

ANNEXURE - 1

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

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CHAPTER-I
GENERAL CONDITION
&
WORK AND SITE CONDITION

GENERAL **CONDITIONS**

1.0 DEFINITIONS:

In the contract(as hereinafter defined), the following words and expressions shall have the meanings hereby assigned to them.

- (a)** Approved/Approval :-
 Means approval in writing.
- (b)** Construction Plant :-
 Means all equipment, appliances or things of whatsoever nature required for the execution, completion or maintenance of the work or temporary works but does not include materials or other things intended to form or forming part of permanent work.
- (c)** Contract :-
 Means the instructions and information for tenderers, general and special conditions of contract, specifications, drawings, tender (including schedules of quantities &tender prices), the formal agreement and all addenda and attachments related to the above.
- (d)** Contractor :-
 Means the particular person, firm or corporation with whom the contract has been made for executing the works.
- (e)** Drawings :-
 Means the drawings referred to in the specifications, any modifications of such drawings approved in writing by the Executive Engineer, and such other drawings as may from time to time be furnished or approved in writing by the Engineer-in-charge.
- (f)** Engineer-in-Charge :-
 Means the Engineer-in-charge of the works, specified parts of the works under the contract or such other departmental assistants or subordinates to whom the Engineer-in charge may have delegated certain duties, acting separately within the

scope of the particular duties entrusted to them.

The contractor will be given a copy of the Government authorization designating the Engineer-in-charge by name and delegating him his authority at the time when contract is signed. It is however, to be distinctly understood that, no delegation of powers shall be made to such departmental assistants or subordinates, except in respect of supervision to ensure compliance of the contract conditions.

(g) Government :-

Means the Government of Gujarat, Narmada, Water Resources, Water Supply & Kalpasar Department or Employer or Owner.

(h) I.S.S. :-

Means Indian Standard specifications.

(i) Day :-

Means a day from midnight to midnight.

(j) Month :-

Means from the beginning of a given date of calendar month to the end of preceding date of the next calendar month.

(k) Week :-

Means seven consecutive days.

(l) Rupees :-

Means Rupees of Indian Currency.

(m) Site :-

Means the lands and other places on, under, in or through which, the works are to be executed or carried out and any other lands or places provided by the Owner for the purposes of the contract together with such other places as may be specifically designated in the Contract or subsequently approved as forming part of the site.

(n) Superintending Engineer :-

Means the Superintending Engineer in overall charge of the works.

(o) Temporary Works :-

Means all temporary works of every kind required for performance of the Contract.

(p) Works :-

Means the works to be executed in accordance with the contract.

2.0 CONTRACTOR'S OBLIGATIONS:

The contractor shall be deemed to have carefully examined the works and site conditions, the Specifications, Schedules and Drawings and shall be deemed to have fully acquainted himself regarding the local conditions.

If he shall have any doubt as to the meaning of any portion of these General Conditions, the Special Conditions, the scope of the work, the specifications or any other matter concerning the contract, he shall in good time before submitting his tender set for the particulars thereof, and submit them to the Engineer-in-charge that such doubt may be removed.

2.1

The Contractor shall unless in the cases specially provided for, make all payments at his own expenses, undertake to do all things and supply all labour, materials, constructional plant, temporary works, transport, supervision and everything whether of a temporary nature or permanent nature required in and for construction, completion and maintenance of the works and for performing the obligations of the contract for which Narmada & Water Resources Department would have to undertake to do or Narmada Water Resources and Water supply Department had carried out the construction, completion and maintenance of works.

3.0 GOVERNMENT AUTHORISED TO WITHHOLD PAYMENT DUE TO THE CONTRACTORS:

The Government shall have a lien over all money payable to the Contractor under this contract and also over his Security Deposit withheld or recoveries made under the relevant clauses of this Contract in respect of any Government Tax or taxes or other moneys which may become payable to Government by the Contractor, either alone or jointly with another, under any provisions of the Government Acts or any other statutory enactments in force, in modification or substitutions thereof. Government shall at all times be entitled to deduct the said sum of taxes due from contractors from the moneys, securities or deposits which may become payable or returnable to the Contractor under this contract.

4.0 AUTHORITY OF THE ENGINEER-IN-CHARGE:

Said in 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 or any matter (whether mentioned in the contract or not). The Engineer-in-charge shall decide all questions which may arise as for quality and acceptability of materials furnished and work executed, manner of execution, rate of progress of the works, interpretation of Plans & Specifications and acceptable fulfillment of the contract on the part of the Contractor. He shall also determine the amount and quantity 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 pertaining to the contract and his decision shall be binding upon the Contractor.

The Engineer-in-charge shall have the power to enforce such decision and order. If the contractor fails to carry out the same promptly, i. e., 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.

5.0 CONTRACT DRAWINGS & SPECIFICATIONS:

- A. Supply of sets of contract drawings and certified copy of accepted tender will be governed by Engineer-in-charge.
- B. The drawings which form part of these specifications show the work to be done in as much details as is possible at the stage of tender invitation. They will be supplemented or superseded by such additional detailed working drawings as maybe necessary as the work progresses. The contractor shall perform the work on these features and in accordance with these additional detailed or revised working drawings at the applicable rates and terms as per the contract. Revised and/or additional drawings will be available for inspection in the office of the engineer - in charge 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 the description of the engineer and the contractor will be charged Rs.100 (One Hundred only) for each of such additional copy of the drawings.
- C. He contractor shall check all drawings and tender specifications carefully and

advise the engineer-in-charge immediately if any errors or omissions are noticed. The contractor shall not take undue advantage of any kind of error or omission in the drawings and tender specifications supplied.

6.0 USE OF SITE:

- A. The contractor shall be permitted to use the land as specified in the permanent occupation of the work. He will also be allowed during the period of his contract the use of any other lands at the rate specified under the clause-54 of tender in the vicinity of the works as and when the engineer may consider such use to be necessary for the classified purpose of work. The contractor shall not commence any operation on such lands without prior approval of the engineer.
- 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 the area 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 any damage or alterations made to the areas which he has to hand back or to other property or land handed over to him for the purpose of this work.
- C. The contractor shall preserve all existing vegetations such as trees on or adjacent to the site which do not interfere with the construction as determined by the engineer. The contractor shall take all possible precautions in felling trees authorized for removal to avoid any unnecessary damage to vegetations and the trees not to be fall on structures under construction or workman 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.
- D. The lands shall as herein before mentioned, be handed over back to the engineer within six months after completion of the work under this contract. Also no land shall be held by the contractor longer than the engineer shall consider or deem it necessary and the contractor shall on due notice by the engineer vacate and return the land which the engineer may certify so as no longer required by the contractor for purpose of the work.

