 - 1979		Code of practice for welding of mild steel used for reinforced concrete
STRUCTURAL STEEL :		
226	Latest	Structural steel
MASONRY WORK :		
1526	Latest	Sand for plastering work
458	Latest	Precast Concrete Pipe

12.0 DEWATERING AND DIVERSION AS AND WHERE NEEDED:

The rates also include arrangement for diversion of water during construction in the fair weather as well as in the monsoon during the entire period of contract. No payment shall be made for any part of earth work or materials washed away or damaged during the monsoon or other period and it shall have to be made good by the contractor at his own cost. It is the responsibility of the contractor to make good, or repair any Government property, material to be utilized for the present work or completed part of present work damage during the construction period.

13.0 LEADS & LIFTS:

The leads and lifts where it is not specified may be considered as all leads & lifts.

14.0 ACTUAL DAYS OF EXECUTION OF THIS WORK:

The period of completion shall be 3 (Three) Months Except Item No.23(Time limit for Item No. 23 of BOQ shall be 5 (Five) years) from the date of notice to proceed with the work.

Signature of Contractor

Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION – 2**GENERAL TECHNICAL SPECIFICATIONS****INDEX**

Sr.No.	Item
1	(A) General Technical Specification
2	(B) Standard Specification & General Specification
3	(C) General Technical Specification for Material
4	(D) General Technical Specification for Principle Material
5	(E) General Technical Specification for Cement Concrete Works
6	(F) General Technical Specification for Plastering & Pointing
7	(G) General Technical Specification for Excavation
8	(H) General Technical Specification for Earthwork
9	(I) General Technical Specification for Reinforcement
10	(J) General Technical Specification for Instrumentation

SECTION-2

(A) GENERAL TECHNICAL SPECIFICATION

(A) GENERAL TECHNICAL SPECIFICATION

General: -

- 1.1 All the items occurring in the work and as found necessary during actual execution shall be carried out in workman like manner as per specifications below and as per written orders of the Engineer-in-charge.
- 1.2 A work order book as prescribed by the Engineer-in-charge shall be maintained on the site of work and the contractor shall carryout field compliance properly.
- 1.3 The contractor shall engage authorised representative who shall be responsible and competent for managing the work. He shall take orders from the Engineer-in-charge and shall be responsible for carrying out the same.
- 1.4 Quantities specified in the tender may vary at the time of actual execution and the contractor shall have not to claim for compensation on account such variation.
- 1.5 Unexcavated lengths of the canal shall be left whatever so required by the Department during the currency of the contract. This portion shall be excavated as and where required either before or after completion of the whole work.
- 1.6 No trees shall be cut without permission of Engineer-in-charge.
- 1.7 Diversion for roads if necessary shall be provided and maintained during the currency of the contract without any extra cost to the Department.
- 1.8 The work shall be executed strictly in accordance with plans & specifications. Only the best materials and sound construction shall be executed in a through workman like manner.
- 1.9 The drawing prepared and trial pits taken are for general guidance and indication and changes either minor or major are likely to take place. No claim for extra payment shall be made by the contractor for such changes.
- 1.10 The quantities in the schedule are only estimate quantities and during execution they may increase or decrease. Any claim put forward for this variation in quantity shall not be entertained.
- 1.11 The rejected materials shall be removed from the site within 24 hours. If they are not removed within this period, the same will be removed at the contractor's risk and cost by the Department.
- 1.12 The work is an important work and this fact shall be constantly borne in mind by the contractors and his workers. Works not specified above shall be carried out according to P.W.D. Hand Book or according to instructions of the Executive Engineer.
- 1.13 The work require constant attention for line, levels and workmanship and hence the contractor shall have to keep the experienced technical staff on the work. The contractor has to supply the necessary materials and labour for the line and levels work at his own cost.
- 1.14 The contractor unless otherwise specified and providing in the contract shall pay all duties, tolls, quarry fees, royalties and taxes on all materials and articles they may use. The rate quoted by the contractor shall be considered inclusive of all such duties, fees, royalties, taxes etc.
- 1.15 In the specification " as directed / approved " shall be taken to mean " as directed / approved " by the Engineer - in - Charge.
- 1.16 Wherever a reference to any India Standard appear in the specifications, it shall be taken to mean as reference to the latest edition of the same in force on date of agreement.
- 1.17 In " Mode of Measurement " in the specifications, wherever a dispute arises in the

absence of specification of a particular point or aspect, the provision on these particular points or aspect in the relevant Indian Standard shall be referred to.

- 1.18 All measurement and computations, unless otherwise specified, shall be carried out nearest to the following limits :-

(1)	Length, Width and Depth (Height)	0.01 Meter.
(2)	Areas	0.01 Sq. Mt.
(3)	Cubic Contents (Except Wood)	0.01 Cumt.
(4)	Cubic Contents (Wood Work)	0.001 Cumt.

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

- 1.19 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.

- 1.20 Where no lead is specified, it shall mean " all leads ".

- 1.21 Lift shall be measured as per current practice for relevant item under direction or decision by Engineer-in-charge.

- 1.22 Definite particulars covered in the items of work, though not mentioned or included in it, specifications shall be deemed to be included therein.

- 1.23 Reference to specifications of materials as made in the detailed specification of the items of work is in the form of a designation containing the number of the specification of the material and prefix "M" i.e. " M-1 " etc.

- 1.24 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.

- 1.25 The contract rate of the item of work shall be for the work completed in all respects.

- 1.26 No collections of materials shall be made before it is got approved from the Engineer - in - charge.

- 1.27 Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.

- 1.28 Materials if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.

- 1.29 No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of various components of the structure.

- 1.30 All works shall be carried out in a workman like manner as per the best technique for the particular item.

- 1.31 All tools, templates, machinery and equipment for correct execution of the work as well as for check line, levels, alignment of the works during execution shall be kept in sufficient number and in good working condition on the site of work.

- 1.32 The contractors shall be responsible for observing the rules and regulations imposed under the " Mine and Minerals Act " and such other laws and rules prescribed by Govt. from time to time.

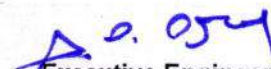
- 1.33 All necessary safety measures and precaution (including those laid down in the various relevant Indian Standards) shall be taken to ensure the safety of men, materials and machinery on the works and also of the work itself.

- 1.34 Approval to any of the executed item for the work does not in any way relieve the

contractor of his responsibility for the correctness, soundness, strength of the structure as per the drawings and the specifications.

- 1.35 The testing charges will be 1% of Amount of Work Done. But in case on testing of material found defective and have to be rejected. The supply of the sample and carrying out of such re-testing charges borne by the contractor over and above 1% of amount of Work Done.
- 1.36 All the materials, labours and other facilities required for testing shall be brought and arranged by the contractor without any extra payment.
- 1.37 All the materials, cubes, instruments shall be transported at field laboratory, Govt. lab., Govt. approved lab or any other laboratory as per instruction of Engineer in charge by contractor within time limit without any extra charge.
- 1.38 Facilities for field laboratory and instruments such as tin shed, curing tanks of required size, cube moulds of required size and other instruments as per instruction of Engineer in charge shall be provided by contractor without any extra payment. Water required for filling curing tanks shall be provided by contractor without any extra cost.
- 1.39 Frequency of testing for material & work under execution either at field lab. Or any other laboratory shall be as per mentioned in general technical specification or in detail specification or in technical specification of principal materials.
- 1.40 The test if Engineer in charge suggest to carried out for the material & execution of work not mentioned in as per mentioned in general technical specification or in detail specification or in technical specification of principal materials then also testing charges shall be born by the contractor and all facilities, materials and transportation regarding these test shall be provided by contractor without any extra cost.
- 1.41 Acceptance criteria of the test results is as per given in General Specification of Principal Materials or Standard Specification or in General specification or in Item wise, detailed specification or as per relevant I.S. code.
- 1.42 Testing of material as well as other tests required during execution of work shall be carried out at field lab. Or GERI lab. Or Govt. lab. Or Govt. approved lab. Or Engineering & polytechnic colleges in Gujarat where facility of testing are available as per I.S. rules and regulation and the results given by them shall be considered correct and authentic.
- 1.43 All the materials required to execute the item shall be procured, carted, loaded, unloaded the same to the site of work by contractor at his own cost except materials quoted in Schedule A.
- 1.44 In case of any discrepancy/dispute the latest edition of Indian Standard shall be followed and shall be binding to the contractor.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION-2

(B) STANDARD SPECIFICATIONS & GENERAL SPECIFICATIONS

(B) STANDARD SPECIFICATION & GENERAL SPECIFICATION

- 1.0 **General:**
- 1.1 All the items occurring in the work and as found necessary during actual execution shall be carried out in the best workman like manner as per specifications as below and as per written orders of the Engineer in Charge.
- 1.2 A work order book as prescribed by Engineer in Charge shall be maintained on the site of work and contractor shall carry out it properly.
- 1.3 The contractor shall engage authorized representative who shall be responsible and competent for managing the work. He shall instruction from the Engineer in Charge out the same.
- 1.4 Quantities specified in the tender may vary at the time of actual execution and the contractor shall have no claim for compensation on account of such variation.
- 1.5 Unexecuted length of canal shall be left wherever so required by the department during the currency of the contract. This portion shall be executed as and when required before completion of the whole work.
- 1.6 Diversion for road if necessary shall be provided and maintained by the contractor during the currency of contract at no extra cost.
- 1.7 No trees shall be cut without permission of the Engineer in Charge.
- 1.8 The work shall be executed strictly in accordance with plans and specifications. Only the best materials and sound construction shall be permitted and every portion of work shall be executed in a through workman like manner.
- 1.9 The drawing prepared general guidance and indication and changes either minor or major are likely to take place. No claim for extra payment shall be made by the contractor for such changes.
- 1.10 The quantities in the schedule are only estimated quantities and during execution they may increase or decrease. Any claim put forward for this variation in quantity shall be as per clause no 14 B2 forms
- 1.11 The rejected materials shall be removed from the site within 24 hours. If they are not removed within period, the same will removed at the contractor's risk and cost by the department.
- 1.12 The work is in important and this fact shall be constantly borne in mind by the contractors and his workers. Works not specified above shall be carried out according to instruction of the Engineer-in-charge.
- 1.13 The works require constant attention for line, levels and workmanship and hence contractor shall have to keep the experienced technical staff on the work. The contractor has to supply the necessary materials and labour for the line and levels work at his own cost.
- 1.14 The contractor unless otherwise specified and providing in the contract shall be pay all duties, tools, quarry, fees, royalties and taxes on all materials and articles they may use. The rate quoted by the contractor shall be considered inclusive of all such duties, fees, royalties, taxes etc.
- 2.0 **General terms and precautions for excavation: -**
- 2.1 As the item of work includes excavation in all sorts of soil, including wet and slushy soil, soft murrum, hard murrum, soft rock and hard rock and depositing or sorting and stacking the excavated stuff material nearly in uniform layer as and where directed up to lead of 100 mt. with the depth of excavation below ground level excluding de-watering if any etc. No specific classification shall

required to be made for the purpose of measurement and payment. However, for general purpose soil, hard murrum, soft rock and hard rock are classified as under.

2.2 **Soil: -**

All sorts of soil, silt, sand mixed with gravel soft murrum and rest of the item, it includes wet and slushy soils of yellow sandy gravelly texture conglomerate etc.

2.3 **Hard murrum: -**

Hard materials are compared to soil and consisting of small pieces of great or quartzite which are formed by disintegration and decompositions of rocks and covered by soil particles if the percentage of such small pieces or quarts of quartzite pebble are considerable shall be classified as hard murrum.

The hard materials comprising the shale or undulated sand or conglomerate interspersed with boulders size between 0.30 cm. to 0.75 cm. shall also be classified as hard murrum. Transition layer of 23 cm. thickness soft rock below hard murrum layers below the soil (incase hard murrum layers classified above does not exist) shall considered as hard murrum.

2.4 **Soft rock: -**

This shall include all materials which does not need blasting and can be excavated with the help to pick bar and shovel but which do not need blasting. All racks of soften verify given ringing sound when struck with and expect the transition layer mentioned in the item of hard murrum shall be considered as soft rock. Irrespective of the it's hardness and effected of weathering. The soft rock which has all the three properties i.e. weathered, decomposed and disintegrated surrounded by soft materials will be considered as hard murrum.

2.5 **Hard rock: -**

This shall include rock occurring is mass of in boulders bigger than 0.75 cm. and which he removed by blasting or by chiseling where blasting is not permissible. The rock which gives ringing sound when struck with hammer (i.e. quartzite, siliceous, pirate etc.) shall be classified as hard rock. Excavation by control blasting in the strata other than hard rock will be considered as hard rock.

3.0 **General specifications for excavation: -**

The contractor shall be liable to pay compensation for injury to like and damage to property if any caused due to any operation connected with items.

The contractor shall hand over the site of work in neat and clean condition and shall remove all wastes arising from construction.

Clearing the site: -

The contractor shall clean the entire area required for setting out and cutting of all trees, stumps, roots, bushwood, rubbish of all kinds, loose stones and all other objectionable materials. The ownership of all the materials so removed from excavation shall be of Govt. Cutting of the trees having girth less than 0.5 meter shall be covered in this item. The roots of trees shall be grabbed to a depth of 30 cm. below it. The contractor shall dispose off such material not required to be kept at site in the manner as directed by Engineer in Charge.

Setting out: -

The contractor shall provide necessary material labour and make all necessary arrangement to get the line out from the Engineer in Charge or his authorized representatives.

It shall be responsibility of the contractor to install substantial reference points benchmarks etc. at his own cost and maintain them during the construction

period. The contractor will be held responsible for the correct of the line out and dimensions of all parts of the work.

After the site is cleared, setting out shall be done as late down on the plans or as per instructions by the Engineer in Charge and profile shall be recited accordingly. The alignment shall be properly setup true to lines, curves and grades and sections as shown on plan or as instructed by the Engineer in Charge of the work.

The contractor shall provide all labour and materials such as line, strings, bamboo's, pegs, nails etc. required for setting out and for setting up bench marks erection profiles and fixing such other marks as are necessary for satisfactory completion of the work. The contractor shall be responsible for the proper maintenance of all these during currency of the contract.

4.0

Excavation: -

The entire line of excavation shall be clearly marked by pegs and by stones at each cabin or change of direction of at shorter intervals on curves, in the beginning. The final lining out will be done by fixing reference stones at 1/4 km. on either side the center line beyond the canal edges, so that they are not disturbed during the contract period. The position of these stones will be marked on the cross sections.

Pits of such width and depth as may be decided by the Executive Engineer shall first be excavated at intervals of 30 mt. normally for deciding if any charge in the designed cross section is considered necessary further widening and/or depending to full section shall be done thereafter.

The edges of excavation shall be marked by beg billing after the vertical strength is excavated.

The excavation shall be done first by cutting a central trench up to C. B. L. or any other higher level fixed by Engineer in Charge with vertical sides and then trimming the slopes and widening the bed widths, if necessary, as per the order of the Engineer in Charge, depending upon the nature of strata met with in excavation. The section of canal thus prepared will be finally directed exactly to the required dimensions and in perfect line and level.

5.0

Excess Excavation :

No claim of the contractor for the extra rates will be entertained for change of side, slopes, graded, depth and alignment of canal during construction. In so case should the canal be excavated in width or depth greater when shown in the plans, designs, except given under written order by the Engineer-in-charge.

If the excavation is done wider or deeper than necessary, no payment shall be made for such excavation and the contractor shall have to set right such excavation, if considered necessary in the opinion of the Engineer-in-charge, by refilling with 1:2:4 P.C.C. in the manner as specified by the Engineer-in-charge at his own cost and to the entire satisfaction and slopes shall be in proper line and level as per drawing and as per instruction of the Engineer-in-charge for which no extra payment shall be made.

6.0

Disposal of Excavated Materials :

The usable excavated materials shall be laid within a lead of 30 meters to form earth work in bank, service road or inspection path or spoil banks or all of them without extra cost. The excavated material shall be spread uniformly in layers not exceeding specified thickness for preparing service road, inspection path as directed by the Engineer-in-charge by breaking the clod with neatly made slopes and top with a suitable berm left between the toe of the bank and the edge of excavation as directed by the Engineer-in-charge.

The rate of this item is for excavation in all soils, wet and slushy soil of yellow,

sandy and gravelly texture including soft murrum, hard murrum, soft rock and hard rock with the depth and lead up to 30 meter including depositing the stuff for earth work in bank, service road, inspection path soil bank etc. This will all include all excavation done in strata such as soil, sand, gravel soft murrum, kanker, hard murrum, soft rock, hard rock and other similar materials.

The item also includes strutting and shorting, thin jungle cutting and disposing the same as directed.

7.0

Finishing:

This shall include removal of all pallis, dead men, steps etc. provided during construction. The finished section shall be as smooth as possible, Unevenness and undercuts shall not exceed limit specified below:

Sr.	Type of soil	Silt	Limit
1	Soil	2.5 Cm.	1.5 Cm.
2	Black cotton	5.00 Cm.	2.5 Cm.
3	Soft and hard	7.00 Cm.	4.0 Cm.

cut excavation. In case

In the case of under cut, the payment will be made on the actual executed excavation

8.

Silting of canals :

Contractor shall make his own arrangement at his own cost for the drawing of rain water away from the excavation portion and he should maintain the canal excavation and spoil banks, service road etc. in working order and desilt the canal silted by any cause before the work is completed and handed over the department

9.

Mode of Payment:

The rate shall be paid per Cum of excavation done in all strata as above.

Signature of Contractor

Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION-2

(C) GENERAL TECHNICAL SPECIFICATIONS FOR MATERIALS

(C) GENERAL TECHNICAL SPECIFICATIONS FOR MATERIALS

1.0 GENERAL :

- 1.1 All materials to be used shall conform to the relevant specification as per the latest revision of Indian Standard.
- 1.2 Where reference to any Indian Standard appears in the specifications it shall be taken to mean as a reference to the latest revision of the standard.
- 1.3 Test for materials shall invariably be got carried out by the contractor when the same are specified in the specifications. Test shall also have to be carried out, even though the same are not specifically mentioned in the specifications, if in the opinion of the Engineer in charge, the same are required to be carried out. All such tests shall be got carried out in Government laboratories and cost thereof shall be entirely borne by the Contractor.
- 1.4 No collection of materials shall be made before it is got approved from Engineer in charge.
- 1.5 Collection of approved materials shall be done at site of work in systematic manner. Materials shall be stored in such a manner as to prevent deterioration or intrusion of foreign materials and to ensure the prevention of their quality and fitness for the work.
- 1.6 Material, if rejected by the Engineer in charge, shall be immediately removed from the site of work, if they are not removed within twenty four hours of receiving such intimation, Engineer in charge shall get the same removed at contractor's cost.