7. BASE LINES AND GRADES:

- A. Permanent base line (and cross lines) shall be established at sufficiently close intervals with bench marks at all corner points to serve as "Reference Grid".

The contractor shall provide at his expense, all templates, pillars, stacks, equipment, materials and labour for establishing the grid lines and pillars & preserve during the whole period of construction. These shall be laid out with prior approval of the engineer-in-charge. No base line or bench mark or reference mark shall be used as reference line, or bench mark or level for the work without prior approval of the engineer. The contractor shall maintain certified copies of such approved reference lines, marks and levels and shall not remove any of them without prior approval of the engineer.

- B The contractor shall further lay out the work from these reference base lines in consultation with the engineer and shall establish level 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 and grades as may be specified on the drawings or established or indicated by the engineer.

8. FENCING, LIGHTING & VENTILATION:

- A. Except as hereinafter provided, the contractor shall, unless otherwise specified, be responsible for the fencing, lighting, ventilation, taking of necessary safety measures for all works included in the contract and/or for proper provisions of temporary roadways, foot ways, guard, fences, caution notice etc. as far as the same may be necessary by reasons of the work, for the accommodations of workmen, for passengers or other traffic and of the owners and occupations of adjacent property and the public and shall remain fully responsible for any accident that may occur on account of his failure to take proper and timely precautions.

B. LIGHTING:

All the work, approaches and galleries shall be adequately illuminated with electric lights to the satisfaction of the engineer. The power lighting connection, wiring equipment shall be subjected to the inspection and passing by Electrical Inspector to Government, authorized under the Indian Electricity Act. Any addition & alteration or omission shall be got approved from the engineer and got certified from the Electrical Inspector. Work spots such as faces of excavation, concreting and masonry work, grouting etc. shall be adequately flood lighted to the satisfaction

of the engineer. All costs involved in drawing low tension or high tension lines, meters, switches, starting and lighting accessories are to be borne by the contractor. Assistance may be given by the Department in the form of expediting power supply release and connections by Gujarat electricity board. Wherever, if more than one agency is working in the area, the contractor who has provided lighting arrangement, shall extend the facilities to the other contractors who shall pay for such facilities at mutually agreed rates. In case of dispute, the matter shall be decided by the engineer whose decision shall be final.

C. VENTILATION:

All galleries, cross drains, adits, stair wells, shall be properly and adequately entilated by a system of ducts and fans to the satisfaction of the engineer. Positive artificial means of ventilation shall be employed and shall be in operation at all times. When more than one agency is working at one location, all the agencies should cooperate with each other. No contractor shall stop or threaten to stop his ventilation system and jeopardise the work of other contractor. The contractor who will be using the ventilation facilities installed by other contractor, shall make payment to him at mutually agreed rates and in case of dispute, the engineer's decision shall be final and binding on all parties.

In case of work are connecting passage ventilation circulation system be kept on getting modified as and when different passage gets jointed excavation or the same and when they get out of when further work of concreting etc. as taken in hand. Also the demand of fresh air may charge when more than one agency are working. The general layout ventilation shall be changed suitable to avoid any part being isolated from ventilation system and fresh air being short circulated.

D.

All the arrangements made for fencing, lighting and ventilation shall be maintained by the contractor throughout the tendency of the contract, till physical taking over of the work by the department.

E. MAINTENANCE OF SERVICES

If, after all the works under this contract are completed and accepted as such and in case the engineer so directs, the contractor shall maintain the lighting, ventilation, drainage, communication facilities etc.

The payment for such services maintained as per the direction, after the completion and acceptance of the work under this contract, shall be made at the rate by the engineer - in - charge at his discretion. The maintenance of these services during the tendency of the work, is of course the contractor's responsibility and at his cost

except otherwise specified.

9. EXPLOSIVES AND INFLAMMABLE MATERIALS

If explosives or inflammable materials are to be used for execution of the works, the contractor shall at his own risk & cost obtain such license or licenses for storing and using the explosives. The contractor shall produce such license whenever demanded by the engineer-in-charge or its subordinate for its verification. For storage of explosives & inflammable materials, the contractor shall construct & maintain magazines, either temporary or permanent, required for storage in accordance with the requirement of the appropriate government explosive rules in force. Such magazines shall be clearly marked "Dangerous Explosives" in the regional scripts and shall be kept in the care of competent watchmen at all the times. The Department shall not take any responsibility whatsoever in connection with the storage of explosives on site or of any accident etc. in connection therewith. All operations of the contractor in which or for which explosives are used shall be at his own risk and upon his sole responsibility. The Contractor shall have to engage licensed blaster for all such operations in actual excavation needing blasting etc.

10. LIABILITY FOR ACCIDENTS TO PERSONS:

Responsibilities and liability of the contractor under "Workmen's Compensation Act".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 no serious as likely to result in death of any such work and, the contractor shall within 24 hours of happening of such accident, intimate in writing to Engineer the facts 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 matter aforesaid, including the penalties or fines, if any, payable by govt. Due to such lapse, the contractor shall be fully responsible for government's failure to give notice under the Workmen's Compensation Act or otherwise / to conform to the provision of the said act in regard to such accidents.
- B** In case of an accident in respect of which compensation may become payable under Workmen's Compensation Act whether by the contractor or by government as Principal employer, it shall be lawful for the engineer to retain out money due and payable to the contractor such sum or sums of money as may in the opinion of the

engineer be sufficient to meet the liability. The opinion of the engineer shall be final in regard to all matters arising under this clause.

- C. The Contractor shall be bound to provide in writing the details of employments, emoluments paid and status of the workmen concerned as may be required, under the act to the engineer-in-charge.

11. 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 work not included in this contract and may execute such work not included in this contract by agents, or by other contractors at his option and the contractor shall, in accordance with requirements of the engineer afford all reasonable facilities for execution of the works including occupation of the lands by structure or otherwise for any 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 answerable to government for any delay or expense incurred by reasons of such default.

It is 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 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.

12. OTHER CONTRACTS FOR THE WORKS:

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

When the government enters into other contract for specified items of the contract work, each contractor shall co-operate with the other to the fullest extent, shall allow each other every facility and co-ordination for execution of their works simultaneously & satisfactorily as intended in the designs and specifications and drawings. Should there be a dispute or disagreement between the contractors for any cause whatsoever, the 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 other, shall be final and binding upon all parties and such a

decision or decisions shall neither vitiate any contract nor absolve the contractor of his responsibility under the contract nor form the ground for any claim or compensation.

13. INTEREST ON MONEY DUE TO CONTRACTOR:

No omission by the engineer to pay the amount due upon measurements or otherwise shall vitiate or make void the contract nor shall the contractor be entitled to any interest upon any guarantee on the Running Account bill & final Payments in arrears nor upon balance which may on the final settlement of his account become due to him.

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

All documents, correspondence, orders 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 by any unauthorized persons of any kind.

15. MAINTENANCE:

Notwithstanding what has been mentioned in the contract for a period from the date of issue of the final certificate till the expiry of twelve calendar months commencing immediately after the plant or works have been considered to be put to commercial use, shall be liable for the proper maintenance and for replacement of any part of the plant, materials, workmanship or any other reason for which in the judgment of the engineer, the contractor is responsible and for making good any damage arising therefrom. The Department's decision regarding date of beginning of commercial use of the completed work under the contract, depending upon the circumstances and merits of the situation shall be final.

The maintenance period in respect of plant or works for which replacement of any part has been made for the above reason, shall be further extended until the expiry of twelve months after the replaced parts have been put into commercial use.

16. WORK DURING NIGHT OR ON SUNDAYS & HOLIDAYS:

Unless otherwise provided, none of the permanent works shall be carried out during night, Sundays or authorised Holidays without the permission in writing. However, when such work is unavoidable or necessary for the safety of life or the properties of work, the contractor shall take necessary action immediately and

advise the Executive Engineer accordingly.

17. PATENT RIGHTS:

In the event of any claim or demand being made or action being brought against government for infringement of letter of patent, registration of design or trade mark in respect of any machinery, plant, work, materials or things used or supplied by the contractor under this contract or in respect of any method of using or working by the government or such machine, plant, work, materials or the things belonging to the contractor, he shall indemnify government against all costs and expenses arising from or incurred by the reasons of any such claim, provided the Government shall notify the contractor immediately that such claim is made 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 machinery, plants, materials, or things shall be used by the government for an purpose or in manner other than that for which they have been supplied by the contractor and specified under this contract. Whenever the contractor desires to use any design, device, materials or process covered by the letter of patent, or copyright, the right for such use shall be generally secured by suitable legal agreement by the contractor with the owner and the copy of such agreement shall be filed with the Engineer-in- charge.

18. CO-OPERATION WITH OTHER CONSTRUCTION AGENCIES:

When two or more contractors are engaged on work in the same vicinity, they shall work together in a spirit of co-operation and accommodation. The contractor shall not take cause to be taken any steps or actions that may cause disruptions, discontent or disturbance to the works, labour and arrangement of other contractors in the neighborhood and the project locality. In case of any difficulties among the contractors, the engineer-in-charge shall direct the manner in which each contractor shall conduct his work so far as it affects the other.

19. NOTICES : HOW TO BE GIVEN:

Where any legal notice or any other document or any order or direction is to be given to or served upon the contractor, it shall be deemed to be duly given, 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 Registered A.D. addressed to the contractor at the contractor's office on the

site, or sent through the Registered A.D. Post addressed to the last known place of business, or in case of a company to its registered office and in the case of a firm of contractors, a notice or other document, which shall be so given to or served on any one of the partners in such firm shall be deemed to have been given to or served on all of them.

20. COST OF FACILITIES AND INCIDENTAL WORK:

The cost of all the facilities or any other incidental work etc. as prescribed 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.

21. DAMAGE BY FLOODS OR ACCIDENT:

The contractor shall take full precautions against any damage to the work by flood or from accidents. No compensation shall be allowed to the contractor for his plants or materials lost or damaged by floods, unanticipated or otherwise, or from such other cause, during monsoon or unexpected rains, and he shall be liable to make good any damage to the plant, machinery or materials of Department hired by him and lost or damaged by flood or from any other cause while in his possession for use on works.

22. RELATION WITH PUBLIC AUTHORITIES:

The contractor shall comply with all proper and legal orders and directions given from the time to time by any local or public authority & shall pay out his own money any fees or charged to which he may be liable.

23. TITLE OF CLAUSES:

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

24. JURISDICTION:

The contract shall be governed by the law of India in force from time to time and be subject to the Jurisdiction of Indian courts. In case of disputes raised by the contractor or Govt. of Gujarat, it shall be referred to Gujarat Public Works Contract Dispute Arbitration Tribunal established as per Arbitration Tribunal Act. 1992.

25. CONSTRUCTION OF THE CONTRACT:

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

26. VEHICLE TAX:

The contractor shall have to pay the vehicle tax and goods tax even if the vehicles are to be plied in the project area. No claim for refund for the same shall be entertained.

27. OBSERVATION OF LABOUR LAWS:

The contractor shall strictly observe all the requirements laid down in the Contract Labour (Regulation & Abolition) Act., 1970 and Gujarat Rules 1972 & Inter state Migrant Workmen (Regulation of Employment & condition of services) Act -1979 Gujarat Rules - 1981 and other acts in force from time to time so far applicable.

28. TRESS PASS:

The contractor shall, at all times, be responsible for any damage to all tress pass committed by him or his agent or working people in carrying out the work unless such trees pass is authorized by the Engineer-in-charge of work.

29. OTHER PERMISSIONS:

The contractor shall approach directly, to the Municipal and other authorities for obtaining any type of permission required under Law. Suitable assistance will be rendered by the Department for expediting such permission. No claim for delay, if any, will be entertained.

30. OCCUPANCY OF ADDITIONAL LAND:

In case when it becomes necessary for the due fulfillment of the contract for the contractor to occupy land outside the W.R.D. limits, the contractor shall make his own arrangement with the land owners and pay such amount as may be mutually agreed upon by them. The department will render the contractor all possible assistance to obtain land for such purpose.

31. EMPLOYMENT OF RESIDENT ENGINEER:

The contractor shall employ a qualified, skilled and experienced Resident engineer for carrying out the work. Before appointing the resident engineer, the contractor shall obtain approval of the engineer-in-charge about the suitability and

eligibility of the resident engineer. In submitting such proposal, the qualification and experience of the person shall be fully listed. The resident Engineer shall be considered at all times to be acting for the contractor with full responsibility in all respects.

32. FOREMEN, WATCHMEN AND WORKERS:

The contractor shall employ competent foremen, watchmen and workmen. The engineer-in-charge shall at all time have the right to remove from the work any foreman or watchman or workman on ground of his unfitness or misconduct or complaints.