The Engineer in charge shall dispose off such materials in a manner as he chosen and the Contractors shall not be entitled to any compensation for the cost of such materials.
- 1.7 Approval to the samples of various materials given by the Engineer in charge will not absolve the contractor from the responsibility of replacing the defective material brought on site of materials used in the work found defective at later date. The contractor shall not claim any payment to compensation what so ever on account of any such materials being rejected by Engineer in charge.
- 1.8 The contractor shall be responsible for observing the laws, rules and regulations imposed under the "Minor Mineral Acts" and such other laws and Rules prescribed by the Government from time to time.

2.0 Specification for Materials:-

- 2.1. 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 is liable to be considered as unauthorized, defective and not acceptable.

The testing of materials including concrete mix design which are to be used in the works shall be carried out in the Government Laboratory before starting of work at the cost of contractor. The samples of sand, metal, cement, steel, stone, water, pipes, wood or any other materials required shall be supplied by the contractor at his own cost.

All testing charges for materials and concrete mix designs shall be borne by the contractor.

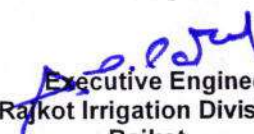
Any additional tests required to be carried out at any stage of the work as per instruction of Engineer-in-charge shall be carried out by the contractor at his own cost.

- 2.2. The day today and periodical tests to be carried out on materials mixed and placed concrete, mortar etc. shall be specified by the engineer from time to time and the contractor shall allow all facilities and co-operation towards collection of samples etc. unless otherwise specified elsewhere, all labour for collecting samples for tests will be supplied by contractor free of cost to government In the following cases where testing charges will be borne by the contractor when.
 - 2.2.1. The supply of sample and the carrying out of such tests at contractor's cost is provided for or clearly intended in the contract and is carried out either at the site of work, or manufacturer's place or at place/laboratory specified in the contract document.
 - 2.2.2 The supply of the samples and the carrying out of such tests is not provided for or clearly intended in the contract but on testing the materials is found defective and has to be rejected.
 - 2.2.3. Any additional tests are to be carried out over and above those specified in the technical specifications then in these cases the cost of testing shall be borne by the Government. The contractor shall however supply all materials required for tests and also make good at his cost materials, mixes and core holes similar for other materials as may be directed by and to the satisfaction of the Engineer.

An authorized representative of the contractor shall remain present at the time when the sample or cores etc. are taken and shall authenticate the facts if so required. If the contractor's agent fails to be present as aforesaid the sample of cores etc. taken by the Engineer-in-charge or his representative shall be considered to be authentic. The contractor responsibility to produce on the works materials will however be informed of the details of such sample and cores have been taken.

- 2.3. The materials, mixes and cores etc. shall be tested day to day or periodically at the Government laboratory set up at the site of work or at nearby approved laboratory and the results given thereby shall be considered correct and authentic. The contractor shall be given access to all operational tests that may be carried out as aforesaid so that he may satisfy himself regarding the procedure and methods adopted. It shall then be the contractor's responsibility to carry out the finished items to the standards based on the laboratory designs and tests.
- 2.4. The methods of sampling and testing and the procedures and standard shall be as laid down by the Engineer-in-charge for the respective item.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION-2

(D) GENERAL TECHNICAL SPECIFICATIONS FOR PRINCIPLE MATERIALS

(D) SPECIFICATION FOR PRINCIPLE MATERIALS**M-1 WATER :**

The water to be used shall be potable water, clean & free from objectionable quantities of silt, organic matters, alkali, salts and other injurious materials and shall be as per I.S.456,-2000 Water sample shall be tested in Government. or Government approved laboratories, and charges for the same shall be born by the contractor.

Permissible limit for some of the important test is as under

	TEST	PERMISSIBLE LIMIT AS PER IS-456-2000
1	Organic solids	200 mg per litres (max.)
2	Inorganic solids	3000 mg per litres (max.)
3	Sulphates (as So ₂)	400 mg per litres (max.)
4	Chorides (as Cl)	2000 mg/lit. for PCC. and 500 mg/lit. for RCC.
5	Suspended Matter	2000 mg per litres (max.)
6	Ph value	Not less than 6

M-2 CEMENT:

- 2.1 Only 53 Grade ordinary Portland cement of reputed major cement plant conforming to IS : 269-2015 shall be used for entire work under the tender in all respects. Mini plant cement shall not be allowed in any cares.

- 2.2 The contractor shall have to make his own arrangement to procure the cement bearing trade-mark or trade name, Grade of cement, type of cement, Name of manufacturer, Lot No. ISI (BIS) Mark Net weight etc. directly from the manufacturers or authorized dealer. The contractor shall have to make arrangement to load, cart and unload the cement to the site of work at his own cost. For verification of such purchase, the contractor shall have to produce all the original TAX-INVOICE or " RETAIL INVOICE" bearing TIN No. of seller and Buyer, Name of Agency, Name of work site, details of cement (Type and Trade Name), Quantity of cement, Net weight, separately shown VAT levied and other details etc. What so applicable as required as per Govt. rules, along with the testing details to the Engineer-in-charge of the work. The sectional officer of the work after verification of TAX-INVOICE or Retail Invoice as detailed above shall accepted the cements and thereafter entry shall be made to stock register from time to time for each receipt of cement and immediately intimate to sectional officer of quality control to take sample for testing of cement. Sectional officer of the work shall have to make entry either in stock register or in cement consumption register detailing date of receipt, Qty. of cement, type of cement, Lot No. trade name and sample taken for testing along with date of sampling.

TESTING OF CEMENT:**2.31 Physical Analysis:**

All physical test required as per IS: 4031 (Part-1 to 6)- 1988 shall be carried out.

2.32 Frequency of Sampling and test shall be as below:

The testing of cement shall be done for each lot / consignment received on site. The frequency of the test shall be as under.

TABLE NO.1

Sr. No.	Quantity of Cement	Nos. of sample
1.	2.	3.
1.	50 MT	1
2.	100 MT.	2
3.	200 MT.	3
4	300 MT.	4
5	500 MT.	5

6	800 MT.	6
7	1300 MT.	7
8	For each larger consignment.	8

2.33 Chemical Analysis:

All chemical test required as per IS: 4032-1985 shall be carried out for one test per ten tests sample of above Para 2.31 i.e. for physical tests.

- 2.4 The cement not satisfying the criteria as per IS: 269-2015 for 53 Grade OPC shall be rejected and contractor shall have to remove it from site immediately.

2.5 Field Test:

The quality of cement shall be confirmed through physical & chemical tests as prescribed in relevant IS in laboratory. These however taken time. However, to quickly ascertain the quality of cement, some field tests of indicative natures as like visual examination (Packing of bags), colour, Texture, initial setting time, Ball test, Float test etc. as described in GERI circular No.1 of 1986 issued vide GERI, Vadodara Letter No.MT-II/Cement/83/21546 of 1986 and 10-3-1986 shall be conducted as guidelines to identify doubtful variety of cement. The doubtful cement when so identified shall be got tested in the laboratory on priority to confirm quality as per IS.

- 2.6 Large stocks of cement shall not be kept at the work but only sufficient quantity shall be kept to assure continuity of the work. The contractor shall have to provide and maintain efficiently water proof storage sheds for cement on the site of work. It shall be stacked on the platform 30 cm above the floor level and cement shall be covered with tarpaulin or any other impervious materials for covering in order to protect the cement bags from moisture. The tax shall be made at one mt. away from wall and distant between two stacks shall be kept also 1.00 mt. so as to count easy.
- 2.7 The cement bags shall be neatly stacked in an orderly manner so as to afford easy access and count. Deteriorated cement shall not be allowed for use.
- 2.8 A regular day to day account of cement received and used on the work together with the particular of the work and quantity of the work in which it was used, shall be maintained in ink separately by the responsible representative of the department and shall be signed at the end of the day's work by the department representative as well as contractor after proper verification in accounting be shown to the inspecting officer when asked for. In addition to above responsible representative of the department shall be maintained the register for consumption of cement as per circular issued vide GOG. ID circular No.CMT/2384/IB-60/25/H Dtd. 30-3-1984.
- 2.9 The contractor shall provide at the site of work satisfactory storage for not less than 3 months average consumption of cement on work and shall keep the cement store in a manner that will satisfy the Engineer-in-charge.
- 2.10 The arrangements of storage and utilization of cement shall be such that to ensure the utilizations of cement in the order of its arrival at the stores, the contractor shall maintain satisfactory up to date records which would at any time show the dates of receipts and proposed utilization of cement lying in the stores at site. Cement shall be used in the "first in first out" method.
- 2.11 The Engineer shall at all times have access to the stores and the site of contractor and shall have authority to check and examine the method of storage, records, accounting and security provided by the contractor. The contractor shall comply with the instruction that may be made by Engineer in this connection. The contractor shall further at all time satisfy the Engineer on demand by the production of records of books of submission of return and Performa or by other proofs that may be demanded that the cement brought being used for the purpose for which it is brought and contractor shall at all times keep his records up to date of enable Engineer to apply such checks as he may be desire to impose.
- 2.12 The cement shall not be stored for unduly long period. It should be handled in such a

way as to impair its strength or useful characteristics.

- 2.13 The Engineer-in-charge or his authorized agent will have the authority to verify the stock and check on the consumption in any manner he thinks proper.
- 2.14 Cement should be measured by weight with MT or Kg as the unit.

M-3 FINE AGGREGATE (SAND)

3.1 General:

All fine aggregate shall confirm to IS: 383-2016 Natural sand from river shall be used only after screening and washing.

Sand for use in concrete work shall be natural sand; sand shall be clean, well graded, hard, strong, durable and gritty particles free from injurious amount of dust, clay, silt, kankar nodules, soft or flaky particles, shale, alkali, salts, organic matter, loam, mica, or other deleterious substances and shall be approved by the Engineer. The maximum size of particles shall be limited to 4.75mm. 100% Sand should be passed through 10mm IS sieve.

TABLE-2 Limits of Deleterious Materials
(Clause 3.2.1 IS: 383-2016 (Specifications)
IS: 2386 (Part-I,II)-1963 (Method of Testing)

Sr. No.	Deleterious substances and Method of test.	Fine Aggregate percentage by weight Maximum (Uncrushed)	Coarse Aggregate percentage by weight maximum (Crushed)
1	2	3	4
1	Coal and lignite IS : 2386 (Part-II) 1963	1.00	1.00
2	Clay lumps IS : 2386 (Part-II) 1963	1.00	1.00
3	Materials finer than 75 Micron IS Sieve. IS : 2386 (Part-I) 1963	3.00	1.00
4	Soft fragments IS : 2386 (Part-II) 1963	--	-
5	Shale IS : 2386 (Part-II) 1963	1.00	--
6	Total of percentage of all deleterious materials (except mica) including Sr. No.1 to 5 for Col.3 & 4	5.00	2.00

TABLE - 3

Gradation of Fine Aggregate
(Clause 4.3 IS: 383-2016) (Specifications)
IS: 2386 (Part-I)-1963 (Method of testing)

Sr. No.	IS Sieve Designation	Percentage(%) passing for			
		Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV.
1.	10mm	100	100	100	100

2.	4.75 mm	90-100	90-100	90-100	95-100
3.	2.36 mm	60-95	75-100	85-100	95-100
4.	1.18 mm	30-70	55-90	75-100	90-100
5.	600 Micron	15-34	35-59	60-79	80-100
6.	300 Micron	5-20	8-30	12-40	15-50
7.	150 Micron	0-10	0-10	0-10	0-15
8.	F.M.	4-2.71	3.37-2.11	2.78-1.71	2.25-1.35
9.	F.A. Type	Coarse	Medium	Fine	Very Fine

- Note :- (1) Grading becomes progressively final from Zone-I to IV.
- (2) Tolerance : Where the grading falls outside the limit of any (Zone-II & III) grading zone of sieves other than 600 micron IS sieve by a total amount > (Should not be more than) 5%.
i.e. Sum of sieve at Sr.No. 1,2,3,4,6,7 outside (Lower & Upper) the limits of grading Zone-II & Zone-III > 5%.
- (3) The ratio F.A./C.A. should be reduced progressively.
- (4) Fine aggregate complying with the requirements of any grading zone in above table is suitable for concrete. It is recommended that very fine aggregate conforming Zone-IV should not be used in reinforced cement concrete.

3.2 Quality of Fine Aggregate:

3.2.1 Deleterious Materials : Aggregate shall not contain any harmful material such as pyrites, coal, lignite, mica, shale, or similar laminated material, clay, alkali, soft Fragments sea shells and organic impurities in such quantity as to affect the strength or durability of concrete. Aggregate to be used for reinforced concrete shall not contain any material liable to attack the steel reinforcement. Aggregate which are chemically reactive with alkalis of cement are harmful as cracking may take place.

3.2.2 Limit of Deleterious materials:

The maximum quantity of deleterious material in fine aggregate (natural sand) shall not exceed the limits specified in Table: 1 of IS:383-2016 when tested in accordance with IS: 2386-1963. However the Engineer-in-charge at his discretion may relax some of the limits, Total deleterious substances like coal and lignite clay lumps, material finer than 75 micron IS sieve (Silt content less than 3%) shale etc. shall not be more than 5% including silt content for uncrushed natural sand.

3.2.3 Grading of Fine Aggregate and Fineness Modulus (F.M.) :-

The grading of fine aggregates when determined as described in IS:2386 (Part-I)-1963 shall be within the limits given in Table: 4 of IS:383-2016 and shall be described as fine aggregates grading zones I, II, III and IV for concrete work. The F.M. of sand shall have ranging between 3.37 and 2.11 ($2.11 < F.M. < 3.37$) subject to the sand being well graded. Gradation and F.M. of sand for masonry mortar & plaster shall be as per IS: 2116-1980 and IS: 1542-1992 respectively. For proper grading coarse & fine sand may be blended.

3.2.4 Silt content: The silt content shall not exceed 3% as per IS: 383-2016 when tested in

accordance with IS: 2386 (Part-I) 1963. The particular of tests, frequency and Acceptance criteria are shown in table below:

TABLE -1
Fine Aggregate (Sand)
IS: 2386 (Part-1 to 8),(Test Method) IS: 383-2016 (Specifications)

Sr. No.	Particulars of Tests & IS Code for Method of testing.	Frequency	Acceptance Criteria
1	Gradation & F.M. IS: 2386-(Part-I) 1963.	1-Test per 150 M ³ Concrete work.	(i) For Concrete IS:383-2016 (ii) For Masonry mortar IS: 2116-1980. (iii) For Plaster IS:1542-1992
2	Specific Gravity (SPG) & Water absorption, IS:2386 (Part-3) 1963	Once for approval of source of supply subsequently in case of doubt and change in source.	As per relevant specification & design.
3	Silt content. IS:2386 (Part-I) 1963	1-Test per 150 M ³ Concrete work	Not more than 3%
4	Alkali Aggregate reactivity IS:2386(Part-7) 1963	Once for approval of source of supply subsequently in case of doubt and change in source.	Relevant specification provision.

3.2.5 Initially before work commenced the entire test as mentioned in above Table-2 shall be carried out at GERI or approved institute or approved private laboratory. The source of sand shall have to specify by contractor and shall be got approved jointly by Engineer-in-charge of work & Q.C.

The gradation of materials from any one source shall not vary in composition beyond the range of value that governs in selecting source of supply. For determining the degree of uniformity, determination of gradation & F.M. shall be made upon representative samples furnished by the contractor from such sources as he proposes to use. Fine aggregate from any one source having a variation in F.M. greater than ± 0.20 from the average F.M. of representative sample submitted by the contractor shall be rejected or may be accepted subject to such change in the proportion of aggregate as the Engineer may direct.

If contractor desires to change of source prior approval of Engineer-in-charge shall have to be got well in advance and Engineer-in-charge shall give approval after satisfaction on additional test carried out.

3.3 Field Test:

Field staff of QC shall have to be carried out tests like gradation, F.M., silt content, at field laboratory at frequency 1 test per 150 m³ concrete work & register for the same shall be maintained at site of work.

3.4 Storage:

The fine aggregate should be stacked carefully on a clean hard surface so that it will not get mixed up with deleterious foreign material.

Sand shall not be stacked in high conical heaps so that segregation of heavier particles by sliding down may be prevented. It shall be placed in layers not thicker than those resulting from lorry loads dumper on the same place.

3.5 Measurement:

When required to be measure, measurement shall be by volume with Cu.mt. as the unit. No deduction shall be made for the voids.

M-4. COARSE AGGREGATE (CRUSHED METAL):

Coarse aggregate shall be of machine crushed stone (Crushed metal) of back trap basalt. Coarse aggregate shall be hard, strong, dense, durable, clean of proper gradation and free from skin and coating likely to prevent proper adhesion of mortar or concrete (Adherent coating) and free from veins and free from injurious amount of disintegrator pieces, alkali, vegetable matter and other deleterious substance.

The coarse aggregate shall generally be cubical in shape and as far as possible flaky, elongated, scoriaceous pieces shall be avoided. It shall generally comply with the provisions of IS: 383-2016. Aggregate most of which is retained on 4.75 mm IS sieve and containing only so much finer material as is permitted as per IS:383-2016.

4.1 Size of aggregate (Provision in IS: 456-2000):

The nominal maximum size of coarse aggregate should be as far as possible within the limit specified but in no case greater than one fourth ($1/4$) of the minimum thickness of the member for plain cement concrete and In addition to this for reinforced cement concrete it can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corner of the form. For most work 20 mm aggregate is suitable where there is no restriction to the flow of concrete in to section 40 mm or larger size may be permitted. In concrete element with thin sections, closely space reinforcement or small cover, consideration should be given to the use of 10 mm nominal maximum size.

Read to above para size of aggregate should be determined as follow.

4.11 For plain cement concrete (PCC) :

(i) The nominal maximum size of Aggregate. $> \frac{1}{4} \times$ Minimum thickness of member

4.12 For reinforced cement concrete (RCC) :

(i) The nominal maximum size of Aggregate. $\geq \frac{1}{4} \times$ Minimum thickness of member
 \geq The minimum clear distance Between main bar – 5 mm.