33. WORK ORDER BOOK:

A work order book as prescribed by the Government will be maintained on the work and the contractor shall sign the orders in token of acceptance as given the Engineer-in-charge or his representative. He shall carry out the orders in the true spirit and as required for the correct performance of the contract. Work order book is the property of the Department and shall remain in the custody of the Department supervisory staff on duty. The compliance shall be carried out promptly and reported to the Engineer-in-charge in good time by the contractor so that the work can be checked. If the contractor fails to take note of orders or instructions issued in the work order book or tries to avoid the same. The engineer-in-charge will have power to take suitable recourse. Any such action of the engineer for the non-compliance on the part of the contractor shall be binding upon him.

34. INCOME TAX, SURCHARGE, EDUCATION TAX:

Government will recovered central taxes like I.T. S.C. & E.C. as per the Income Tax Act-1061 and amended from time to time under works contracts from each R.A. Bills/Final bill.

35. LABOUR WELFARE CESS:

As per prevailing rules under labours Act, Labours welfare cess shall be recovered from R.A. Bills/Final Bill.

36. WORK UNDER POLICE PROTECTION:

In case of dispute by land owner and consequent obstruction in execution of works when the land in question is in possession with the Department, contractor shall be bound to execute the demarcated works under police protection if required, and no extra cost for stoppage, slow work or obstructions, shall be payable to the contractor.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

WORK AND SITE CONDITION

1.00 INTRODUCTION:-

GENERAL FEATURES OF THE PROJECT

Construction of Coastal Protection Work At Village Saiyad Rajpara In Una Taluka Of Gir Somnath District.

2.00 LOCATION:-

The proposed site is situated as below: -

The proposed project site is situated at near Saiyad Rajpara village Ta.Una, Dist.Gir Somnath.

3.00 COMMUNICATION:-

The nearest city & town is **Una** is a taluka place of Gir Somnath district. Nearest villages are connected through VRB & SH with district and taluka place.

4.00 BRIEF DESCRIPTION OF WORK:-

Construction of Coastal Protection Work At Village Saiyad Rajpara In Una Taluka Of Gir Somnath District.

I. PROPOSED WORK CONSISTS OF FOLLOWING:-

This work includes Excavation, Soil Testing, Steel, Stone for Various Component, and Cement Concrete for tetrapod work as per grade for Various Component, etc.

II. PRINCIPAL DETAILS OF WORK:

Works to be performed for the various items included in Bill of Quantities.

The above information is only a general outline and does not in any way limit, the performance of all work and supply of plant, machinery, all labour and materials necessary for completing the works as shown in the approved working drawing and mentioned in the specification.

No extra payment or claim on account of any additions or alteration in working drawing shall be admissible.

5.00 LABOUR:

Availability is good except sawing and harvesting period. However, there may be shortage of skilled labour like masons, carpenters' operators, mechanics etc. However, the contractors shall have to make his own inquiry in this regard and quote his rates.

6.00 HOUSING:

Area being highly rural, there is no local housing arrangement 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-63 & 64 of SBD.

7.00 WATER SUPPLY:

The contractor shall have to make his own arrangements of water supply for this work. Fresh use of available water for work will be allowed free of cost to the contractor from the river length flowing in the construction areas and area transferred to Narmada Water Resources, W.S. & K. Department. Contractor shall have to make his own arrangement for Pumping, purification; storage tanks, pipe line etc. for the said purpose at his own cost.

8.00 DRAINAGE:

Suitable and adequate arrangement shall have to be made by the contractor for drainage of 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 & solid waste from his colony. The labour colony layout shall be got approved from the Engineer-in-charge.

9.00 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 as required, unauthorized or undesirable persons shall be excluded from the camp and the work. If in the opinion (which shall not be questioned) of the Engineer-in-charge any employee or agent of the contractor misbehaves and/or causes obstructions in the proper execution or otherwise makes himself undesirable, the contractor shall on receipt of the instruction to do so remove him from the premises.

10.00 MEDICAL AID:

There is no dispensary on Project Site. However, there is a Government Hospital at Taluka Head Quarter. The Services of this Hospital will be available to contractor's staff and labour on payment of requisite charges as may be required to be paid by the agency at his risk & cost.

11.00 POWER SUPPLY:

Power supply shall be arranged by the contractor at their own cost. No power supply is guaranteed by the department.

12.00 ROADS:

The contractor shall construct and maintain the inspection roads and quarries roads for all purposes required during construction at his own cost. There will however be no charge for

any reasonable use of any road constructed by Government at site of work. At present site is only approachable during fair weather.

13.00 POST, TELEGRAPHS & TELEPHONE:

Post office is available at taluka head quarter. Contractor shall make their own arrangements for telephone if required.

14.00 BANK FACILITY:

Branches of Nationalized Bank and other Schedule Banks are available at Taluka. head quarter.

15.00 SUPPLY OF PETROL & DIESEL:

There is no petrol pump near Dam site. However, Petrol & Diesel will be available from Taluka Head Quarter.

16.00 MATERIALS: - (Quarry details are shown for guidance purpose only)

(a) WATER:

Water is scarily available in Dam/Canal vicinity area in summer season. Hence, contractor shall have to make his own arrangement and inquiry regarding this at his own cost.

(b) SAND:

Good quality natural sand will be used. However, sand of required quantity may not be available in reasonable lead. The contractor should arrange to obtain the sand of approved quality from any lead. No extra claim shall be admissible for extra lead.

(c) COARSE AGGREGATE (CRUSHED METAL):

The black stone crushed metal for concrete work will be obtained from stone crushers situated in the vicinity of dam site. However coarse aggregate of required size & quantity may not be available in reasonable lead, the contractor should arrange to obtain the coarse aggregate of required size & of approved quality from any lead. No extra claim shall be admissible for extra lead.