OR

\geq The minimum cover to the Reinforcement – 5mm.

Whichever is smaller.

4.13 The minimum and maximum size of the aggregates may be between 4.75 mm to 80 mm. (about 3/16" to 3") & shall be well graded.

The range in grading of coarse aggregate shall be as follow.

(i) 40mm – 80 mm (Or 63mm) (Approximate 1 1/2" to 3" (or 2 1/2")

(ii) 20 mm – 40 mm (-do- 0III" (3/4") to 1 1/2"

(iii) 10 mm – 20 mm (Approximately 0II" (1/2") to 0III" (3/4")

(iv) 4.75 mm – 10 mm Grit. as available in market.

Engineer-in-charge may give relaxation to range in grading according to availability in

market.

4.2 Quality of coarse Aggregate.

4.21 Deleterious materials & its limit:

Deleterious material as described and its acceptance criteria for crushed metal shall be as per IS: 383-2016 when tested according to IS:2386 (Part-II)-1963, IS:2386 (Part-I)-1963. In no case total of percentage of all deleterious materials including material finer than 75 micron IS sieve (Silt content) more than 5% by weight i.e.

Deleterious material (Coal and lignite, clay, slums) including silt content (3%) shall not be more than 5%.

4.22 Gradation: -

Graded coarse aggregates shall be supplied in the nominal size as per IS: 383-2016 or as per relevant specifications provision.

The particular of tests, frequency and acceptance criteria are shown in Table-2 below.

TABLE-2

Coarse Aggregates (Crushed Metal)

IS: 2386 (Part-1 to 8) if method of test

IS: 383-2016: Specifications.

Sr. No.	Particulars of tests & IS Code for method of testing.	Frequency	Acceptance Criteria.
1.	Gradation IS:2386(Part-I)-1963	1- Test per 150 M ³ concrete or as per specification.	As per relevant specification provision.
2.	Sp .Gravity (SPG) & Water absorption (WA) IS:2386(Part-3)-1963	Once for approval of source of supply subsequently in case of doubt and change in source.	SPG generally 2.5 to 3.0 & WA 1.0% to 1.50%.
3.	Flakiness & elongation Indices. IS:2386(Part-I)-1963	- do -	As per design.
4.	Impact value IS:2386(Part-4)-1963	- do -	As per IS:383-2016 (i) Concrete – wearing surface – 30% Max. (Wt) (ii) Overlaid surface 45% Max.(Other than (i))

Initially before work commenced, kind of test as mentioned in above on discretion power of Engineer-in-Charge shall be carried on function of concrete at GERI or approved institute or approved private laboratory and at the change of source of material again necessary test shall be carried out as per directive of Engineer-in-Charge.

4.3 Field Test:-

The material coming out of the IS: sieve shall be in the grade ranging from 80mm (or 63mm) to 4.75 as specified or as determined as per IS:456-2000 (MSA as specified in specification or as determined as per IS:456-2000). Each grade (80 mm (or 63 mm) – 40 mm, 40 mm – 20 mm, 20mm – 10 mm, 10mm – 4.75mm (Grit) which ever applicable according to MSA shall be stacked separately. The stack shall be considered as

approved only if it conforms the following criteria.

- (1). The material retained on IS sieved corresponding to the upper limit of size of stack not exceeding 15% by weight.
- (2). The material passing through the IS sieve corresponding of the lower limit of size of stack not exceeding 15% by weight.
- (3). The sum of (1) and (2) above shall not exceed 20% by weight.

The gradation register shall be maintained at site. The frequency of test shall be 1-test per 150 m³ concrete work.

4.4 Storage:

The aggregate of different sizes shall be stacked or batched or stored separately and handle in such a manner as to prevent inter mixing of different size of aggregates required separately for grading purpose. No foreign materials shall be allowed to be mixed up with aggregates. It shall be covered to prevent mixing of dust etc. They shall be washed clean before use/ the aggregates shall be stacked in one shape of frustum of pyramid of standard size as per code of practice or as directed by Engineer-in-charge.

4.5 Measurement:

When required to be measured the measurement shall be by volume with Cum. as the unit. No deduction shall be made for voids.

Table-2 : Specification of single size Coarse Aggregate

(Clause-4.1 IS: 383-2016)

IS sieve Designation	Percentage passing for single size Aggregate						Percentage passing for Graded size Aggregate			
	MSA 63mm	MSA 40mm	MSA 20mm	MSA 16mm	MSA 12.5mm	MSA 10mm	MSA 40mm	MSA 20mm	MSA 16mm	MSA 12.5mm
80 mm	100	-	-	-	-	-	100	-	-	-
63 mm	85-100	100	-	-	-	-	-	-	-	-
40 mm	0-30	85-100	100	-	-	-	90-100	100	-	-
20 mm	0-5	0-20	85-100	100	-	-	30-70	90-100	100	100
16 mm	-	-	-	85-100	100	-	-	-	90-100	-
12.5 mm	-	-	-	-	85-100	100	-	-	-	90-100
10 mm	0-5	0-5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
4.75 mm	-	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36 mm	-	-	-	-	-	0-5	-	-	-	-

M-5 MILD STEEL

The steel shall be procured by the contractor. The contractor shall make suitable arrangement for storage of the steel at site. In any circumstances steel produced by rerolling mill will not be allowed to be used. The steel shall conform to IS-432. The steel shall be free from loose mill scales, rust, oil, grease or any other harmful matter.

The testing of steel shall be done for each size of bars and one sample for 40 MT or less of steel in government or government approved laboratories, to know the physical properties of steel bars, like nominal mass, 0.2 percentage proof stress / yield stress, Elongation percentage, Tensile strength, Bend and rebend.

For the purpose of payment the bars shall be measured correct upto 10mm in length and unit weight of bar shall be computed as per weight given in IS-1786 specification for Indian steel or at the rate specified below. (As per IS-1786-2008 clause-6.2, Page No.5) Tables below.

BAR DIA (in mm)	UNIT WEIGHT (kg/rmt)	BAR DIA (in mm)	UNIT WEIGHT (kg/rmt)
6	0.222	20	2.47
8	0.395	25	3.85
10	0.617	28	4.83
12	0.888	32	6.31
16	1.58	36	7.99
18	2.00	40	9.86

M-6 HIGH YIELD STRENGTH DEFORMED STEEL BARS:

The steel shall be procured by the contractor. The contractor shall make suitable arrangement for storage of the steel at site. In any circumstances steel produced by rerolling mill shall not be allowed to use. The testing of steel shall be done for each size of bars and frequency mentioned below of steel in government or government approved laboratories to know the physical properties of steel bars, like nominal mass, 0.2 percentage proof stress / yield stress, Elongation percentage, Tensile strength, Bend and rebend.

TABLE-E (Table-5, Page No.17 of IS-1786-1985)		
FREQUENCY FOR NOMINAL MASS, TENSILE, BEND AND REBEND TESTS		
NOMINAL SIZE IN mm	QUANTITY	
	FOR CASTS / BEATS BELOW 100 TONNES	FOR CASTS / BEATS OVER 100 TONNES
Under 10mm	One sample from each 25 tonnes or part thereof	One sample from each 40 tonnes or part thereof
10mm to 16mm inclusive	One sample from each 35 tonnes or part thereof	One sample from each 45 tonnes or part thereof
Over 16mm	One sample from each 45 tonnes or part thereof	One sample from each 50 tonnes or part thereof

The steel shall be either cold twisted or hot rolled or thermo mechanically treated and shall conform to IS-1786. The steel shall be free from loose mill scale, rust, oil, grease or any other harmful matter.

For the purpose of payment the bars shall be measured correct upto 10mm in length and unit weight of bars shall be computed as per weight given in IS-1786, as per specification M-5

M-7 TMT STEEL:

The thermo-mechanically treated, popularly known as TMT steel shall be conform to IS-1786. The steel shall be procured by the contractor. The contractor shall make suitable arrangement for storage of the steel at site. In any circumstances steel produced by rerolling mill shall not be allowed to use.

Testing of steel shall be done for each size of bars and frequency mentioned above in

specification M-6 (Table-E) of steel in government or government approved laboratories to know the physical properties of the steel bars like nominal mass, 0.2 percentage proof stress / yield stress, elongation percentage, tensile strength, bend and rebend.

The steel shall be free from loose mill scale, rust, oil, grease or any other harmful matter. For the purpose of payment the bars shall be measured correct upto 10mm in length and unit weight of bars shall be computed as per weight given in IS-1786, as per specification M-6

M-8 BINDING WIRE

The binding wire for tying reinforcement shall be of soft and annealed mild steel conforming to IS-280. The diameter of wire shall be of 1.63mm or 1.22mm (16 or 18 gauge). The use of black wire shall be permitted for binding reinforcement bars. It shall be free from rust, oil, paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-9 R.C.C. HUME PIPES:

The precast concrete pipe shall conform to IS-458-2003. The contractor shall have to produce manufacturer certificate regarding the pipes are of as per IS standard, if asked for the same, if the quantity of the pipes is more than 20 pipes, than two percent of total number of pipes (min. one nos.) shall be tested at manufacturer facility / store or at site or in government / government approved laboratory (if found necessary), for the requirement laid down in IS-458. The testing charges, if any shall be born by the contractor and recovered from RA / FINAL bill.

Signature of Contractor


**Executive Engineer
Rajkot Irrigation Division
Rajkot**

SECTION-2

(E) GENERAL TECHNICAL SPECIFICATIONS FOR CEMENT CONCRETE WORKS

GENERAL TECHNICAL SPECIFICATIONS FOR CEMENT CONCRETE WORKS

1.0 SCOPE OF WORK :-

The work covered by this chapter consists of cast in situ 1:2:4 grade plain cement concrete (Weigh batching) for Damaged portion furnishing all materials required, equipment, machineries, labours for manufacture of concrete, transport, placing, form work, finishing, curing etc. and inclined sleepers and performing all the functions necessary for and ancillary to the work related by contractor.

2.0 MATERIALS:

(As per Section-V, Chapter-II of specification of Principal Materials.)

- * Water shall confirm to specification M-1
- * Cement shall confirm to specification M-2
- * Fine Aggregate (Sand) -do- M-3
- * Coarse Aggregate (Crushed Metal)-do- M-4

3.0 COMPOSITION:

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

4.0 CLASSIFICATION:

For all items of concrete grade 1:2:4 MSA-40 shall be carried out on volumetric basis.: concrete in any portion of the structure or its associated works, shall be of Nominal mix as specified in specification of item or as decided by engineer in charge as per provision made in IS-456 Page No-23 cluse-9.3. The cement concrete work to be carried out are classified in grades as mention in item of work. Following table is provided for general guidance to the contractor. There may be change in criteria like water cement ratio, slump, aggregate size and proportion etc, for which contractor is bound to carryout work without claiming any extra cost. The cement level mention in the Table:- AA, given below are tentative and for general guidance only.

The Nominal mix for different grade of concrete to be used, will be carried out in GERI/ Government Approved Laboratory.

5.0 SLUMP:

Slump test at field shall be carried out at the frequency according to frequency of sampling for compressive strength at 28-days on 150 mm x 150 mm x 150 mm cubes. And slump observed shall be registered.

6.0 For General Guidance only.

: Table - AA :

Sr. No.	Grade Of Cement Concrete	MSA.	Min. Avg. Compressive Strength Of 3-Specimen AT FIELD ON 15 X 15 X 15 Cms. Cubes.	Min. Avg. Compressive Strength Of 3-Specimen AT LAB. ON 15 X 15 X 15 Cms. PRELIMINARY TEST CUBES.	MIN. CEMENT LEVEL REQ. AS PER IS PCC / RCC.	CEMENT LEVEL CONSIDER IN THE RATE PC C / RCC.	MAX. W/C. RATIO PCC / RCC.	REMARKS.
1	2	3	4.	5.	6.	7.	8.	9.
		mm.	kg/cm ² at 28 days.	kg/cm ² at 28 days.	kg/cum.	kg/cum.		For moderate exposer condition.
1	1:3:6	40	128	155	-	205	0.68	
2	1:2:4	40	177	204	-	280	0.64	
3	M-15.	20	177	204	210	300	0.64	

NOTES:

- 1 Concrete works classified as above shall be designed with reference to the field strength shown in above table. Other requirements shall have to be adjusted to obtain this strength in each case incl. cement level. indicated in above table
 - 2 Compressive strength mention in column no-4 is based on characteristic compressive strength compliance requirement given on table E-11 page no-30 of IS-456-2000. And it is the average characteristic compressive strength of three specimens.
 - 3 Compressive strength mentioned in column no-5 is based on para-9.2.2 (page no-22) of IS-456-2000 (The target mean strength of concrete Mix should be equal to the characteristic strength plus 1.65 times the std. deviation.). Standard. deviation of 3.5 is taken for M-10 & M-15, 4.0 is for M-20 & M-25, and 5.0 is for M-30 as per IS-456, Page-13, Table-8
 - 4 The test result of the sample shall be the average of the strength of three specimens. The individual variation should not be more than (+) or (-) 15 percentage of the average.
 - 5 The characteristic strength compliance requirement mentioned in column No-4 and target mean strength mentioned in column No-5, are based on 'GOOD QUALITY CONTROL' and MODERATE exposer condition.
 - 6 For every one kg of cement required to be reduced than that of stated in column No-7 of Table-AA in each case based on approved laboratory nominal mix, the recovery shall be made at Rs.7.80 Per kg. of cement. And for every one kg of cement required to be added than that of stated in column No-7 of Table-AA, in each case based on approved laboratory Nominal mix, NO EXTRA payment shall be made.
 - 7 Curing period shall be 14 days (min.) for OPC / PPC Cement.
 - 8 Above details are primarily given for the guidance of contractor while quoting there tender rate and is only informative for the general requirement of concrete.
 - 9 The Price Adjustment payment shall be applicable as per CLAUSE NO-47 OF SBD FORM for additional quantity of cement, if required.
- 7.0 PROPORTIONS FOR NOMINAL MIX CONCRETE:**

The proportion of Nominal Mix Concrete shall be in accordance with the tests carried out at GERI/ Govt. approved lab for concrete grade 1:2:4 MSA-40

6.0 SAMPLING AND STRENGTH OF NOMINAL CONCRETE MIX

Proportions for Nominal Mix Concrete

As per IS code 456:2000 Page No.23 Clauses 9.3 and 9.3.1

7.0 TABLE : BB			
GRADE OF CONCRET E	TOTAL QUANTITY OF DRY AGGREGATE BY MASS PER 50Kg OF CEMENT TO BE TAKEN AS THE SUM OF THE INDIVIDUAL MASSES OF FINE AND COARSE AGGREGATE, (IN Kg) Max	PROPORTION OF FINE AGGREGATE TO COARSE AGGREGATE (BY MASS)	QUANTITY OF WATER PER 50Kg OF CEMENT, ax
1	2	3	4
1:3:6	480	GENERALLY, 1:2 BUT SUBJECT TO AN UPPER LIMIT OF 1:1.5 AND A LOWER OF 1:2.5	34
1:2:4	330	GENERALLY, 1:2 BUT SUBJECT TO AN UPPER LIMIT OF 1:1.5 AND A LOWER OF 1:2.5	32
M-15	330	GENERALLY, 1:2 BUT SUBJECT TO AN UPPER LIMIT OF 1:1.5 AND A LOWER OF 1:2.5	32

The proportion of the fine to coarse aggregate should be adjusted from upper limit to lower limit progressively as the grading of fine aggregates becomes finer maximum size of coarse aggregate becomes larger. Graded coarse aggregate shall be used.

Example:

For an average grading of fine aggregate (that is Zone-II of Table-4 of IS-383), the proportions shall be 1:1.5, 1:2 and 1:2.5 for maximum size of aggregates 10mm, 20mm and 40mm respectively.

Nominal mix shall be carried out at field laboratory or in government laboratory, in case of field laboratory facility not available in such case, the charges of the same shall be borne by the department.

9.00 NOMINAL MIX CONCRETE:

The Nominal mix shall be design to produce the grade of concrete having the required workability and a characteristic strength and target mean strength not less than appropriate values given in able-AA column-4 & 5 respectively.

10.0 SAMPLING AND STRENGTH OF NOMINAL MIX:

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

Frequency.

The minimum frequency of sampling of concrete of each grade shall be in accordance with following

CEMENT CONCRETE

IS : 456 – 2000 (Reaff. 2005) IS : 516-1959 (Reaff. 2008), IS : 1199-1959 (Reaff. 2008)

The frequency and results of the test shall be as under;

Sr. No.	Particulars of Tests	Frequency	Equipments	Acceptance criteria	Purpose of testing
1	Mixer efficiency IS : 4634 – 1991 (Reaff. 2005)	As start of job and occasionally for each batching plant / mixer – requirement of work	# Container # Mixer # Weighing Balance etc.	Maximum unit weight variation within batch 0.8 percent from average. Maximum average variability 0.6 % for 3, 0.5% for 6, 0.4% for 9, 0.3% for 10 batches	Ensures intimate homogeneous mixing and uniform dispersal of cement paste.
2	Workability IS : 1199-1959 (Reaff. 2008)	Daily for each shift at plant and site	# Slump cone, # Plate # Tamping rod, # Steel tape	It should be as per Indian Standards, IS 456 : 2005	Ensure proper placement and minimum voids.
3	Yield & Unit weight IS : 1199-1959 (Reaff. 2008)	Occasionally or as directed by Engineer – in – Charge	# 0.01 / 0.02 m ³ # Container # Weighing Balance (Sensitive 0.01 Kg) # Weighing Balance (Sensitive 0.01 Kg) Tamping rod	±2 % from design as per specified in the specification	Useful for determining and controlling cement level.
4	Air content IS : 1199-1959 (Reaff. 2008)	Occasionally or as directed by Engineer – in – Charge	# Air entrain meter capacity 0.005 m ³ , 0.01 m ³ 0.01 m ³ with access.	±1 % from design as per specified in the specification	Higher air content causes reduction in strength.

Sr. No.	Particulars of Tests	Frequency		Equipments	Acceptance criteria		Purpose of testing
5	Compressive strength IS : 516-1959 (Reaff. 2008)	As per IS 516 and as specified in the relevant specification		# 2000 KN compression testing machine # 15 cm. cube mould # Vibrating Table	As per relevant specifications provision		To evaluate the quality of concrete, its acceptability. If not acceptable measures to improve are tried.
		Qty. of concrete work in m ³	No. of sample		Grade designation	Specified characteristic compressive strength of 150 mm cube 28 days, N/mm ² Approx.	
		1-5	1		M-10	10	
		6-15	2		M-15	15	
		16-30	3		M-20	20	
		31-50	4		M-25	25	
		51 & above	4 Plus one additional sample for each additional 50 m ³ or part there of		M-30 M-35 M-40 Upto M-80 in increment of 5	30 35 40 Up to 80 in increment of 5	
	Note :	(1) At least one sample is taken from each shift (2) Three tests specimen shall be made for each sample for testing of 28 days. Additional samples may be required for various purpose such as to determine strength of concrete at 7 days or at the time of striking the form work or to determine duration of curing or to check the testing error.			(A) The concrete shall be deemed to comply with the strength requirement when both the following condition are met ; (a) The mean strength determined from any group of four consecutive test results complies with the appropriate limits in Col. 2 of Table below (b) Any individual test result complies with the appropriate limits in Col. 3 of Table below		
					(B) If the concrete is deemed not to comply pursuant to (A) above the structural adequacy of the parts affected shall be investigated (see clause 17 of IS : 456-2000) and any consequential action as needed shall be taken		
					Note : Standard deviation based on test strength of sample		

154

Sr. No.	Particulars of Tests	Frequency		Equipments	Acceptance criteria		Purpose of testing
					Number of test results of sample :		
					(a) The total no. of test strength results of samples required to constitute an acceptable record for calculation of standard deviation shall be not less than 30. Attempts should be made to obtain the 30 samples test results as early as possible, when a mix is used for the first time. (b) In case of significant changes in concrete (example change in material) than standard deviation value shall be separately calculated.		
					Specified Grade	Mean of Group of 4 Non Overlapping Consecutive Test Result in N/mm^2	Individual Test Results in N/mm^2
					M-10 & M-15	$\geq f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/mm^2) or $f_{ck} + 3 N/mm^2$ whichever is greater	$\geq f_{ck} - 3 N/mm^2$
					M-20	$\geq f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/mm^2) or $f_{ck} + 3 N/mm^2$	$\geq f_{ck} - 3 N/mm^2$ (Amendment No. 3, Aug 2007)

Sr. No.	Particulars of Tests	Frequency		Equipments	Acceptance criteria		Purpose of testing
					whichever is greater		
					Note : In the absence of established value of standard deviation, the values given in Table 8 of IS : 456-2000 may be assumed, and attempt should be made to obtained results of 30 samples as early as possible to establish the value of standard deviation		

11.0 INSPECTION OF FOUNDATION BEFORE CONCRETE PLACEMENT:

Following care shall be taken for rock surface, soil surface & concrete surface.

Rock Surface:

- Check lines & levels, obtain clearance of geologist.
- Inspect with hammer for hollow sound.
- Remove loose rock.
- Clean with air and water jets under pressure.
- Keep surface wet for 24 hrs before placement of concrete.
- Ensure adequate drainage or dewatering or caulking for leaks.

Soil Surface:

- Remove loose or soft patches.
- Moisture the surface to a depth of about 15 cm for 24 hrs before placement of concrete.
- Do tamping or rolling.

Concrete Surface:

- Remove loose material.
- Existing concrete should be wet sand blasted & washed thoroughly.
- Completely dried immediately prior to placement.

12.0 BATCHING:

The concrete mixing shall be done in concrete mixing mixture only. Only mechanical weigh batching shall be allowed. The quantity of both cement and aggregate shall be determined by weight, water shall be weighted or measured by volume in a calibrated tank. All ingredient of concrete shall be taken by weight proportion as per concrete mix design finalized.

Except where it can be shown to the satisfaction of the Engineer-in-charge that supply of properly graded aggregate of uniform quality can be maintained over a period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions when required, the different sizes being stocked in separate stock piles. The material should be stock piled for several hours preferably a day before use. The grading of coarse and fine aggregate should be checked as frequently as possible. The frequency for a given job being determined by the Engineer-in-charge to ensure that the specified gradient is maintained.

The accuracy of the measuring equipment (like weigh batcher) shall be within ± 2 percent of the quantity of cement being measured and within ± 3 percent of the quantity of aggregate, admixture and water being measured proportion / Type and grading of aggregates shall be made by trial in such a way so as to obtained densest possible concrete. All ingredients of the concrete should be used by mass only.

Volume batching shall be allowed only where weigh-batching is not practical and provided accurate bulk densities of materials to be actually used in concrete have earlier been established. Allowance for bulking shall be made in accordance with IS: 2386 (Part-III). The mass volume relationship should be checked as frequently as necessary, the

frequency for the given job being determined by Engineer-in-charge to ensure that the specified grading is maintained.

Volume batching shall not be resorted without prior consent of the Engineer-in-charge who may allow this at his sole discretion when the quantity of concrete work and the rate of its placement and so small as not to vary the use of complete batching equipment.

It is important to maintain the water cement ratio constant at its correct value accordance with Design concrete mix finalized. To this end determination of moisture contents in both

fine and coarse aggregates shall be made as frequently as possible. The frequency for a given job being determined by the Engineer-in-charge according to weather conditions. The amount of the added water shall be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content in the aggregates IS: 2386 (Part-3) shall be referred to. To allow for the variation in mass of aggregate due to variation in their moisture content, suitable adjustments in the masses of aggregates shall also be made. In the absence of exact data, only in the case of nominal mixes, the amount of surface water may be estimated from the values given in table below.

Table

Sr. No.	Aggregate	Approximate Quantity of surface water.	
		Percent by Mass	l/m ³
1.	Very wet sand	7.5	120
2.	Moderate wet sand	5.0	80
3.	Moist sand	2.5	40
4.	Moist gravel or crushed rock coarser the aggregate, less the water it will carry.	1.25 – 2.5	20-40

No substitutions in materials used on the work or alterations in the established proportions (CMD or NMC) except as permitted in previous two para as described above shall be made without additional tests to show that the quality and strength of concrete are satisfactory. In the absence of any automatic weigh batches, weighing shall be done only by means of providing and using steel measuring boxes shall have adjustable bottom to allow for daily variation in moisture properties of the fine and coarse aggregates. Enough boxes shall be provided separately for each ingredient as approved by Engineer-in-charge.

The contractor shall have to provide the weigh batchers of the requisite capacity to maintain the required progress on different item of work, calibration of weight batcher shall be carried out

prior to use it and from time to time in presence of a Govt. representative nominated by Engineer-in-charge to check the accuracy of the measuring devices. The frequency of such test for establishment of accuracy shall be determined by the Engineer-in-charge. Unless otherwise directed, tests shall be made once in one or two weeks at random. The contractor shall provide standard test weights and other necessary equipment required for checking the operation performance of each scale or other measuring device. The contractor shall make such adjustment, repairs or replacement as may be necessary to meet with the requirement specified by the Engineer-in-charge for accuracy for measurement.

13.0 MIXING :

Concrete shall be mixed in a mixture . In no case manual mixing of concrete shall be allowed. The ingredients shall be fed in to the mixer simultaneously. A portion of water (5% to 10%) shall be fed first and an equal quantity shall follow the introduction of other materials. The remaining water shall be added uniformly and simultaneously when all other materials are in the mixer. Mixer shall not be loaded in excess of its rated capacity. The mixer shall be fitted with water measuring devices. The mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete should be remixed.

For guidance, the mixing time shall be at least 2 min. For other type of more efficient, mixers, manufacturers' recommendations shall be followed. Workability should be checked at frequent interval. The freshly mixed concrete should be finally placed in position within 30 minutes.

The freshly mixed concrete should be tested for slump, unit weight, compressive strength and may also tested mixer uniformity, test, yield test, air content etc. Mixer shall be examined daily for change in condition due to accumulation of hard concrete or mortar or due to wear of blades. No mixer shall be changed in excess of its rated capacity for mixing or agitations. The size of batch mixed in that mixer may be reduced, until upon testing a uniformly.

Whenever mixing is done at higher elevation (> 1.5 m) chutes former of plain G.I. sheets with its end provided with deflector. Inclination of the chute shall be so adjusted that segregating does not take place. Chutes shall be washed and clean as and when necessary.

14.0 FORM WORK:

General:

The form work shall be designed and construction which have sufficient strength so as to remain sufficiently rigid during placing and compaction of concrete and shall be such as to prevent loss of cement slurry from the concrete. For further details regarding

design detailing etc. reference shall be made to IS: 14687. The tolerances on the shapes, lines and dimensions shown in the drawing or as directed by Engineer-in-charge shall be within the limits given below. The tolerances specified are for finished concrete and not for form works.

- (a) Deviation from specified dimensions of cross + 12mm
 Section of column and beam or similar type - 6mm
 Of super structure i.e. Vertical components and
 Horizontal components.
- (b) Deviation from dimensions of footings.
 - (1) Dimension in plan + 50mm
 - 12mm
 - (2). Eccentricity : 0.02 times the width of the footing in the
 direction of deviation but not more than 50mm.
 - (3). Thickness ± 0.05 times the specified thickness.

The tolerances apply to concrete dimensions only and not to positioning of vertical reinforcing steel or dowels, where the concrete surface can be trimmed to the prescribed lines, the use of forms shall not be required (e.g. cast-in-situ concrete work are carried out on sub grade of canal with specified thickness). All exposed concrete surface having slope of one horizontal to one vertical or steeper shall be formed unless otherwise directed. The design of form work shall be quite necessary for heavy structure like high level bridge solid slab etc. for that contractor shall have to provide design and drawing from authentic structural engineer.

Cleaning and treatment of form work :

All rubbish, particularly chippings, shavings and saw dust shall be removed from the interior of the forms before the concrete is placed. The face of form work in contact with the concrete shall be cleaned and treated with form release agent (oil). Release agents shall be applied so as to provide a thin uniform coating to the forms without coating the reinforcement.

For heavy structure, the forms shall be constructed of steel i.e. horizontal-vertical member or slant member i.e. props, Bracing, ties plates etc. shall be designed steel work. The surface of forms in contact with the concrete shall be clean, smooth, rigid and tight. The supports shall be so arranged to keep the maximum deflection within 1/360 of the span. The forms shall be designed and constructed to permit early removal without damage to the concrete. Suitable devices shall be used to hold corners, adjacent ends of panels of other forms together in accurate alignment during compaction of concrete by vibration or other means. The forms and their joints shall be tight enough to prevent while vibrating, the loss of mortar or water from concrete. The ties and bracing as may be necessary shall be attached to form and to be used more than once. They shall be maintained in serviceable condition and shall be clean, smooth and free from adhering grout before being reused curved and special forms shall be of character that will result in smooth concrete surfaces. They shall be designed and constructed. So that they

will not warp or spring during erection or placing of concrete.

Form Sheathing or Lining :

In general forms for all structure shall consist of or shall be lined with steel plates panel shall be so treated or coated that there will be no chemical deterioration of the formed concrete surface.

Steel plate panel :

Steel plate shuttering shall be of made of appropriate thickness of steel sheet and stiffened by steel angles of appropriate size. The shuttering shall be supported by steel pipes, channels, Girder and steel props and properly cross braced to gather, so as to make the centering rigid. The complete form work shall be got inspected by and got approved from the Engineer-in-charge before the reinforcement (in case of R.C.C. work) are placed in position.

The props shall consists of adjustable steel pipes with facility to tie with each other and form plate / channel by suitable type clamps.

As far as possible clamps, nut and bolts shall be used to hold the forms together and use of nails, spikes, and wires shall be avoided.

The type and conditions of forms sheathing or lining.

The ability of the forms to withstand distortion caused by placement and vibration of the concrete and the workmanship used in the form construction shall be such that formed surface after being treated will conform to the applicable requirements of these specifications pertaining to finish of formed surface where finishing is specified. The sheathing or lining shall be so placed that the joints makes in the concrete surface will be in the general alignment both vertically and horizontally.

Steel Sheathing & Steel Plates :

Steel sheathing and steel plates should be free from twists, bends, offsets, wraps, etc. their surface should be neat clean, and smooth. Before placing concrete steel forms shall be thoroughly cleaned off all rust, dust, and loose materials. Colourless oil or grease of approved quality shall be applied before placing steel.

The size of angles used for framing and bracing of steel plates should be sufficient to withstand the weight of mass concreting without forming clinks, twists, offsets, wraps etc. in the steel plates. Bracing angles used on all the four sites of steel shuttering and steel channels shall have permissible to facilitate nut bolting.

Form Ties :

Embedded metal rods or embedded wires ties for holding forms shall be used. Wire ties shall be cut off with the surface of concrete after the forms are removed.

Erection:

Where forms for continuous surface are placed in successive units, the form shall fit tightly over the complete surface so as to prevent leakage of mortar or cement slurry from the concrete and to maintain accurate alignment of the surface. Forming of block joint to the concrete portion shall be done carefully to ensure a smooth joints and avoid sharp

deviation, Projections, or edges and particular attention shall be paid in setting and tightening the form to ensure that the contraction / construction joint's surface are plumbed and in accurate alignment.

Inspection:

The forms which have been erected and set to line and grade shall be inspected as to their accuracy. All forms anchor ties and bracing shall be checked for rigidity and tightness and form surface for cleaning and oiling. Where the forms appear to be insufficiently braced, unsatisfactorily built either before or during the placing of concrete, the work shall be suspended until the defects are rectified.

Stripping Time:

Form shall not be released until the concrete has achieved a strength of at least twice the stress to which the concrete may be subjected at the time of removal of formwork. The strength referred to shall be that of concrete using the same cement and aggregates and admixture (if any), if any with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work.

While the above criteria of strength shall be the guiding factor for removal of form work, in normal circumstances where ambient temperature does not fall below 15° C and where ordinary Portland cement is used and adequate curing is done, following striking period may deem to satisfy the guideline given in above para (IS: 456-2000 provisions)

	Type of form work	Minimum period before striking form work.
(a)	Vertical form work columns piers, walls, beams.	16-24 hrs.
(b)	Soffit form work to slabs (Props to be refixed immediately after removal of form work)	3 days
(c)	Soffit form work to beams (Props to be refixed immediately after removal of form work)	7 days
(d)	Props to slabs : (1) Spanning upto 4.5 m (2) Spanning over 4.5 m	7 days 14 days
(e)	Props to beams and arches. (1) Spanning upto 6m (2) Spanning over 6m	14 days 21 days

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

Where the shape of the element is such that the form work has reentrant angles the form work shall be removed as soon as possible after the

concrete has set to avoid shrinkage cracking occurring due to the restraint imposed.

Removal of forms:

All forms shall be removed in a careful workman like manner without causing deflection or distortion and damage to the laid concrete sections and surfaces either due to removal of support or stripping operation. Supporting forms and shoring shall not be removed from form until the stripping period over. No superimposed load shall be allowed within the period for which the form work is required to remain in place. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight and any other incidental superimposed load and the sequence shall be as directed by the Engineer. The use of crow bars and similar metal tools for loosening the form shall not be permitted. In design of forms, the sequence and facility of stripping of forms shall be taken into consideration and wedges shall be provided where necessary to facilitate removal. The form work shall be removed by driving the wooden wedges behind them and lightly tapping for loosening away from the concrete surface.

Forms should be removed at the earliest practicable time to facilitate curing the formed surface without much delay and repairs under most favorable conditions for good bond.

Transporting and Handling:

After mixing concrete shall be transported to the form work as rapidly as possible by method which will prevent the segregation or loss of any of the ingredients or ingress of foreign matter or water and maintaining the required workability.

Conveying method and equipment shall be approved by the Engineer-in-charge not below the rank of Deputy Executive Engineer.

When mixing concrete from drum of mixer poured through chute (Plain G.I. sheet inclined properly) away from form work shall be remixed and then after conveyed to form work. Newly mix concrete is susceptible to segregation if dropped through height. The unrestrained dropping of concrete on apex of a pile also results in coarser particles segregating and concentrating at the toe of the slope. Unrestrained dropping, chuting and horizontal flow of concrete should not permitted.

Minimum handling and persistent precautions should be observed to prevent segregation and to see that concrete remains a cohesive mass.

During hot or cold weather, concrete shall be transported in deep containers other suitable methods to reduce the loss of water by evaporation in hot weather and heat loss in cold weather may also be adopted.

15.0 Placing (Placement) :

The concrete shall be deposited as nearly as practicable in its final position to avoid rehandling. The concrete shall be placed and compacted before initial setting of concrete commences and should not be subsequently disturbed. Methods of placing should be such as to preclude segregation. Care of placing should be such as to preclude segregation. Care should be taken to avoid displacement of reinforcement (In case of RCC) or movement of form work. As a general guidance, the maximum permissible free fall of concrete may be taken as 1.5 m.

When all components of structure are cast monolithically the concrete in the top 60 or 90 cm of walls & column should be of the lowest slump that can be vibrated adequately & should be fully

consolidated at the surface.

Concrete should be deposited in horizontal layers. Each layer should be compacted thoroughly before succeeding layer is placed. In reinforced concrete work and plain cement concrete work, it is good practice to place concrete in layers 25cm and 45cm thick respectively. However, thickness shall be decided in view of size and shape of section, consistency of concrete, spacing of reinforcement, method of concrete placement, method of compaction and necessity of depositing concrete of next layer before hardening of previous layer which take place within 30 minutes.

Concrete shall be deposited continuously in order to avoid appearance of slightest layer line on the finished structure. No construction joint should be allowed to form unless directed by the designer.

Placement of concrete shall be carried out at such a rate that lower layer concrete which is being integrated with fresh concrete is always plastic. Normally this will be achieved if next layer is placed within 30 minutes of this is not done, cold joints will develop which must be avoided. The cold joints are interfaced which remain as discontinuities and cause separation when subjected to tensile stresses.

The concrete should be worked thoroughly in to all positions around reinforcement, embedded fixtures and in to corners of form work. Only slurry, if allowed to pass below reinforcement gives a firm finish but leaves voids near reinforcement and hence causes loss of bond and corrosion.

16.0 COMPACTION:

Concrete should be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures, and in to corners of the form work.

Concrete shall be compacted using mechanical needle vibrators complying with IS 2505, IS 2506, IS 2514 and IS 4656 over vibration and under vibration of concrete are harmful and should be avoided vibration of very wet mixes should also be avoided. Complete consolidation can be judged by evidence of leveled appearance of concrete at exposed surface, embedment of surface aggregate, expulsion of entrapped air, formation of cement skin and appearance of cement slurry at surface. Manually vibration of concrete shall not be allowed.