(d) STONE:

The good quality black stone hard stone to be used in above said work. The contractor shall have to make his own inquiries regarding availability of above materials and other materials for work and accordingly he should quote the rates. If the materials of required standard are not available from the specified quarries, no extra lead will be payable by the department. Contractor should make his own arrangement to bring all quality. materials from any lead without any extra cost to the Department.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-II
SPECIAL CONDITION

SPECIAL CONDITIONS

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Sr. No.	Particulars
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4	Recovery of hard rock available from excavation
5	Loans of Government's Tools, Plant & Machinery
6	Assistance in Procurement of Properties, Permits, Import License, Exchange Facilities etc.
7	Security Measures
8	Applicability of Specifications
9	Change in Design & Drawings
10	Dewatering & Diversion as and where Required
11	Application of Publication
12	Inspection of work by third party
13	Working Drawing & Final Drawing
14	Foundation Finalization as per CDO Approval

SPECIAL CONDITIONS

1.0 ACCURACY OF LINES, LEVELS AND GRADES:

The various works shall be done true to the line, levels, and grade. The periodical checking of these works by the government staff shall not absolve the contractor of his responsibility regarding the accuracy of lines, levels, and grades. In case of any deviation or discrepancy in line, level or grade at the meeting faces, the contractor shall have to make good the discrepancy at his own cost and without any extra compensation for the additional work involved. Whenever such discrepancy is found to arise at the junction of works of different contractors, the responsibility to set right such discrepancy lies with contractors concerned. The engineer in charge shall further have been unquestioned right if need to be rectify the discrepancies and recover the cost from the contractor or contractors according to proportion as he may consider reasonable.

2.0 TESTING OF MATERIALS AND WORKS:

2.1 All materials before being incorporated in the work shall be inspected visual & by common field tests according to Table-2 of GERI guidelines for Quality Control & Quality Assistance Vol.1,2002 and if necessary tested before being approved by the Engineer 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. Any additional test required to be carried out at any stage of the work as per instruction of Engineer - in -charge etc./ C.E (Q.C) / E.E (Q.C.) / D.E.E.(Q.C.) shall be carried out at department's cost, however sample test results are failed then retesting charges shall be borne by the contractor, but if sample test results are found ok, the Cost of testing charges of material shall be borne by the department.

2.2 In all other cases, the cost of the testing shall be borne by the government as per government's NWRWS&K Dept's Gujrati circular No - PRCH/ 1097/ 1397/ (11)/ PA.FA/ K-1(MICELL) Dt.12/01/2013. The contractor shall, however, supply all material required for tests and also make good at his cost with materials, mixes, core holes and similar for other materials as may be directed by and to the satisfaction of the engineer in charge.

An authorized representative of the contractor shall have to remain present at the time when the sample or cores etc. are taken & shall be authenticated the facts, if so required. When the contractor's agent fails to remain present at aforesaid time, 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. that have been taken.

2.3 The materials, mixes and cores etc. shall be tested at field laboratory / GERI / other government approved laboratory and the results given by them 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 than be contractor's responsibility to carry out the finished item of work to the standard based on the laboratory design and test.

2.4 The method of sampling and testing and procedures and standard shall be as laid by respective IS code of practice and GERI manual / as mentioned in the tender.

2.5 (a) DESIGN MIX (DMC) OF CONCRETE:

Concrete mix design of stipulated or designated grades of concrete shall be carried out only at nearest GERI laboratory e.g., GERI, Rajkot Or Junagadh All materials required shall be supplied, loaded, carted and unloaded at GERI Laboratory by contractor at his own cost.

(b) NOMINAL MIX DESIGN (NMC) OF CONCRETE:

No mix design is necessary for nominal mix concrete. Nominal mix shall be carried out as per table mention in the regional S.O. R- 2024-25. Page no-63.

GRADE OF CONCRETE	MSA IN mm	TOTAL QUANTITY OF DRY AGGREGATE (COARSE+FINE) BY MASS PER 50Kg OF CEMENT	WEIGHT OF COARSE AGGREGATE	WEIGHT OF FINE AGGREGATE	Cement	WATER-CEMENT RATIO
1	2	3	4	5	6	7
M-10	20	480Kg	320Kg	160Kg	50Kg	NOT MORE THAN 0.68
	40	480Kg	343Kg	137Kg	50Kg	
	80	480Kg	343Kg	137Kg	50Kg	
M-15	20	330Kg	220Kg	110Kg	50Kg	NOT MORE THAN 0.64
	40	330Kg	235Kg	95Kg	50Kg	
	80	330Kg	235Kg	95Kg	50Kg	
M-20	20	250Kg	166Kg	84Kg	50Kg	NOT MORE THAN 0.60
	40	250Kg	178Kg	72Kg	50Kg	
	80	250Kg	178Kg	72Kg	50Kg	

Preliminary test cubes of size 15x15x15cms shall be casted and tested for 7 days and 28 days, well before starting of actual work at departments own field laboratory / Govt. Approved laboratory at the cost of department.

- 2.6** The materials, mixes, cores etc. shall be tested day to day or periodically at the department's field laboratory set up at the site of work or nearby regional or district level GERI laboratory or Engineering/Polytechnic colleges in Gujarat or government approved (R&B, IRRIGATION Deptts. etc.) private laboratories where facility of testing is available as per BIS rules & regulation or Government approved private institutes and the results given there by shall be considered correct and authentic.

Out of total number of such tests, 80% tests will be carried out in site laboratory,

10% in Government approved laboratories and 10% in GERI laboratories. However minimum one test of all type of tests shall have to be carried out in GERI laboratories only. The choice of testing laboratory where test to be carried out shall on sole discretion of Engineer in charge. If there are any dispute regarding test results, GERI / NSIC / Govt. Engineering College, test results shall be final and binding to all. If test results of sample does not comply relevant BIS code further investigation shall be carried out as per BIS: 456-2000 or relevant BIS code of practice prior to rejection of work. The contractor shall be given access to all operations of tests that may be carried out as aforesaid so that he may satisfy himself regarding the procedure and methods adopted. It shall then be contractor's responsibility to carry out the finished items the standards based on the laboratory design and tests.

Site laboratories tests will be carried out by qualified Engineer of the contractor whom I Card is given by the Executive Engineer and in the presence of Section Office / Dy. Executive Engineer in charge of the work.

80% of site tests will not be carried out at one time but will be related to the progress of work and consumption of materials. Prescribed Registers for recording details and results of tests will be maintained on site of work. The tests which are not done in GERI laboratories e.g. electrometric bearing etc. will be carried out in the laboratory consented by the Executive Engineer.

One percentage of estimated cost of work put to tender for this work will be deducted from the Running Bills of contractors for testing of materials and workmanship. (G.R. B&C No. TNC-1085-(4)-C, dated 10-5-85.