Whenever vibration has to be applied externally the design of form work and the disposition of vibrators should receive special consideration to ensure efficient compaction and to avoid surface blemishes.

Concrete shall be consolidated by vibration, spreading, Roding or forking so that concrete is thoroughly worked around the reinforcement, embedded fixtures and into concrete of forms eliminating all air or stone pockets which causes honeycombing, pitting or planes of weakness.

Internal immersion vibrators shall have a minimum frequency of 8000 vibrations per minute with sufficient aptitude to consolidate concrete effectively.

Vibrators shall be inserted vertically and withdrawn gradually at points approximately 0.4 m to 0.50 m apart. At each insertion, the duration shall be 5 to 15 seconds which is sufficient to consolidate. The concrete but to disallow segregation and increase in surface laitance.

Where the concrete is to have coat finish a full layer of mortar shall be brought against the form of vibration process-vibrators shall be operated by competent workman, A space vibrator shall be kept on site of work

during all concrete placing operations.

17.0 CONSTRUCTION JOINTS AND COLD JOINTS:

Joints are a common source of weakness and therefore it is desirable to avoid them. If this is not possible, their number shall be minimized. Concreting shall be carried out continuously up to construction joints. The position and arrangement of which shall be indicated by the designer. Construction joints should comply with IS 11817.

Construction joints shall be placed at accessible locations to permit cleaning out of laitance, cement slurry and unsound concrete, in order to create rough / uneven surface. It is recommended to clean out laitance and cement slurry by using wire brush on the surface of joints immediately after initial setting of concrete and to clean out the same immediately thereafter. The prepared surface should be in a clean saturated surface dry condition when fresh concrete is placed, against it.

In the case of construction joints at location where the previous pour has been cast against shuttering the recommended method of obtaining a rough surface for the previously poured concrete is to expose the aggregate with a high-pressure water jet or any other appropriate means.

Fresh concrete should be thoroughly vibrated near construction joints so that mortar form the new concrete flows between large aggregate and develop proper bond with old concrete. Where high shear resistance is required at the construction joints, shear keys may be provided. Sprayed curing membranes and release against should thoroughly remove from joint surfaces.

18.0 CHIPPING AND ROUGHENING OF CONCRETE SURFACE:

At construction joints where fresh concrete is to be placed on old settled concrete, the surface of construction joints shall be clean rough and dry when covered with fresh concrete. Concrete surface upon or against which fresh additional concrete is to be placed shall be chipped off and roughened to a depth not more than 2 cm. After being roughened, the surface of the concrete shall be cleaned thoroughly of all loose fragments, dirt, lime and other objectionable materials and shall be sound and hard and in such conditions as to assume good mechanical bond between old and new concrete. All concrete which is not hard, dense and durable shall be removed to the depth required to secure a satisfactory surface. Cost of work of chipping, roughening and all above treatment at construction joints shall be deemed to have been included in the rate tendered for the item of concrete.

19.0 FINISHING:

The surface of concrete finished against forms shall be smooth and shall be free from projections, honey combing and other objectionable defects. Immediately on the removal of forms all unsightly ridges or lips shall be removed and undesirable local bulging on exposed surface should be remedied by tooling and rubbing, repairs to concrete surface and additions where required shall be made by cutting regular opening in to the concrete and placing fresh concrete to the required lines. All exposed concrete surface shall be cleaned of impurities, lumps of mortar and concrete or grout and unsightly stains.

The concrete shall be finished to an even and smooth surface free from pockets, voids or exposed aggregates. This shall be obtained by careful use of long handled steel trowel, any remaining roughness spots shall be rendered smooth without any time interval after laying the concrete,

with cement mortar of 1:3 proportion.

Concrete proportions and consistency and method of compaction should be such that sufficient mortar is available at the surface for finishing purpose.

Over indeed or too wet or over consolidated mix is likely to be covered with bleed water. They may be corrected for better finishing; such water shall be allowed to drain or absorb or scrap.

Sprinkling of dry or a dry mortar should not be permitted. If surface is trowelled too soon a layer of laitance is found, if too late, the partly handed concrete is too hard to be trowelled effectively.

20.0 REPAIRS OF CONCRETE:

Repairs of concrete shall be performed by skilled workers. Repairs of imperfections in formed concrete shall be completed as soon as practicable within 24 hours after the removal of forms. Concrete that is damaged from any cause and concrete that is honey combed, fractured or otherwise defective and concrete with excessive surface depressions must be removed and built up to bring the surface to the prescribed lines or shall be removed and replaced by dry patching mortar or concreting without any extra cost.

Where bulges and abrupt irregularities protrude outside the limits specified on formed surface, the protrusions shall be reduced both by hammering and griding so that the surface irregularities are brought within the specified limits.

Dry pack filling shall be used for holes that have surface dimensions smaller than the depth of holes left by the removal of fastener from the ends of form tie rods for grout inert holes and for narrow slots, cut for repairs of cracks. Dry pack mortar or concrete filling shall be resorted as directed by Engineer-in-charge.

All patching shall be done with extreme care so that patches will not be noticeable from a distance of 20m colored cement as an ingredient of the patching mortar shall be used if necessary, to produce patches of same colour as the adjoining concrete.

Dry Pack Mortar:

Repairs operation shall be preceded by a careful inspection to see that the hole is thoroughly clean and lightly wet but with a small amount of free water on the interior surface. The surface shall than dusted lightly and slowly with cement by means of a small dry brush until all surfaces are covered and darkened by the absorption of water by the cement. There shall be no dry cement in the hole when packing begins and such cement if present shall be removed. The hole shall not be painted with neat cement grout.

Dry pack mortar shall consist a mixture of 1 part of cement to 2 part of sand by volume that will pass IS sieve No.120, white cement will be used in sufficient quantity to produce uniform colour matching with that of surrounding concrete at points wherever desired by the Engineer.

For packing concrete holes, a lean mix of 1:3 or 1:3 1/2 shall be used only enough water shall be used to produce a mortar which when used will stick together on being moulded in to a ball by slight pressure of hand and will not extrude water but will have the hand dump.

Proper compaction in layer wise shall be carried as directed by Engineer-in-charge. The holes shall not be overfilled and finishing shall be completed at once by the float of a hand wood piece against the fill and striking it several good blows. Finishing tools shall not be used and water shall be used to facilitate finishing.

21.0 CURING:

Curing is defined as maintenance of humidity and temperature of freshly placed concrete during definite period following finishing assuring satisfactory hydration of cementitious material and proper hardening of the concrete. The curing period depends upon type of cement, weather condition, wind speed, stripping time, sections of concrete, method of curing etc. Improper curing results in formation of surface shrinkage cracks, loss of strength, increase in permeability, spoilage of surface finishing, decrease durability and quality of concrete is affected. Moist curing, membrane curing are normally used. Former is predominantly used.

- (1) Concrete surface shall be kept moist continuously (day & night for 24 hours a day) for 14 days (curing period 14 days) as prescribed and directed.
- (2) Application of water shall begin after 12 hours of its placement or as directed by Engineer-in-charge.
- (3) Water shall be sprinkled over centering till its removal.
- (4) Cure horizontal surface of concrete with pond formation, Ponds shall be frequently filled of water. Jute soaked in water shall be used for vertical and slant surface of concrete. Water shall be frequently sprinkled over jute (bags or mats)
- (5) Curing arrangement shall be made under direction of the engineer.
- (6) Ensure that all exposed surface including sides, edges, and corners shall continuously moist throughout the curing period.

Curing Protection:

- (1) All concrete shall be protected against injury until final acceptance.
- (2) Unhardened concrete shall be protected from heavy rains and flowing water.
- (3) No fire or excessive load shall be permitted near or indirect contact with the concrete at any time during curing period.
- (4) All conduits and other opening shall be bulk hided during construction period to prevent free circulation of air and resultant drying of concrete.
- (5) Exposed finished surface of freshly laid concrete shall be protected from direct rays of the sun for at least first three days after placement, such protection shall be made effective as soon as practicable after placing of uniformed concrete or after the removal of forms of formed concrete.
- (6) Exposed concrete shall also be kept moist for at least 72 hours period to the placing of additional concrete up to the joints.

22.0 PREVENTING HAIR CRACKS:

Hair cracks are usually the result of concentration of water finds at the exposed concrete surface caused by over manipulation during finishing operations. Such cracking is aggravated by untimely finishing and by too rapid drying & cooling when the humidity is so low as to cause cracking of the finished surface before it can be covered without damage. The surface shall be moistened and kept temporarily wet with a fine spray of water so as to wash the surface but not to form poolson it. Since chilling of the green concrete increase its tendency to crack, it is desirable that the water used for preliminary moistening not too cold and shall preferably be warmer than concrete.

Over working the surface and the addition of water / cement to aid in finishing shall be avoided. The resulting laitance will have impaired strength and durability and will be particularly vulnerable to freezing and

thawing under wet conditions.

23.0 SEEPAGE WATER ENCOUNTER IN FOUNDATION: (CONCRETING)

When seepage water meets in foundation following care shall be taken under direction of Engineer-in-charge. No extra payment shall be made for that.

- (1) Make arrangement of continuously dewatering according to amount of seepage water.
- (2) As far as possible block the seepage way & reduce the flow of water.
- (3) Cofferdam or forms shall be sufficiently tight to ensure still (calm) water if practicable.
- (4) Reduce water cement ratio by adding more cement, cement content shall be at least 350 Kg/m³ of concrete i.e. rich concrete mix shall be used.
- (5) Vibration of very wet mixes (due to seepage water) shall also be avoided.
- (6) Concrete cast under water should not fall freely through the water, otherwise it may be leached and become segregated.
- (7) Concrete shall be deposited continuously until it is brought to the required height (No construction joint allowed) while depositing, the top surface shall be kept as nearly level as possible and the formation of seams avoided.
- (8) The methods to be used for depositing concrete under water shall be one of the as stated in IS: 456-2000 clause 14.2.4 on Page No.28.
- (9) To minimize the formulation of laitance, great care shall be exercised not to disturb the concrete as far as possible while it is being deposited.

24.0 CONCRETING UNDER SPECIAL CONDITIONS:

- (a) Underwater Concreting: Concreting shall be carried as per above clause under heading "seepage water encounter in foundation".
 - (b) Hot weather concreting: Dampen the sub grade and forms, place concrete at the lowest practicable temperature, start curing early, use cold water or ice as a part of mixing water.
 - (c) Cold weather concreting: Prevent concrete from freezing, concrete should be placed at temperature not lower than 50°C, maintain curing condition which fosters normal strength development without excessive heat, keep surface at a temperature that may not cause early freezing or seriously prolong hardening.
- No extra payment shall be made to contractor for concreting under special condition as stated above.

25.0 RECORDS AND REPORTS:

A systematic joint record in the form approved by Engineer-in-charge shall be maintained to record the details regarding use of cement, number of mixes of concrete and of mortar used on works, rejected mixes, Location (Name of structure component with chainage and levels) in which concrete or mortar used and quality records like F.M., silt content and gradation of sand, gradation of crushed metal, weight / volume batching, test for fresh concrete (Slumps) and for cube specimens for compressive strength, weight of cubes etc. These records shall be signed by the Engineer or his authorized representative on the site. Compare results with standards if the contractor fails to scrutinize and verify the entries and sign the joint record, the record as scrutinized, verified and signed by the Engineer or his representative shall be taken final and binding on the contractor.

Ensure monthly summary reports giving compliance of instructions recorded in work order book.

26.0 TOLERANCE FOR CONSTRUCTION:

GENERAL:

The intent of this paragraph is to establish tolerances that are consistent with modern construction practices, yet governed by the fact that permissible deviation will have no adverse effect on the structural action or operational function of the structure.

Where tolerances are not stated in the specifications or drawing for any individual structure or feature thereof, permissible deviations will be interpreted in conformity with the provision of this paragraph.

The contractor shall construct all concrete structures to the exact lines, grades and dimensions established. However inadvertent variation from the established lines, grades and dimensions will be permitted to the extent set forth herein provided that the Engineer reserves the rights to diminish the tolerances set forth herein for such tolerance which impairs the structural action or operational function of the structure. The notation of the drawings of specific maximum tolerance in connection with any dimension shall be considered as a supplemental to the tolerance specified herein.

Rejected work shall be remedied or removed and replaced at the expense if any by the contractor.

Tolerance in Dam and Appurtenant Works:

- 1) All Structures:
 - I) Variation of constructed lines outline from established position in plans.

In 6 m	10 mm	In 12 m	25 mm
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 - II) Variations of dimensions of individual structural features from established position. In 6 m or more 30 mm
(in buried construction :- Twice the above amount).
- 2) I) Variations from the plumb from the specified batter, vertical joints, grooves and visible are

In 3 m	10 mm
In 6 m	20 mm
In 12 m	30 mm

(In buried construction: Twice the above amounts)

- II) Variation from the level from the grades indicated on the drawing in slabs, beams soffits, horizontal joints, grooves and visible areas.

In 3 m	5 mm	In 6 m	10 mm
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(In buried construction: Twice the above amounts)
- 3) (I) Variation in cross sectional dimensions of columns, beams, piers and similar members:

Minus	(-) 5 mm
Plus	(+) 10 mm

- (II) Variation in thickness of slabs, wall, arch section and similar members:

Minus	(-) 5 mm
Plus	(+) 10 mm
- (4) (I) Footing for piers, wells and similar members:

Minus	(-) 5 mm
Plus	(+) 10 mm

- | | Reduction in
Thickness | 5 percent of specified
thickness. |
|------|---|--------------------------------------|
| (5) | Sills and side walls for service and emergency gates and similar water tight joints variation from the plumb to end level: not greater than 3 mm. | |
| (6) | Tolerances for placing reinforcement steel | |
| (a) | Variation of protective covering. | |
| (I) | below 50 mm cover | 5 mm |
| | With 50 mm cover | 10 mm |
| | Above 50 mm cover | 12 mm |
| (II) | Variation from indicated
Spacing | 25 mm |

27.0 MEASUREMENT AND PAYMENT:

Measurement and payment of concrete shall be made on basis of the actual volume of the concrete for the grade as placed within the lines as specified or as otherwise directed by the engineer according to all the provisions mentioned above. No deduction shall be made for the space occupied by reinforcement and other metal work, electric conduit line etc. The quantities of all holes and passages greater than 0.80 sq m in cross section or 100 mm shall, however, be deducted from the payment. The reinforcement steel and other embedded metal parts shall be separately paid at the rates accepted as per the schedule of prices. No payment shall, however, be made for embedding minor fixtures or providing grooves, block outs, recess etc. for gates and other installations like electric conduits, etc. All labour, materials, plants etc. involved in providing cement slurry and mortar on rock surface and construction joints etc. shall be deemed to be included in the unit rate to be paid for concrete. The work pertaining to labour anchorage for erection of horizontal and vertical of necessary supports, templates etc. will have to be carried out by the contractor as per separate items.

The rate is also inclusive of erection and removal of form work and centering, if any, required for the work due to change in design of the structure etc.

The rate includes concreting with best types for work required in the cases of block out and grooves. No extra payment shall be made for this.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION-2

(F) GENERAL TECHNICAL SPECIFICATION FOR PLASTERING & POINTING

GENERAL TECHNICAL SPECIFICATION FOR PLASTERING AND POINTING

1.0) MATERIALS :

i) **CEMENT :**

Specifications M-2 of section of material shall apply.

ii) **WATER :**

Specifications M-1 of section of material shall apply.

iii) **SAND :**

Specification M-3 of section of material shall apply. The sand to be used only after proper screening to get required FM and shall be of natural sand and shall confirm to IS-1526 also.

Grading of coarse sand and fine sand shall be as given below.

COARSE SAND		FINE SAND	
IS SIEVE DESIGNATION	% PASSING BY WEIGHT	IS SIEVE DESIGNATION	% PASSING BY WEIGHT
4.75mm	100	4.75mm	100
2.36mm	90 - 100	2.36mm	100
1.18mm	70-100	1.18mm	70-100
600 micron	30-100	600 micron	40-85
300 micron	5-70	300 micron	5-50
150 micron	0-50	150 micron	0-10

2.0) MORTAR AND ITS INGREDIENTS :

Specifications laid down in IS-

i) **PROPORTION OF INGREDIENTS :**

The cement mortar shall be obtained by mixing cement, sand and water in the proportion as specified by weight or by volume. For volumetric mix 50 kg of cement bag being equal to 0.0342 cum

ii) **MIXING :**

The mortar shall be machine mix or hand mix as specified in respective item of work. For major nature of job, only machine shall be allowed. The cement mortar shall be obtained by thoroughly mixing the ingredients in mechanically operated mixer/or by hand mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogenous mixture of uniform colour is obtained. For machine mix, Mixing time shall commensurate with the RPM and capacity of machine. Following points shall be carefully attended while mixing. The ingredients are fed into mixer simultaneously. A five to ten percent of water shall be fed first and an equal quantity shall follow the introduction of other material. The remaining water shall be added uniformly and simultaneously when other materials are in the mixer. The addition of water shall be done with

calibrated bucket.

QUANTITY OF WATER :-

Mortar shall be such that the working consistency is obtained. The consistency of mortar shall be decided on depending upon the job

iii) TIME OF USE :

Mortar shall be used within 30 minutes from the time of adding water.

iv) PLACING :

The mortar, shall be collected in large shallow bucket and than transported it by mechanically or manually, to the place of requirement. The mortar shall not be through for a height more than 60 cm. so as to avoid segregation. Whenever mixing is done at higher elevation, chutes formed of plain G.I. sheets can be used to transport mortar to the place of work. Inclination of the chute should be so adjusted that segregation does not take place.

3.0 SCAFFOLDING:

Wooden ballies, bamboos/steel pipes planks, treadles and other scaffolding shall be sound and shall be examine before use Steel stage scaffolding shall be preferred as far as possible.

4.0 PREPARATION OF SURFACE :

The surface to which plastering is to be done shall be cleaned of all dust, loose mortar droppings trace of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be roughed by wire brushing/chiseling. Trimming of projections on stone/brick/concrete surface where necessary shall be carried out to get an even surface. All joints in stone masonry shall be thoroughly racked out to a depth of 20 mm and the joints and walls washed with fresh water. Surface shall be wetted before plastering.

5.0 APPLICATION OF PLASTER :

Plastering work shall be started from top to downwards. The plaster about 15x15 cms shall be first applied horizontally and vertically at not more than 2 mt. intervals over the entire surface to serve as gauge. The mortar shall then be applied in uniform surface slightly more than the specified thickness. Then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movement at a time. Finally the surface shall be finished off true with a trowel or wooden float according to smooth or a sandy granular texture is required. All corners, arriser, angles and junctions be truly vertical or horizontal as the case may be shall be carefully finished. Rounding or chamfering corners, arrises junctions etc. shall be carried out with proper templates to the size required. In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically. The edge of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days.

6.0 CURING :

The plastered surface shall be kept damp for a minimum period of 7days.

7.0 MODE OF MEASUREMENT AND PAYMENT. :

The rate are inclusive of cost of all materials, labour, scaffolding, curing etc. as describe. The work shall be measured in square metres basis. Thickness of plaster shall be average thickness with minimum 10mm at any point for 12mm thick plaster and 18mm at any point for 20mm thick plaster on the surface. No deduction shall be made for ends of joints, beams, posts etc. and openings not exceeding 0.5 sq.mt. each. For openings exceeding 0.5 sq.mt. and not exceeding 3.0 sq.mt. in each area shall be deducted by half. For opening more than 3.0 sq.mt. in area, deduction shall be made for full openings. For building works, rules for measurement and payment of R&B shall be followed.. The rate shall be for a unit of one sq meter.

Signature of Contractor
**Executive Engineer
Rajkot Irrigation Division
Rajkot**

SECTION-2

(G) GENERAL TECHNICAL SPECIFICATION FOR EXCAVATION

(H) GENERAL TECHNICAL SPECIFICATION FOR EXCAVATION

1.0) SCOPE OF WORK:

The work to be done under this specifications shall consist of clearing the site, excavation in different type of strata as mention in item of works and disposal of excavated material within lead and lift mention in the item of works. The scope of work also incl. of furnishing all tools, plants and labour and materials required to carry out excavation. and maintaining the slope of excavated trenches by way of artificial manner (strutting) also, if required so.

2.0) CLEARING THE SITE:

The item of clearing site as given below shall be considered as included in the excavation and shall not be paid for separately, if there is no separate item of work for this in the tender.

REMOVAL OF RUBBISH :

The area to be occupied under the work shall be made free from rubbish and shall be cleared of all rocks, stumps, decayed timbers, bush and all other objectionable materials.

DISPOSAL OF WASTE MATERIAL FROM SITE CLEARANCE :

Waste materials decided as such by the engineer, obtain from clearing the site, shall be burnt or removed as directed by the engineer.

REMOVAL OF LOOSE ROCK ETC. :

Before any work of excavation is taken up, all loose rocks semi detached rock in or close to the area to be excavated, that is liable to fall or otherwise endanger the work or workmen shall be stripped. The methods employed shall be such as will not shatter or render unsuitable and therefore make unsafe the ground, that was original sound or safe. Any material not requiring removal as contemplated herein, but which may latter become loosened or unsuitable shall be promptly & satisfactorily removed. The cost of such clearing shall be deemed to have been incl. in the rate of different item of excavation

3.0) CLASSIFICATIONS :

The work under excavation shall be divided into item as under.

EXCAVATION IN OVERBURDEN :

This shall include all excavation in strata other than soft and hard rocks such as soil, clay sand soft murrum kankar, hard murrum and boulders or mixture of above strata.

Hard murrum and boulders shall include all kinds of disintegrated rock or shale or indurated sand or conglomerate interspersed with boulders less than 0.70 cubic meter and larger than 0.03 cubic mt. which do not need blasting and can be removed by pick bar and shovel.

EXCAVATION IN SOFT ROCK.:

This shall include all excavation in strata soft rocks which can removed with a pick bar and shovel by little more force & efforts but which do not come under the catogary of hard murrum and boulders.

EXCAVATION IN HARD ROCK :

This shall includes all excavation in rock occuring in masses, which can be best removed by blasting. This shall also includes rock required to be removed by chiselling, when blasting is not permitted.

4.0) PAY LINE :

The pay line shall be sloping as 1:1 (H:V) in overburden, 0.50:1 (H:V) in soft rock

and 0.25:1 (H:V) in hard rock.

- a) When actual depth of foundation is taken lower than proposed foundation levels, the pay line shall be the line starting from the limiting lines of structure at actual foundation level & sloping at the rate specified above.
- b) When actual depth of foundation is taken above than proposed foundation levels, the pay line shall be the line confirmed to appropriate slopes excavated on the basis of width required for proposed foundation levels, but ending at the level of actual foundation.
- c) No payment shall be made for work done beyond the specified payline. mentioned above.
- d) The contractor shall, however, be permitted to excavate at flatter slopes in the interest of stability and safety of work without any extra cost if site condition permit so.
- e) In the event of actual line of excavation being steeper than that specified under pay line above, payment shall be made for actual line of excavation only.
- f) Over cut beyond specified pay line of excavation carried out by the contractor for any purpose or reasons, unless at the specified direction of engineer in charge, shall be at the expense of the contractor. Refilling required of such unauthorized excavation with suitable materials, as directed by the engineer shall also be done by the contractor at his expense.

5.0) SHORING AND STRUTTING :

Any shoring and strutting that may be required during excavation and progress of work, shall be deemed to be covered in the rate quoted for the respective item of work.

6.0) SLIPS :GOVERNMENT NOT RESPONSIBLE. :

The contractor shall be bound to take necessary precautions to avoid any slips. But if any slip occurs on account of any reasons, no claims shall be entertained for such slips and their consequences and the excavation shall be properly restored to stability.

7.0) DISPOSAL OF EXCAVATED MATERIALS :

The excavated material shall be disposed of within specified lead and lift mentioned in the respective item of work and manner as directed by engineer. Any useful materials what's so ever, shall be stacked separately and in the manner, as directed by engineer. The directions of engineer in charge shall be binding in respect of location and manner for disposing off the waste and stack of useful materials within specified lead and lift mentioned in the respective item of work.

The contractor shall however, use such of the stones, obtained from excavation in masonry work / pitching / road metal / rock fill etc as engineer in charge deemed fit for the use and at the rate mentioned in the Schedule-A on gross stack measurement. The sorting / stacking of useful excavated materials is a must and inclusive in the quoted rates for the item of excavation.

After sorting of useful materials is done, the rest of the materials which are declared not useful shall be disposed off in the areas on the down stream. Waste shall be levelled and trimmed to a reasonable regular line and level.

8.0) FINAL FINISHED SURFACE OF FOUNDATION :

After rough excavation to the required depth is completed, scalling & trimming of all loosen rock shall be carried out by chisels and wedges. All weathered or partly decomposed pieces of rock remaining in foundations, shall be removed. Areas of low bearing capacity, steep, inclined seams, faults & crushed zones in an otherwise good foundation, if permitted to be kept, shall be cleaned off to a stuffiest depth before starting masonry or concrete.

Where seams, joints, cavities or other defect are found in an otherwise satisfactory foundation, such defects shall be corrected by excavation of open trenches to the lines, depth and dimensions as directed by the engineer in charge.

The surface shall be rough, free from steps, angle and the edges of benches shall be chamfered approximately at 45 degree.

While preparing the foundation, it will be seen that neither along the length of the dam nor across shall the foundation have slopes exceeding angle of internal friction on rock and masonry. The finally finished foundation surface shall be tested by striking with a 7/8 pound hammer. If any loose portion of foundation is revealed by a hollow sound, the same shall be removed by wedging, chiseling etc. till a good clear ringing sound (for the case of hard rock strata) is obtain from the rock or as decided by engineer in charge.

9.0) **MODE OF MEASUREMENT AND PAYMENT :**

For the purpose of measurement, initial and final levels in grid of not more than 5x5 mt. shall be taken by cross section method. with levels at each corners.

The rate for the respective excavation incl. necessary lead & lift and disposal of excavated stuff as directed and dewatering, if any.

No payment shall be made for any silt, debris etc that might accumulate in excavated areas on any account. Removal of such, thereof shall be deemed to have been incl. in the tendered rate for the respective item of work.

No extra claim shall be entertained for any excavation in overburden and rock, below those, shown in drawing or instructed.

The rates of the respective item of work are inclusive of all lead and lead specified thereof.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION-2

(H) GENERAL TECHNICAL SPECIFICATIONS FOR EARTHWORK

SECTION 2

(I) GENERAL TECHNICAL SPECIFICATION FOR EARTH WORK

1.0) PREPARATION OF WORK AREA :

- i) **CLEANING THE SITE :** Cleaning and grubbing shall be done in work area & borrow area as directed by engineer in charge. The site should be cleared of all trees, stumps, roots, bush, rubbish and all other objectionable matters. All such materials shall be removed from the site or burnt as directed so as not to interfere with the construction operation and shall be disposed off as directed by engineer in charge. All trees shall be cut down to at least 0.6 mt below ground level. The department will indicate the specific areas which need to be cleared and decision of the engineer in charge in this connection shall be final and binding to the contractor. The measurement and payment shall be made as mentioned in the detailed technical specification of clearing the site of work. If there is no separate item for clearing the site, then rate of respective items for striping, earth work etc shall be considered inclusive of clearing the site and no extra payment shall be made for clearing the site of work.
- ii) **STRIPPING :** The entire area of embankment from u/s to d/s toe, continuous with the area of embankment as shown in the drawing, shall be stripped to a sufficient depth (max. upto 30 cms) as directed to remove unsuitable materials as mentioned in the detail technical specification of respective item of stripping. The stripping shall be carried out in far enough in advance of the other items of works to ensure that no undesirable materials get mixed up with approved embankment materials and to allow for inspection and measurement. The payment for stripping shall be done as per respective item of work.

2.0) BORROW AREAS:

GENERAL :

- i) Materials required for embankment or C.O.T. or back fill which are not available from compulsory excavations of work, shall be obtained from the designated borrow areas.
- ii) The depth of cut in all parts of borrow areas shall be limited to design depth only.
- iii) Borrow areas shall be cleaned and stripped by the contractor, at his own cost to a depth necessary to obtain materials of desired quality.
- iv) All borrow areas shall be operated with certain amount of regularity having regard to convenience of the work during execution and to the safety and appearance of the work after its completion. Decision of engineer in charge will be final.
- v) Temporarily road leading to & from the borrow area as to site of work shall be constructed and maintained by the contractor at his own cost for which no payment shall be made.
- vi) The contractor is expected to have his own assessment and inquiries carried out before tendering for the work. No claims shall be entertained in future due to lack of conformity between the nature of the materials actually met with during construction and that indicated in borrow area plan. If, suitable is brought from other places by the contractor for his own convenience, no extra payment shall be made.

3.0) PREPARATION OF BORROW AREA:

All areas required for borrowing earth for embankment shall be cleaned of all trees and stumps roots, bushes, rubbish and other objectionable materials. Particular care shall be taken to execute all organic matter from the material to be placed in the embankment. All cleared materials shall completely burnt to ashes. The cleared areas shall be maintained free from vegetation growth during the progress of the work.

STRIPPING: Borrow areas shall be stripped as required (maximum unto 30cms) of top unsuitable soil, clods and any other materials which are unsuitable for the purposes. No extra payment shall made for the clearing and stripping done for the borrow area.

4.0) PREPARATION OF FOUNDATION:

Foundation preparation shall be performed subsequent to stripping and excavation, if any. No portion of the embankment should be started until the foundation for that section has been suitably prepared and approved.

5.0) INSPECTION AND TESTS:

Routine field and laboratory tests shall be carried out as per relevant IS code and work shall determine whether the desired results are being attained.

TEST FOR BORROW AREAS:

- 1 Limit excavation to borrow areas as indicated in plans.
- 2 Make visual inspection of excavated soil.
- 3 measured moisture content of borrow area excavated soil on daily basis.
- 4 Take one proctor density test for every 1000 cum of work.
- 5 Prepared daily reports as required.

TESTS FOR EARTH WORK EMBANKMENT:

- 1 Control moisture content by adding the water in soil spread layer according to laboratory instructions.
- 2 Immediately after compaction take field density test, one for every 300 cum of work done, or one test per layer whichever ever is minimum.
- 3 Take one proctor density test for every 1000 cum of work.

6.0) MODE OF MEASUREMENT AND PAYMENT:

- i) The completed work will be measured in cubic meter basis. The quantities shall be computed from the cross section areas of the compacted fill of specified density and on levels basis.

ii) PART PAYMENT:

The tendered rates of respective items represent complete work with all lift. Any care and diversion incl. dewatering if required in the work of earthen dam, it shall be dealt with as per general technical specification of care and diversion incl. dewatering work. The payment of all running bills shall be based on 97% of the quantity measured & payable from time to time for embankment works done. This will be additional retention in amount of work payable over and above other securities recoveries etc. as a safe guard to complete the earth work to its final height.

iii) FINAL MEASUREMENTS:

100% of the work shall mean the final completion of the item of work, for which the engineer in charge shall certify that the item of work shall be operated no more. The final measurement shall be recorded on cross sectional basis as directed by Engineer-in-charge. These will be paid for without any percentage deduction for future settlements etc.

7.0) LEADS AND LIFTS:

All work conditions shall be executed as per leads and lifts specified in the detailed technical specifications of respective item of work. Where the items of earth work specify 'Prescribed or specific lead' the same shall be taken as the lead involved in carrying out the earthwork in the various zones from the borrow areas demarcated and annexed to the tender. The lead provided for all embankment work is up to five km and all lift, unless otherwise specified. If due to some reasons, it becomes necessary to borrow earth from areas outside the designated boundaries prescribed, the contractor shall be bound to do so as.

Signature of Contractor


**Executive Engineer
Rajkot Irrigation Division
Rajkot**

SECTION-2

(I) GENERAL TECHNICAL SPECIFICATIONS FOR REINFORCEMENT

SECTION-2**GENERAL TECHNICAL SPECIFICATION FOR REINFORCEMENT****1.0 MATERIALS:****1.1 MILD STEEL BARS:**

Specification M-5 of section of materials shall apply.

1.2 H.Y.S.D. STEEL BARS:

Specification M-6 of section of materials shall apply

1.3 TMT STEEL BARS:

Specification M-7 of section of materials shall apply

2.0 BINDING WIRES:

Specifications of M-8 of section of materials shall apply.

2.0 SCOPE OF WORK:

Scope of work shall include supplying all materials and labour for cutting, bending, binding, and placing in position steel reinforcement, dowels, anchor, etc. Required quantity of steel shall be procured by the contractor at his own cost.

3.0 REINFORCEMENT WORK:

Steel reinforcement bars shall be placed in position where concreting is to be done, after cutting & bending as shown in the drawing or as directed. Steel bars shall be cleaned of objectionable foreign substances like rust, scale, dirt, grease, oil, etc before placing in position free from any defects and of proper diameter. Bars shall be accurately placed and secured in position by means of bolts in concrete blocks, metallic chairs, rangers, spacers or other suitable devices at sufficient close intervals as directed so they will neither sag between support nor be displaced during the placing of concrete nor by any operations of work.

Special care shall be exercised to prevent any disturbance of the reinforcement, after being placed in position and it shall be maintained in clean condition until it is completely embedded in concrete to prevent further damage to the concrete or unsightly rust stain on exposed concrete surface.

Reinforcement shall not be straighten or bent in manner that will injure or weaken the material. Bars with kinks or bend not shown in the drawings shall not be used. Bars shall be bent to the shapes and dimensions shown in the drawings or as directed, using a barbender, operated by hand or power. The radius for bends along the edge of bar shall not be less than 4 times the diameter of the bar. Heating of bars to facilitate bending will not be permitted, except for large diameter of bars. The reinforcement available from rejected concrete shall not be used.

Reinforcement may be fixed in position by means of anchor rods, supporting and hanger, rods as approved by the engineer. In difficult locations, tack welding of bars at isolated spots may be permitted to keep these bars in position.

4.0 COVERS:

Concrete cover to the reinforcement shown in drawing or as directed shall be maintained by providing cement mortar (1:2) blocks of same w/c ratio as the concrete to be used in the particular work.

Sufficient concrete cover shall be provided to protect reinforcement from erosion and shall be as shown in the drawing or as directed. But it shall not be less than 5cms and more than 10 cms, depends upon type of structures and exposer condition.

5.0 BINDING:

Wire for tying reinforcement shall conform to specifications of materials. All reinforcement bars shall be tied securely by binding wires, so as to transfer the stresses easily. All main bars and distribution bars shall be tied with each crossing, so that spacing of bars remains accurate and cannot be displaced during concreting operation.

6.0 SPLICING / DEVELOPMENT LENGTH:

Bar splices as indicated in the drawing or as specified by the engineer shall only be allowed. The lapped ends shall be placed to ensure full bond on each bar. The development length shall be calculated as per clause no-26.2.1 page no-42 & clause no-26.2.5.1 page no-45 of IS-456-2000 for tension bars/main steel. And for distribution bars/temp. reinforcement bars/skin reinforcement bars, it shall be 30 times the diameter of bars.

Laps splices shall not be used for bars larger than 36 mm, for larger diameters, bars may be welded in cases where welding is not practicable, lapping of bars larger than 36 mm may be permitted, in which case additional spirals should be provided around the lapped bars. The bars to be spliced shall be lap or butt welded by electric welding in the manner specified without loss of strength. Suitable means shall be provided for holding the bars accurately in position during the welding process. Welded joints shall be paid in terms of length of bar equal to 40 times the diameter of the bars. The welded joints shall be staggered as directed. Three percent of the welded joints shall be tested for the tensile strength. Splicing shall not be done in the region of maximum bending moment & splicing of adjacent bars shall be avoided as far as possible. Also splices shall be suitable staggered.

7.0 INSPECTION BEFORE CONCRETE:

No concreting shall be started unless the reinforcement as laid is finally checked and recorded by engineer in charge or by his representative.

8.0 ANCHOR BARS:

Anchor bars and rods are required in connection with installation of gates, etc. shall be supplied by the contractor or by department, as per tender provision, shall be placed in the concrete as shown in the drawing or as directed. No extra payment shall be made for placing of anchor rods.

9.0 DOWEL BARS:

Dowel bars as required for anchoring concrete face to the masonry shall be placed on masonry as shown in the drawing or as directed and included under reinforcement work.