- 2.7** The day to day and periodical tests to be carried out on materials, mixes, cores and placed concrete, mortar etc. shall be specified by the Engineer-in-charge from time to time and the contractor shall allow all facilities and co-operation toward collection of samples, transportation up to any laboratories, all labour for collecting samples, casting, testing of cubes shall be supplied by contractor without any extra payment.
- 2.8** Contractor shall have to establish the field laboratory at site as per the instruction of engineer in charge. The necessary equipment shall be kept duly calibrated in the field laboratory for the required Field test for concrete, FA, CA and Field soil testing for earth work. Contractor shall have to construct pucca underground curing water tank of minimum size 2.0 x 2.0 x 0.60 mt (or size as directed as per size of the project) at nearby site of work for curing of cubes as per Engineer's instructions. No extra payment shall be made for this to the contractor.
- 2.9** It shall be the responsibility of the contractor to provide clean water to fill the curing tank & maintain full water level in curing tank periodically and also maintenance of leak proof curing tank throughout the work without any extra payment for this.
- 2.10** Contractor shall have to provide sufficient 15 cm cube mould and skilled labours for laboratory and field tests of works and materials for activity such as:
- (i) Cleaning, fitting and unfitting of molds, oiling etc.
 - (ii) Carting of molds and placement in to curing tank.
 - (iii) Transporting the cubes from site of work to field laboratory for testing.
 - (iv) Helping in cube testing on compressive machine etc. All facilities for carrying out field test on various materials, mixes and cores shall be provided by contractor. No extra payment for the above work shall be made to the contractor.
- 2.11** The method of sampling and testing procedures and standard shall be as laid down by the Engineer-in-charge for respective items.

4.0 RECOVERY OF HARD ROCK AVAILABLE FROM EXCAVATION:

(1) Govt. of Gujarat N.W.R.W.S. and Kalpsar Dept. Order No. MI Cell /2010 /17 /(2) K-1, Dt.05/10/2019 for the hard rock, which is excavated from the work will be allotted to the agency. **For Excavation in Hard Rock, Hard Rock utilized for the work will be recovered rate Rs.481.81 per Cum. Hard Rock not utilized for the work will be recovered rate Rs.224.08 per Cum per Cum excluding GST.** In addition, necessary royalty for these materials has to be paid by the agency as per prevailing rules and regulation to the Industries & Mines Dept. according to classification of materials. The

quantity will be calculated as per instruction of Engineer-In-Charge. This fact should be kept in mind while quoting the tender rates of these items.

5.0 LOAN OF GOVERNMENT FOR TOOLS & PLANTS AND MACHINARIES:

The machinery and tools & plants as and where available with the department shall be supplied on hire as per rules and regulations and as per the provisions contained in Government PWD GR No- MCN / 167 / 97, Part-iv / h, dated 01-10-1980 and as amended from time to time. It must be also noted that the machineries or equipment's justified for the use in the work and available with the department will be given on hire. No claim for delay in procurements of such machineries or equipment shall be entertained. At present no machineries or tools and plants are available with the departments.

6.0 ASSISTANCE IN PROCUREMENT OF PROPERTIES, PERMITS, IMPORT LICENCE, EXCHANGE FACILITIES ETC.

Generally, it shall not be realized in the normal course by the department for providing assistance in purchase of Tools & Plants and Machineries required for the execution of work, contracted for. However, the engineer in charge, on request by the contractor shall assist in the procurement of necessary import license, exchange facilities etc. for importing necessary plants & machineries, which is not locally available and engineer in charge deemed it in the interest of work and its progress. The government shall not however, be responsible for non-availability of any of the above facilities or delay. The contractor's application for import license etc. will be scrutinized by the engineer in charge regarding the responsibility of the government etc. and recommendations will be made as deem fit. The decision of engineer in charge in this regard shall be final and no claim either in cost or delay in time will be admissible.

7.0 SECURITY MEASURES:

In view of the strategic importance of all the project and installations, security restriction may be imposed by the engineer in charge as per directions of the security authorities and the contractor shall abide by, to implement all such instructions scrupulously. In case a system of identity cards with photos is introduced, then the contractor shall have to provide the same to his personal at his cost. The identity cards shall be duly sign by engineer in charge. The contractor shall also keep informed regarding all visitors and obtain permits for their visitors. No authorized visitors will be allowed on site of work.

8.0 APPLICABILITY OF SPECIFICATIONS:

Considering the common general item required in executive of irrigation project, general subject wise specifications has been drawn and provide 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 & more of execution and standards to be observed etc. for the work. To avoid descriptive matter, suitable reference for the relevant IS (BIS) code 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. The general subject wise specifications are further supplemented in separate chapter to cover the item wise specification of work as per the Bill of Quantities of the tender. These item wise specifications shall cover the applicable provision of the general specification, considering the item description as per Bill of Quantities. Over and above this, the specific requirement of each item such as applicable lead and lift, proportion of concrete & mortar mix, description about the execution of the item in detail and other applicable aspects will be covered in detail/item wise specification. Intending tenderers are there for requested to read the tender papers on above lines and quote their rates.

9.0 CHANGE IN DESIGN AND DRAWINGS:

The drawings attached with tender documents are at present available data. However, during execution of work any change in design and drawing that may be warranted on account of strata met with or the materials that may be available or any reasons shall not vitiate the contract and no extra payment shall be made to the contractor. The variation in quantities under the relevant items on account of above changes shall be paid only as per the Clause 38 (Page No. 50) of Section 3 Conditions of Contract of SBD.

10.0 DEWATERING AND DIVERSION AS AND WHERE NEEDED:

If, there is no separate provision for dewatering, diversion of water and construction of temporary diversion road during construction in the fair weather as well as in the monsoon,

the rates of respective item of works quoted by the contractor shall be consider inclusive of dewatering and diversion as and where needed with maintaining it during construction. In such condition no extra payment shall be made for dewatering & diversion of water, road diversion etc. Also, no payment shall be made for any part of earth work of materials washed away or damaged during 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, materials to be utilized for the work or completed part of present work damaged during the construction period. If there is a separate item for care and diversion in the tender, then general technical specification for "care and diversion" shall be applicable.

11.0 APPLICABLE PUBLICATIONS:

All methods or procedure for execution of different items of work shall confirm to the INDIAN STANDARD (IS) now renamed as BUERO OF INDIAN STANDARD (BIS) Specifications. The latest addition shall be followed. Some of the important IS publications are listed below. The provisions of these IS specifications shall be applicable.