10.0 TESTING:

Testing of steel shall be done for each size of bars as per provision mentioned in specification of materials in government or government approved laboratory. The charges for the same shall be born by the contractor and recovered from RA/FINAL BILL of the contractor.

11.0 MEASUREMENT AND PAYMENTS:

The payment for the steel used shall be paid on the basis of the actual length of bars used and placed as shown in the drawing / bar bending schedule including hooks, bends, laps, etc. The length of the bars shall be measured to the nearest 100 mm. The rate quoted in the schedule of price shall include the cost of supplying, cutting, bending binding, cleaning, straightening, placing, fixing and maintaining in position, including binding wires or welding etc. All steel shall be paid on the basis of the unit weight per running meter for different diameter of bars computed as specified in relevant IS-1786/as specified in Table-D. No separate payment shall be made for supplying and fixing metal wire, ties, supports, separators, chairs, anchor rod, pins, binding wire, random tack weld, etc. used for tying the bars.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

SECTION-2

(F) GENERAL TECHNICAL SPECIFICATION FOR INSTRUMENTATION

1.0 Procurement, Inspection, Supply and Transport of Instruments

The Bidder shall be responsible, at his own costs, for loading, transporting, shipping and unloading of the equipment to be supplied under the contract from the point of manufacture to the final destination of delivery.

Arrangement for secure storage of the goods at designated location near the project site prior to installation shall be responsibility of the Bidder. The Purchaser may, if available, provide such unsecured accommodation as may be available for the purpose on a specific request from the contractor. Watch & ward of the same has to be arranged by contractor at his expenses.

Delivery of the Goods shall be made by the Contractor in accordance with the terms specified by the Department in the Agreement for the contract work.

Contractor shall be responsible till the entire stores ordered for arrive in good condition at destination and are installed, tested and commissioned.

The Bidder shall ensure that all instruments supplied comply with applicable BIS/IS codes, relevant national standards, and Original Equipment Manufacturer (OEM) certifications.

Each instrument shall be permanently marked with:

- Manufacturer's name
- Serial number
- Operating Range
- Accuracy class
- Year of manufacture
- Location ID (tagged during installation)

Testing and Inspection

It is the bidder's responsibility to ensure that the equipment is sufficiently tested prior to the shipment and installation.

The costs for all tests and for all inspections to be made under the contract shall be borne by the bidder along with boarding & lodging, local travel etc., expenses (both in India and/ or abroad) and shall be deemed to be included in the contract price.

The purchaser or its representative shall have the right to inspect and / or test the Goods to confirm their conformity to the contract specifications at no extra cost to the purchaser. The purchaser shall notify the contractor in writing, in a timely manner, of the identity of any representatives retained for these purposes. TA/DA of the inspection team will be borne by the purchaser.

The inspections and tests may be conducted on the premises of the Contractor or its subcontractor(s), at point of delivery, and / or at the Good's final destination.

If any Goods inspected or tested are found not to conform to the contract specifications, the Purchaser shall have the right to reject such Goods. In such event, the Contractor shall, at its own cost and without any additional expense to the Purchaser, promptly replace the rejected Goods or carry out such modifications or corrective measures as may be necessary to ensure full compliance with the specified requirements.

The purchaser's right to inspect, test and, where necessary, reject the goods after the goods' arrival in the Purchaser's country shall in no way be limited or waived by reason of the Goods having previously been inspected, tested, and passed by the purchaser or its representative prior to the Goods shipment from the country of origin. Nothing shall in any way release the Contractor from any warranty or other obligations under this contract.

The inspection of the Goods shall be carried out to check whether the Goods are in conformity with the technical specifications attached to the contract agreement. Complete hardware and software as specified in the contract should be supplied, installed and commissioned properly by the contractor prior to commencement of acceptance tests.

In the event of the hardware and software failing to pass the acceptance test, a period not exceeding two weeks will be given to rectify the defects and clear the acceptance test, failing which the purchaser reserves the rights to get the equipment replaced by the contractor at no extra cost to the purchaser.

Before the goods and equipment are taken over by the Purchaser, the Contractor shall supply operation and maintenance manuals together with drawings of the goods civil works and equipment. These shall be in such detail as will enable the Purchaser to operate, maintain, adjust and repair all parts of the works as stated in the technical specifications.

The manuals and drawings shall be in the ruling language (English). Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purpose of taking over until such manuals and drawings have been supplied to the Purchaser.

For the System software & other Software's, the Contractor shall provide complete and legal documentation of hardware, all subsystems, operating systems, compiler, system software and the other software. The Contractor shall also provide licensed software for all software products, whether developed by it or acquired from others. The contractor shall also indemnify the purchaser against any levies/penalties on account of any default in this regard.

Packing

The contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit, and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the final destination and the absence of heavy handling facilities at all points in transit.

The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the contract, including additional requirements, if any.

Packing Instructions: The Contractor will be required to make separate packages for each Consignee. Each package will be marked on three sides with proper paint/indelible ink with the following:

(i) Project; (ii) Contract No.; (iii) Country of Origin of Goods; (iv) Contractor's Name; (v) Packing List Reference number.

2.0 Installation, Testing and Commissioning

The Bidder shall carry out all civil, mechanical, and electrical works required for installation, including drilling, grouting, cabling, trenching, mounting, and provision of protective measures.

The Bidder shall integrate all sensors with data loggers. Appropriate Hardware shall be provided in the Data Logger to synchronize Analog/ Digital Output from Instrument to Data Logger.

The Bidder shall install the whole system including the laying of cables, installation of new or replacement sensors, data loggers and communication equipment and make the system fully operational. Particular note should be taken of the mounting of the prisms on the face of the dam. The Bidder shall be responsible for working closely with the Engineer-in-charge to coordinate the installation of the prisms and all works and procedures shall be approved by the Engineer-in-charge prior to commencement.

The Bidder shall submit the Test Certificate of Each Instrument mentioned in the Bill of Quantity. As per Requirement of Engineer in charge, The Bidder shall perform the Trial/ Test of Instrument in order to verify the Accuracy, precision, Resolution and other instrumentation Data at Manufacturer Lab. No separate cost for Testing/ Trail of Instrument shall be paid to Bidder.

Department will provide the Power supply for Execution work at the Rate mentioned in the tender document. Power meter to extract the Power from Dam Power line shall be fitted by The Bidder.

Prior to 2 weeks to Handover the Instrumentation and its Data acquisition system to Dam owner, The Bidder shall perform the Testing and Commissioning of fitted instrument and its Basic Operation training shall be Given to Dam Owner and Concern staff.

The Installation requirements for all Water Level Monitoring Instruments: The instruments should be installed so that sensitive equipment such as the data logger, batteries, telemetry radios, and antennas is located well above expected high water to ensure that sensitive instruments are not submerged.

The site must be kept clear of bushes and other hazards to ensure safe access throughout the Warranty and Maintenance period.

Radar or ultrasonic sensors should be mounted such that they have a direct vertical shot to the water surface with no obstruction of their beams. Beam spread must be determined based on manufacturer's specification and the maximum expected distance to be measured at low flows. Consideration should be made in designing the mounting structure to allow for easy access to the instrument for maintenance.

The following inspections and tests shall be performed:

Factory Acceptance Test (FAT)

Factory Acceptance Testing (FAT) shall be conducted in the presence of the Engineer-in-Charge or his authorized representative. The bidder shall prepare and submit a comprehensive Factory Testing Report.

Site Installation and Acceptance Tests

The bidder will install all the equipment's and will undertake tests for each lot of equipment's included in the Schedule of Requirements. The exact locations for installation by bidder shall be decided by the Dam owner in consultation with the bidder. After final configuration and programming, the bidder will conduct an "end-to-end" operational test for each of these installations. A formal check list shall be followed and the results of the tests shall be recorded. The Dam owner's personnel will be trained in conducting the same site acceptance tests. A Site Acceptance Test will be passed if all sensors and data collection platforms obtain and store correct values for a continuous period of 7 days.

Operational Test (OT)

Operational Tests shall be conducted at two stages of project implementation. In each case, any operational problems related to the installations are to be fixed before approval can be received for the system OT. The first OT must be conducted immediately after the first lot of installations has been installed by the bidder. All hardware and software components of this real time network have to be tested. The OT will be considered to be successful if all components as a whole have been operating without problems during at least continuous period of 7 days. Then final OT shall be test for "end-to-end" performance of the entire system for a period of 7 days. The bidder shall demonstrate and document that the system correctly generated 95% of all expected data (normally scheduled data collections and transmissions) for the one week. The bidder will produce a report documenting the quantities of data expected/received and indicating the success/failure of the OT.

Operational testing should be done on end-to-end basis for all the installations to be installed. The test for each installation would include but not limited to:

- Measurement of data by sensors and recording in data-logger
- Setting of datum for water level installations
- Transmission of data from remote site to data center by telemetry
- Reception of data on server and storage in database
- Quality check on data and application of filters for minimum, maximum and rate of change limits
- Presentation of quality checked data in tabular and graphical format on local work installations / servers
- Publishing of data on web portal on real time basis
- Continuous operation of the system for at least 7 days' period for each installation

During OT, all hardware and software components of this real time network have to be tested. The OT will be considered to be successful if all components as a whole have been operating without problems during at least 7 days period. OT will be witnessed by the Dam owner's designated representatives as each lot / batch of installations are completed.

Ideally all the installations should pass the OT before going to next stage, which is Final Acceptance. Once at least 90% of the total installations pass the OT, the bidder is eligible to go next stage, which is final acceptance.

Final Acceptance

The final Acceptance shall be provided after test for "end-to-end" performance of the entire system for a period of one month. The Bidder shall demonstrate and document that the system correctly generated 100 % of all expected data (normally scheduled data collections and transmissions) for the one-month period. The Bidder will produce a report documenting the quantities of data expected / received and indicating the success / failure of the test. The test will be repeated until the 100 % success level is achieved.

When the system has passed the Final Test, the Bidder can apply for Final Acceptance. When Final Acceptance is given, the system will be officially considered to be under Warranty.

Before awarding the final acceptance, all the contractual requirements like trainings, user manuals, tool kits, installation and commissioning of data center at field control room and State control room including all the software and hardware etc must be complete in all respect.

3.0 Establishment of Real time monitoring Data Acquisition network and IT infrastructure

The Bidder shall integrate all field instruments with the following systems:

- RTDAS & SCADA system
- Field Control Room
- State Data Surveillance Room at Center of Excellence, Gandhinagar

The Bidder shall ensure that uninterrupted data communication shall be provided by installed Data Acquisition system through latest technologies, including wired, wireless, GSM, and/or satellite-based systems.

The Bidder shall design and implement secure data storage (on National Information Center Server), backup, and cybersecurity protocols in accordance with applicable standards.

Access to data shall be role-based: regional-level data will be available to the respective Regional Head, while dam-specific data will be accessible to the concerned Dam In-charge.

The historical data available must be incorporated into the new monitoring system. The monitoring system must be capable of accepting manual observations of non- automated sensors, as well as additional manual geodetic or other observations which may be observed as and when required. The system should be

capable of continuous monitoring of data from sensors in the Dam. Data will be collected from Instrument to Data logger at field control room to NIC Website and its access shall be given to Centre of Excellence, Gandhinagar.

The proposed solution must provide complete, unfiltered raw data at the local server/system level. The client shall have direct access to this raw data, and no restrictions, limitations, or filtering of the raw data will be permitted.

1. Wireless Communication Security

- The system shall support AES (Advanced Encryption Standard) encryption for all wireless communications.
- All data transmitted between field devices and the central coordinator shall be encrypted to prevent interception, packet sniffing, or unauthorized access.
- The encryption mechanism shall comply with IEEE 802.15.4 or equivalent secure wireless communication standards.

2. Secure TCP/IP Communication

- The system shall operate on configurable TCP and UDP communication ports.
- The communication ports shall be user-configurable to avoid security conflicts.
- The system shall restrict communication only to designated and authorized ports.

3. Firewall Compatibility

- The application shall support integration with standard operating system firewalls.
- The system shall allow configuration of firewall exceptions where required.
- The solution shall not require disabling of firewall protections for normal operation.

4. Connection Integrity Monitoring

The system shall support TCP keep-alive mechanisms.

Configurable parameters shall include:

- Keep-alive timeout
- Keep-alive interval
- Maximum retry attempts

The system shall detect broken, interrupted, or unauthorized session attempts.

5. Client-Server Architecture

- The system shall operate on a secure client-server architecture.
- The solution shall support controlled client access to the monitoring server.
- The system shall allow restricted access or limited operational permissions for client users.

6. Local Data Storage & Log Management

- The system shall store measurement data and diagnostic logs locally on the designated server/system.
- The solution shall allow configurable data cache and log management parameters.
- The system shall provide secure log retention without mandatory cloud dependency.

7. Time Synchronization & Audit Integrity

- The system shall support automatic time synchronization between server and field devices.
- Field devices shall maintain an internal real-time clock with backup capability.
- All recorded data shall include accurate timestamping to ensure audit integrity.

8. LAN Configuration & Network Control

The system shall support operation in isolated private LAN environments.

The solution shall allow configuration of:

- Static IP addressing
- DHCP enable/disable
- DNS configuration
- Gateway configuration
- Custom communication ports

The system shall be deployable without requiring internet connectivity.

9. Additional Deployment Security Requirements

- The system shall be capable of operating within segregated VLAN environments.
- Remote access, if required, shall be enabled only through secure VPN configuration.
- External internet access to communication ports shall be blockable through standard network controls.

The Bidder will be required to install all computer systems, software and ancillary devices. The Competent Authority/dam owner will provide space to install equipment at Center of Excellence, Gandhinagar and at field control room at Dam Sites. Specification and arrangements of IT infrastructure is as per table B-25 attached

Supply of Computer rack, Uninterruptable Power Supply pack, table, chair, electronic displace boards, etc. are included

The bidder shall establish the Communication Network for real time monitoring as follows:

- The supplier should provide connectivity from the remote dam sites to the State Data Surveillance Room at Center of Excellence, Gandhinagar through Cellular Modem network.
- The real time data collected at the dam sites shall be transmitted to the field control room at dam site and the same data shall be transmitted to the Center of Excellence, Gandhinagar through cellular modem network and its multiple access shall provide to Concern Field office and Centre of Excellence, Gandhinagar.
- The Bidder should carry out the feasibility site survey for the Mode of Data transmission which is best suitable to Concern Dam. Mainly 1) Cellular modem 2) Fiber optical Lines 3) Direct GPS Internet, which ever suitable for Dam shall be incorporate in the Bid.
- The Bidder should provide complete Cellular Modem Network communication equipment with all interconnecting cables at each remote dam site and State Control Room.
- The communication network should support full duplex communication between Center of Excellence, Gandhinagar and each remote dam site in the network.
- The communication system should be reliable and it should provide 95% or more data availability throughout the year at any climate condition.
- The supplier should provide satellite Bandwidth in Extended C Band in locations wherever Cellular Modem Network system is installed.
- The Bidder shall obtain the required mobile connections and suitable data plan for the installation of cellular modem at the remote dam sites wherever required.
- The data charges for the mobile connections shall be paid by the supplier till the completion of the Comprehensive Warranty and Operation & Maintenance period.

- The Bidder should provide DC operated cellular modem equipment at the remote dam sites.
- Power unit (Cellular modem) :
- The Cellular Modem Network system battery shall be charged by the solar module as well as the battery charger. The battery, solar module and battery charger should be provided by the Bidder with necessary interconnecting cables.
 - i. Battery 12V, 100AH (2 Nos.) Sealed Maintenance free VRLA make Exide / Amaron / HBL or equivalent.
 - ii. Solar Module 12V, 100W (1 No.) High efficient Solar cells make Tata Solar / adani Solar/Vikram Solar / Waaree or equivalent.
 - iii. Solar charge controller (1 No.) Morning star or equivalent.
 - iv. A rugged and reliable AC-DC charger Output 12V, 10A to be provided. As the dam locations are remote, a spare AC-DC charger should be provided as a standby.

The Bidder should provide iron mesh caging for solar module to avoid monkey menace at the remote dam sites wherever required.

Installation at Field Control room on dam sites

The Bidder will be required to install all computer systems, software and ancillary devices as mentioned in tender document. The dam owner will provide space to install equipment at offices in State control room and field control room at Dam Sites.

Field control room equipment

The supplier should provide the following Equipment at Field control room. Workstation computers (3 Nos.) (One Primary data acquisition computer for field control room, One Secondary data acquisition Computer for sub-divisional office and One computer at division office are required) and Colour Laser Jet Printer (1 No.)

- Ethernet Switch (1 No.) and cables to connect three computers and Printer
- On Line UPS (1 No.) (to provide backup of 2 hours for three Workstation computers, Cellular Modem and Ethernet Switch)

The installation and commissioning of the data acquisition software shall be carried out by the supplier.

4.0 Calibration, Verification and Performance Validation of Instrumentation

The bidder shall be responsible for the calibration of all instruments at the time of installation and at regular intervals thereafter, in accordance with the manufacturers (OEM) recommendations and/or as directed by the Engineer-in-

Charge. This activity shall form an integral part of the Operation and Maintenance (O&M) scope.

Calibration Requirements

Conduct initial calibration at the time of installation.

Perform periodic calibration of all instruments as per OEM specifications, prescribed standards or as directed by Engineer-in-Charge.

Data Validation

Ensure accuracy and reliability of instrument data through validation and cross-verification with manual measurements or reference standards.

Documentation and Reporting

Prepare and submit calibration certificates for all instruments to the the Engineer-in-Charge.

Maintain and provide verification and calibration reports as required by the Engineer-in-Charge.

5.0 Training and Capacity Building

The Bidder shall provide training to the Dam owners for proper operation of the monitoring solution, including but not limited to the handling, basic maintenance of equipment and for taking readings and analysis of data. Hands on experience and troubleshooting session shall be carried out before the handover of the handover of the system.

The Bidder shall be capable of providing additional training on request of the project Engineer-In-charge as and when required shall not be chargeable for existing monitoring and system setup.

Training Programme

Training shall also be provided by the bidder in multiple phases during the O&M period. The training shall include both classroom and field trainings and will be continued during all five (5) years. The bidder is required to have hydro-meteorological, geodetic, seismic & geotechnical equipment specialists.

The training shall include:

Sr. No.	Description	Number of Training Sessions	Max. Number of Participants
1.	User Training Course for Senior Management	2	10
2.	User Training Course including Operation & Maintenance course for working staff Course topics will include; sensor calibration, data logger configuration, data downloading, 10 data retrieval, collection, compilation, processing, maintenance requirements, errors handling & procedures for equipment configuration, installation, site testing & Commissioning.	2 Training Each of 2 Days	3 may be altered by the Dam owner

The Bidder is responsible for the salaries of the training instructors & all training materials.

The training course will take place at Dam owner's requirement. In case of formal training, the Dam owner will provide classroom and other logistics. The Bidder will facilitate the professional and the training material. On-the-job training will be provided by the Bidder in conjunction with the installation of hydro-meteorological, geodetic and geotechnical installations and during the course of maintenance as required.

These trainings will be repeated every year during warranty & Comprehensive Operation and Maintenance Contract periods for refreshing the trained staff and training additional staff.

The classroom training, hands on experience and troubleshooting will be prepared as video for easy access and will be posted on the web. All training modules will be also provided as a media file (Windows Media Player Compatible) on a USB Drive. Five copies on five separate media shall be required.

6.0 Documentation and Submittals

The Bidder shall submit complete documentation in English for all equipment and software components supplied, including user manuals and operation & manual.

In addition, the Bidder shall prepare and submit a project-specific System Operation Manual covering the following:

- Detailed equipment layout
- Procedural handbook
- System block diagrams (logical connections)

- Wiring diagrams
- Interface specifications, including communication protocols and configuration modes
- Software licenses
- Calibration and testing certificates
- Instrument operation manuals
- Maintenance schedules and guidelines

The documents will also be transformed in to web-based helpline. The manual shall be provided both as hardcopy and pen drive (20 copies).

Instrumentation Analysis report

The Bidder shall submit an instrumentation analysis report on a quarterly basis throughout the Operation and Maintenance (O&M) period. In addition, an annual instrumentation analysis report shall also be submitted during the O&M period.

The Dam Instrumentation Analysis Report should include the following:

1. Detailed description of all instrumentation

- Summary of all instrumentation
- A plan view drawing of the dam should be developed with the name and location of all instrumentation.

2. Compilation and presentation of available and new instrumentation data (Historical data shall be provided by the Dam owners for this analysis)

- Uplift Pressure Variation Hydrograph
- Piezometric hydrographs
- Flow measurement hydrographs and
- reservoir level correlation plots
- Dam Movement Monitoring Hydrograph

3. Data analyses

- In conjunction with developing instrumentation data plots, the bidder should analyse the data to evaluate the dam's performance, identify any concerning trends or data points, and assess whether any data gaps exist that warrant the installation of additional instrumentation.

4. Summary of findings and recommendations

- A summary section should clearly itemize conclusions and recommendations.

The details included in the Instrumentation Analysis Report are not limited to those mentioned above. The same shall be reviewed, verified, corrected, or

supplemented by the Dam Owner in accordance with site requirements, and the necessary actions arising therefrom shall be carried out by the Bidder.

7.0 Operation and Maintenance Support

The Bidder shall provide comprehensive operation & maintenance services for a period of 60 months (5 years) after final acceptance of equipment.

Application of data collection software, and all other software packages that are procured by specialized personnel to be provided by Bidder. The personnel will have a firm grip of the software and be capable of training the Dam owner's officials as requested by the Dam owner. The personnel will assure that the data transmitted to the Center of excellence is being properly stored on base installation software.

The personnel will serve in providing assistance in maintaining the computer server and all software packages and all other activities.

All the activities must be carefully coordinated with the Dam owner. Regular dialogue is required between the Bidder and Dam owner.

The Maintenance services will include the following activities:

Maintenance of observation network including:

- Preventative Maintenance (PM) of observation network to occur every 3 months or sooner whereby each installation will be visited at that interval or sooner.
- Emergency Maintenance (EM) of observation network as required (installations down or delivering questionable data).
- Document maintenance visit, whether PM, using software specified and to be acquired by the Bidder.
- Provide monthly maintenance reports accounting for all field visits performed, nature of visits, action taken.
- The bidder shall make arrangements to ship the required equipment for maintenance. He shall receive those and maintain the same. He is also responsible for maintaining document equipment inventory.

Maintenance Reports

There is a requirement for the Bidder to provide monthly operation & maintenance reports during the warranty period. The reports shall be submitted on the 7th day of every month documenting the previous month's activity. The reports must include an accounting of all installation, or visits, actions taken.

Hand Holding Support Services

For Hand holding support in managing the operation of system: minimum one additional system engineer shall visit the site for two days in each quarter for five (5) years to facilitate data gathering and analysis from the instruments installed and resolve difficulties encountered / provide solutions resolve required to keep system operational. It shall not be paid separately.

Backup of Data

The monthly backup of data is to be provided by the Bidder before 5th day of next month with external hard disk/stick or any suitable digital backup system

8.0 Warranty

The warranty period shall begin immediately after all instruments have been commissioned and final acceptance accorded. The warranty and Comprehensive operation & maintenance period will last for five (5) years', during which time the Bidder will be responsible for the comprehensive operation and maintenance of the entire network. The Bidder will be responsible to replace faulty or damaged equipment.

The Bidder shall electronically record all maintenance activities using the software specified elsewhere in this document. Monthly maintenance reports shall be submitted to the Engineer-in-Charge, summarizing the number of visits conducted, sites attended, and the purpose of each visit. The Bidder may also be required to perform ad hoc queries or analyses as requested by the Dam Owner/Employer.

The Bidder shall deploy and utilize adequate staff as required for the proper execution of the works. The Dam Owner shall provide office space for instrument technicians; however, all costs related to transportation, ancillary equipment, tools, and consumables shall be borne by the Bidder.

The instrument technicians shall restore any installation or sensor outages within 48 hours of occurrence. For this purpose, technicians shall be stationed at the Field Control Room or State Control Room, as directed by the Engineer-in-Charge.

An Information Technology Specialist shall also be provided to maintain the newly procured and commissioned Field Control Room servers. The Dam Owner shall provide office space for the IT Specialist. The IT Specialist shall be responsible for overseeing data collection, and managing system hardware and software.

9.0 Additional Conditions during Warranty & AMC period:

In case of theft or damage to the telemetry system due to vandalism, the Contractor shall be responsible for repairing or reinstalling the affected components in accordance with the conditions of the contract. The payment for such repair or replacement work shall be made by the Engineer-in-Charge based on the approved item rates specified in the tender during the Operation and Maintenance (O&M) period. This replacement shall be in addition to the damage caused by the river waters during monsoon/non-monsoon period.

The bidder shall have an operational branch office in the State of Gujarat. In case the bidder does not have an existing branch office in Gujarat at the time of bidding, the bidder shall establish the same before commencement of the contract.

The Contractor shall make suitable arrangement to ensure that it's representative mandatorily visit each telemetry station once in a month and submit a certified report of matching telemetry data with the manual data.

10.0 Payment Schedule

Sr. No.	Activity	Payment to be given to Bidder
1.	Milestone-1: Delivery, Installation, operational, testing, commissioning and acceptance by the Engineer-in-Charge of instruments on dam site	65 % of contract value
2.	Milestone-2: Training	5 % of contract value
3.	Milestone-3: Operation, Maintenance, Documentation and Submittals During O&M Period (For Five (5) year)	30 % of contract value
	1 st Year O&M- 5 %	
	2 nd Year O&M- 5 %	
	3 rd Year O&M - 5 %	
	4 th Year O&M - 5 %	
	5 th Year O&M - 10 %	

The Supplier shall obtain the Acceptance Certificate in triplicate from the officer in charge of the equipment, not lower than the rank of Executive Engineer, when it is installed & the same should also be in the format as follows:

Acceptance Certificate

Certified that the following equipment's were supplied and installed by

The Supplier

The above equipment has been calibrated, validated & are functioning satisfactorily.

Executive Engineer

Office of

.....

11.0 Personnel Requirements

Operational Engineer

During the stretch of each monsoon period, the bidder shall be deploying a qualified and experienced technical staff having sound knowledge for maintaining "Data Collection Centre" and other equipment/sensor/IT/ITES/ICT and devices as residential resource engineer at dam site for the Throughout contract period..

The remuneration of deploying the residential technical staff shall be bear by the bidder including the salary, Insurance, staying, flooding, lodging & boarding etc.

The detail updated resume of two shorted candidates having experience to manage the dam site as resource engineer, bidder shall send all details of them for the screening and getting administrative approval from Project Engineer In charge before the final for nomination of candidates. The bidder shall be deploying one of the nominated technical staff either/or among two screened resumes as resource engineer. The shuffling resource engineers may be carried by bidder as per requirement and event of needs.

Project Engineer

The instrumentation & Monitoring activities under this O & M contract shall be carried under the supervision of qualified and experienced geotechnical engineer shorted by bidder after getting approval from project Engineer-In Charge. The bidder shall submit detailed resumes for screening of candidate having minimum 5 years of domain experience with project management skill for handing similar prototype of techno management works.

The geotechnical engineer shall have the understanding of dam safety monitoring principal, construction behaviors, instrumentation, hybrid communication network, deliverables to dam authority, necessities and priorities to be recognized. The engineer shall to install, maintain, and read the instruments properly and shall instruct field engineer remotely to look for the way engineering changes in the data and troubleshooting in system required with diagnostics. The engineer shall be capable of understating for any significant changes by reading the data and can rapidly brought to the attention of the engineer in charge/project authority.

The bidders shall ensure that the technical operator/field staff assigned the responsibility to handle the O & M works, thereby creating a sense of involvement and motivation and permitting the engineer to concentrate on interpretation of the data. The assigned staff shall be capable of collecting, reducing and evaluating data taken through portable reader and taken manually from gauges.

The Bidder shall also ensure that the deployed technical staff having sound knowledge of dam safety, common causes of dam failures and incidents, identification of signs of potential distress any event recorded, observed and collected visually. Deployed engineer also shall be capable for understating any abnormal unusual conditions, signs of potential distress, or emergency conditions occur shall be taken on defined tabulated format.

The geotechnical engineer and Technician/operator's updated Resume, degree and experience certificate shall be submitted by Bidder during bidding with the tender document as mandatory required technical documents.

Sr. No.	D & R-Role-Duties & Responsibilities	Qualification & Experience (Minimum)
01	Operational Engineer	ITI in Electronics/Electrical/Instrumentation; 3 years of experience in O&M for Dam Instrumentation and Monitoring (IT, ITES, ICT, Geodetic, Hydro meteorological, Geotechnical sensors, DAS, Data logger and components of Electrical System, Panel) etc. Experienced in execution of preventive and non-maintenance and troubleshooting
02	Project Engineer	B.Tech/ BE/ Electronics/Electrical/ Instrumentation/ Computers; 5 years of experience in O&M of Dam Instrumentation and Monitoring (IT, ITES, ICT, Geodetic, Hydro meteorological, Geotechnical sensors, DAS, Data logger, Calibration, Collection, Processing, Reduction and Evaluation and components of Electrical System, Electrical Distribution, Electrical Panel with Data Analysis and Plotting Etc. Experienced in execution of preventive maintenance schedules and troubleshooting of UPS, DG Sets & Transformers

The project requires the Bidder to provide one technician having graduate degree is required experience of handling this equipment for O &M, positions to fill the tasks of hydrometeorology, geodetic, geotechnical, seismic and computer systems & software support. The personnel will be required to be dedicated to the project as scheduled below, and will remain onsite for the period of the schedule. Engineer-in-Charge will provide office space and furnishing (desk, chair, cabinets) for the Bidder provided staff at Dam sites. The staff will have their own arrangements for reliable transportation which will also be supplied by the Bidder. It is required that the vehicle being used shall be capable of holding and securing all of the equipment used for field measurements.

Standards & References

The guidelines listed below shall be referred to and followed for the execution of all instrumentation works

- DRIP guidelines for instrumentation of large dams, January-2018
- CWC Technical manual on instrumentation of dams, December-2022
- DRIP Technical specifications of Hydro-meteorological, Geodetic, Geotechnical and seismic Instruments, January-2018

Responsibilities of Dam Owner

The Dam owner will be responsible for:

- Provide all necessary site access and facilitate drilling/sampling operations.

- Support in obtaining statutory/administrative permissions for site activities.
- Provide original as-built drawings and instrumentation plan
- Obtaining government approvals as required.
- Assist in import / customs clearance by issue of recommendatory letters
- Direct the Bidder in transportation of equipment to the installation sites.
- The Dam owner is responsible for issuing recommendatory letters for obtaining permissions to use radio frequencies.
- The Dam owner is responsible for providing office space for the technical staff being requested on this contract

12.0 Responsibility of Bidder

The Bidder will be responsible for obtaining all special tools and equipment necessary to make the installation. The Bidder will be responsible in acquiring vehicles for field use and paying all expenses related to these vehicles. The Bidder is responsible for obtaining office devices and supplies for their use, such as computer printers, paper stock, pens, etc.

The Bidder will be responsible for acquiring computers for field use, and prepare reports, etc. The Bidder will be responsible for acquiring internet connectivity.

The Bidder's Services will further include, but is not limited to, the following elements:

The Bidder is responsible for offering all work and supplying all accessories to ensure that all upgraded components are complete and operational upon acceptance.

- Design, configuration, integration and programming of each type of measurement installation according to the Scope of Bid & Technical Specifications given in Schedule of Requirements. Provision of detailed instructions and standard design drawings or blueprints of the equipment required for installation. The Bidder shall carry out the 'last mile connection civil works' required for installation.
- Supply and Installation of all hydro meteorological, geodetic and geotechnical instruments & apparatus, sensors, data loggers, and cabling including protective conduit.
- Supply and Installation of all power supply equipment required including solar panels, batteries, and cabling with protective conduit.
- Delivery of spare parts based on a complete list of recommended spare parts to be provided by the Bidder. Performance testing of all instruments and equipment prior to shipping.
- Commissioning of the entire system/network after installation.

- Design and implementation of a training program for the staff of Dam owner that covers all aspects related to the installation, configuration, operation and maintenance of components. The training will include field training on proper data acquisition methods and classroom training on data management. Training will be conducted at the field and office locations selected by the Dam owner.
- Train Dam owner's staff on basic statistical, graphical and reporting capabilities for data conversion and related computations. This should include the aggregation and summary of all data (e.g. hourly to daily data, means, maximum, and minimum values).
- Supply, install, and configure all software required for the operation of each network component, including hydro-meteorological sensors, geodetic sensors, Geotechnical sensors, Seismic sensors data-loggers, and other instruments.
- Supply and design web-based server for data collection, analysis, archival, and dissemination.
- All the devices including Desktop shall be provided with anti-virus protection software including annual subscriptions by the Bidder, during the Contract Period, including Comprehensive Warranty and Operation & Maintenance period Delivery of full documentation related to all components of the network, including operation and maintenance manuals in English, system integration diagrams and wiring diagrams.
- Provide country of origin for all major equipment and materials.
- Bidder shall Establish his own service centre or a service agent in Gujarat, India.
- Ensure that all software licenses and maintenance agreements are in the name of Dam owner and should seek full support and updates for such software for the duration of the warranty and Comprehensive Operation & Maintenance Services for 5 years.
- Provision for expansion of Dam monitoring software in both hardware (data-logger) and software (such as server).
- The Dam monitoring software should have the facility to track the non-functional sensors on a daily basis and display on the web. It should also display the charges recoverable from the Supplier on a monthly basis for the non-functional sensors and data lost in sensor-days.
- The Bidder will be responsible for the site installation of all the equipment including the required 'last mile connection to civil works. Bidder is responsible for providing sufficient and correct documentation on the civil works and installation, including site-specific features such as lightning protection and power supply for purposes of supervision by the Dam owner. The bidder shall provide report with location of all installed devices in dam after installation of instruments.

13.0 Plans and Schedules to be provided by the bidder

A project execution plan shall be provided after award of Contract, including system design block diagrams, a list of critical engineering activities, a manufacturing & delivery schedule, the proposed training program, as well as guidelines & standard drawings for civil works.

14.0 Field Visits

For installation and subsequently for maintenance of the installations, the Bidder must have team of technical staff to meet the requirement and equipped for field visit. As back up, the system must be designed in such a way and the training component must be strong enough that equipment installation at remote installations can also be done by the Dam owner's national staff, if required. Appropriate training courses shall be conducted by the supplier's experts. All systems must be preassembled and an end-to-end test must be passed prior to installation.

15.0 Geographical and Ambient Specifications

All materials and equipment supplied under these specifications shall be suitable for being delivered, stored and operated under continental conditions with changes of temperature between winter and summer and between day and night. It is the Bidder's responsibility that the offered equipment / configuration be appropriate for the locations and climatic conditions in Gujarat.

16.0 Units

Measurement units of all the equipment / systems to be procured shall be metric system.

17.0 Civil Works

The Bidder shall provide the detailed instructions and standard design drawings like footprints of the equipment required for installation. All civil works are included in Bidder's responsibility during installation & during Comprehensive O & M period.

The civil works related to installation of equipment are responsibility of the Bidder.

18.0 Spare Parts

A list of mandatory & recommended high-usage spare parts and consumables for a period of five (5) years of operation must be submitted by the Bidder and include the cost of these spare parts & consumables in Comprehensive Operation & Maintenance price schedule. High-value spare parts, such as entire components, shall be included in this list. The Bidder shall indicate a number of spare installations to be supplied which are not intended for immediate installation. These spare installations will be available for short-term replacement of damaged

or malfunctioning installations, while arrangements are made for repair, warranty or replenishment of spare parts.

The Bidder shall ensure that Instrument installed under the Dam instrument bid must have spare parts support from Original Equipment Manufacturer not less than 05 Years from the Date of installation. Even after, obsolete of Instrument from the market, Spare parts required during maintenance must be provided by OEM through Bidder.

In addition, the Bidder must submit a complete listing of spare parts for each equipment component (data loggers, power supply, etc.) and consumables valid for Five (5) years from the date of Final Acceptance. Cost of these spares and consumables shall be included in contract price.

19.0 Lightning Protection

Each installation shall employ a grounding system that will protect the electronic equipment from electrical surge caused by lightening. The system will consist of a single point grounding system which will tie all grounding wires to a copper grounding plate. The plate will then be connected with a copper grounding strap to a grounding rod. Antenna cables will utilize polyphasers to protect the data collection platform and radios from lightning damage. The Bidder will provide all parts for this installation and properly install the Single Point Grounding System at Data center.