IS OR BIS CODE NO	VERSION	SUBJECT OF CODE
EXCAVATION AND EARTH WORK		
2720 Part-I	Latest	Method of test for soil-particle size and shape
2720 Part-III	Latest	Determination of water contents, dry density relation using light compaction.
2720 Part-IV	Latest	Grain size analysis
2720 Part-5	Latest	Determination of liquid and plastic limit
1498	Latest	Classification and identification of soil for general engineering purposes
2720-Part-III / sec-1&-2	Latest	Determination of Sp. Gravity
9429	Latest	Drainage system for earth and Rock fill dams
3764	Latest	Safety code for excavation work
CONCRETE WORK		
269	Latest	Specification for OPC cement
12269	Latest	Specification for 53 grade OPC cement
1489 Part-1 & 2	Latest	Specification for 53 grade PPC

		cement
432	Latest	Specification for MS & medium tensile steel bars
1786	Latest	Specification for HYSD bars
280	Latest	Specification for Binding wires
2336 Part I to VIII	Latest	Method of various tests for aggregate
383	Latest	Coarse and fine aggregate from natural sources for concrete
10262	Latest	Concrete mix designs
456	Latest	Plain & Reinforced concrete
457	Latest	Plain & Reinforced concrete for Dams & other massive structures
3873	Latest	Laying in situ cement concrete lining For canal
9556	Latest	Construction of diaphragm walls.
14334	Latest	Cost. Of diaphragms for under-seepage control.

MASONRY WORK

2116	Latest	Sand for masonry mortar
1121	Latest	Testing for stone-Comp. Strength
1126	Latest	Testing for stone-Soundness
1124	Latest	Testing for stone-Water absorption
1526	Latest	Sand for plastering work.

IS OR BIS CODE NO OTHERS:

IS OR BIS CODE NO	VERSION	SUBJECT OF CODE
15068	Latest	PVC Water stop.
4985	Latest	PVC Pipes
2266	Latest	Wire Rope
11855	Latest	Rubber seal

IS OR BIS CODE NO

VERSION

SUBJECT OF CODE

458	Latest	Specification for pre-cast concrete pipes (With and without reinforcement)
3597	Latest	Methods of test for concrete pipes.
5382	Latest	Specification for rubber sealing rings for gas mains, water mains and sewers
516	Latest	Method of test for strength of concrete
783	Latest	Code of practice for laying of concrete pipes

12.0 INSPECTION OF WORK BY THIRD PARTY:

All the conditions and scope of work of Third-Party inspection shall apply and shall be binding to the contractor if there is a provision for the same.

13.0 WORKING DRAWING & FINAL DRAWING :-

Initially working drawing shall be prepared & made by contractor at his own cost under instruction of Engineer. Final drawing shall be prepared in Auto CAD computerized drawing with C.D. for which amount **shall be withheld till finalized the work.** (Check with SBD As per clause No.58)

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-III
STANDARD GENERAL TECHNICAL SPECIFICATIONS

CHAPTER-III

: STANDARD GENERAL TECHNICAL SPECIFICATIONS :

- 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 authorized 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** No trees shall be cut without permission of Engineer-in-charge.
- 1.6** Diversion for roads, if necessary, shall be provided and maintained during the currency of the contract without any extra cost to the Department.
- 1.7** 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.
- 1.8** 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.
- 1.9** The quantities in the schedule are only estimate quantities and during execution they may increase or decrease. The Amount of variation are subject to conditions in Cl. 39 & 40 of condition of contract and as per latest guideline from Govt. of Gujarat.
- 1.10** 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.
- 1.11** 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. Handbook or according to instructions of the Executive Engineer.

- 1.12** The work requires 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.
- 1.13** 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.
- 1.14** In the specification “as directed / approved” shall be taken to mean “as directed / approved “by the Engineer - in - Charge.
- 1.15** Wherever a reference to any India Standard appears in the specifications, it shall be taken to mean as reference to the latest edition of the same in force on date of agreement.
- 1.16** 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.
- 1.17** 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 (Woodwork) | 0.001 Cumt. |
- In recording dimensions of work in measurement book the sequence of length, width and height (depth) or thickness shall be followed.
- 1.18** 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.
- 1.19** Where no lead is specified, it shall mean “all leads ”.
- 1.20** Lift shall be measured as per current practice for relevant item under direction or decision by Engineer-in-charge.

- 1.21** Definite particulars covered in the items of work, though not mentioned or include in it, specifications shall be deemed to be included therein.
- 1.22** 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.
- 1.23** 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.
- 1.24** The contract rate of the item of work shall be for the work completed in all respects.
- 1.25** No collections of materials shall be made before it is got approved from the Engineer - in - charge.
- 1.26** 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.
- 1.27** Materials if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.
- 1.28** 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.
- 1.29** All works shall be carried out in a workman like manner as per the best technique for the particular item.
- 1.30** 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.
- 1.31** 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.

1.32 All necessary safety measures and precaution (including these 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.

1.33 Approval to any of the executed item for the work does not in any way relieved the contractor of his responsibility for the correctness, soundness, strength of the structure as per the drawings and the specifications.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-IV

MATERIAL SECTION

SPECIFICATION OF PRINCIPAL MATERIALS

CHAPTER-IV

SPECIFICATION OF PRINCIPAL MATERIALS

The following specifications are only for the principal materials of construction which are included in the details specifications of items and indicated the requirements of qualities of materials. They are given as guide and neither includes all the materials of construction nor exhibits all their desirable qualities. This should be supplemented by detailed specifications as per relevant IS Code unless otherwise not mentioned. The rate of all items is inclusive of all materials inclusive of all lifts and leads for the material unless otherwise specified in detailed specifications.

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, once before starting of work and then starting of new working season.

Permissible limit for some of the important parameters are as under.

Sr.No.	TEST	PERMISSIBLE LIMIT AS PER IS-456-2000
1	Organic solids	200 mg. per liters (max.)
2	Inorganic solids	3000 mg. per liters (max.)
3	Sulplates (as So ₂)	400 mg. per liters (max)
4	Chlorides (as Cl)	2000 mg./lit. for PCC. And 500 mg.lit.for RCC
5	Ph Value	Not less than 6

1.1 Water used for mixing and curing of cement / lime mortar or concrete shall not be salty or brakish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces if oil, acid and injurious alkali, salts, organic matter and other deleterious materials which will either weaken the mortar or concrete or cause effloresces or attack the steel in R.C.C. water shall be obtained from sources approved by the Engineer-in-charge. Sources of water shall be maintained at such a depth and the water shall be withdrawn in such a manner as to exclude silt, mud, grass or other foreign materials. Containers for transport, storage and handling of water shall be clean container for transport, storage and handling of water shall be clean water. Water shall conforming to IS 456:2000 as per necessary test carried out.

- 1.2 Potable water is generally considered satisfactory for mixing and curing mortar or concrete.
- 1.3 Under ground water shall be checked before using it in mortar or concrete because of the presence of dissolved salts and chemicals which affects setting time and strength of concrete & Mortar.
- 1.4 Sea and sewage water shall not be used.
- 1.5 Water formed satisfactory for mixing shall also suitable for curing concrete and mortar. However water used for curing shall not produce any objectionable stain or unsightly deposit on the concrete or mortar surface. The presence of tannic acid or iron compounds shall objectionable.
- 1.6 Water shall chemically tested at GERI,/ Other Govt. approved Lab. before being used it in mixing and curing in concrete or mortar once for approval of source of supply subsequently only in case of doubt and change in source of supply. The test results shall be as per permissible limit laid in IS : 456-2000

Table-1

Permissible limit for solids in water

I.S. : 456-2016 (Specifications) I.S. 3625 (Part 17, 18, 24, 32 Test method)

Sr. No.	Particulars of tests & I.S. Code for method of testing	Permissible limit Max.	Remarks.
1	Organic solids (I.S. : 3025 (Part-18))	200 mg/l	Frequency of sampling and testing shall be once for source of supply of subsequently in case of doubt and change in source.
2	Organic Solids (I.S.: 3025 (Part-18))	3000 mg/l	
3	Sulphates (As SO ₃) (I.S. : 3025 Part-24)	400 mg/l	
4	Chlorides (as CL) (I.S. 3025 Part-32)	2000 mg/l for P.C.C. and 500 mg/l for R.C.C.	
5	Suspended matter	2000 mg/l	

	(I.S. 3025 Part-17)		
6	P.H. Value	Not less than 6	

M-2 CEMENT:

The cement shall be used ordinary Portland cement or Portland cement conforming to Indian Standard Specification IS:269 or Portland Slag cement conforming to Indian Standard Specification IS:455:2015

Cement used in the work shall conform to IS 455 for Portland Slag Cement (PSC). All testing of cement shall be carried out as per relevant BIS specifications, and only approved quality cement shall be used in the work. The physical and chemical properties of cement shall satisfy the requirements specified in IS 455.

The contractor shall have to make his own arrangement to procure the cement bearing I.S.I. mark directly from the major cement manufacturing plants having installed capacity of one LACES tones per annum or its authorized dealers only. The contractor shall arrange to cart, load and unload the same to the site of work at his own cost. The cement brought to site shall be tested in Government or government approved laboratory as per provision in IS-12269.

The cement bags shall be neatly stacked in a orderly manner so as to afford easy access and count in a damp proof condition. If the consumption of cement exceeds 25.00 MT., then the cement shall be stored in tin shed godown or in a pucca godown, one feet above the ground, so as cement can be prevented from atmospheric effect. Deteriorated cement shall not be allowed to use.

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

Quantity of Consignment	No. of Test Specimen
50 M.T.	1
100 M.T.	2
200 M.T.	3
300 M.T.	4
500 M.T.	5
800 M.T.	6
1300 M.T.	7
For each larger consignment	8

All physical tests required as per IS - 4031 (Part 1 to 6) – 1988 shall be carried out as per frequency mentioned in the table above. While the chemical test shall be carried out as per IS-4032-7986 one for ten physical test samples.

Each consignment shall be stacked separately and shall be used on the basis of first cum first used. The cement shall be used after testing only. Cement older than 90 days shall not be allowed to use.

The cement lot failed in testing shall be removed immediately from the site. A day-to-day account of cement received & used on the work together with the particulars of the work and quantity of the work and quantity of the work in which it was used, shall be maintained separately by the representative of the department, and shall be signed at the end of the day's work, both by the department's representative and the contractor.

2.1 Only 53 Grade ordinary Portland cement of reputed major cement plant conforming to IS : 269-2015 for general concrete and Portland Slag cement use for tetrapod.

2.2 shall be used for entire work under the tender in all aspects. Mini plant cement shall not be allowed in any cases.

2.3 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 GSTIN 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 GST 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.

2.4 TESTING OF CEMENT:

2.4.1 Physical Analysis:

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

TABLE NO : 1

Physical Requirements for 53 Grade ordinary Portland cement.

I.S. 269-2015 (Specifications) (Clause-7 Table No.3 P.No.4)

I.S. 4031-1968 (Physical tests)

Sr.No.	Physical Properties	Requirements as per I.S. 269-2015
1	Fineness (Specific Surface Area)	Not less than 225 M ² /Kg
2	Compressive Strength	
(a)	03 days (72 ± 1 h)	Not less than 27 Mpa (N/mm ²)
(b)	07 days (168 ± 2 h)	Not less than 37 Mpa (N/mm ²)
(c)	28 days (672 ± 4 h)	Not less than 53 Mpa- (N/mm ²)
3	Setting time (vacate apparatus)	
(a)	Initial	Not less than 30 minutes
(b)	Final	Not more than 600 minutes
4	Soundness	
(a)	By Le Chatelier method	Note more than 10mm
(b)	By Autoclave test	Not more than 0.8%
5	Consistency of Standard cement paste (Standard consistency)	The quantity of water required to produce a paste of standard consistency to be used for determination of water content of mortar for the compressive strength tests and for the determination of soundness and setting time.

2.4.2 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.2

Sr. No.	Quantity of Cement	Nos. of sample	Nos. of Test	Remarks
1	2	3	4	5
1	Up to 50 MT	1	1	Same lot
2	50-100 MT	2	2	Same lot
3	100-200 MT	3	3	Same lot
4	201-300 MT	4	4	Same lot
5	301-500 MT	5	5	Same lot
6	501-800 MT	6	6	Same lot
7	801-1300 MT	7	7	Same lot
8	For each large consignment	8	8	Same lot

N.B. : If different lots found in cement Qty. as described in Col. No.2 of Table No.2 one sample from each lot shall be taken for Testing, minimum sample & Test shall be as per Table No.1 therefore sectional officer of work shall be enter lot No. against quantity of each lot in the stock register for each receipt from time to time. Sample shall be taken random.

2.4.3 Chemical Requirements: -

TABLE NO. 3

Chemical Requirements for 53 Grade ordinary Portland cement

I.S. 269-2015 (Specifications) (Clause-6.1 Table No.2 P.No.3)

I.S. 4032-1985 (Chemical analysis)

Sr. No.	Characteristic	Requirement
1	Ratio of percentage of lime to percentage of silica, alumina and iron oxide when calculated by the formula $\frac{CaO}{2.8SiO_2 + 1.2Al_2O_3 + 0.65Fe_2O_3}$	Not greater than 1.02 and not less than 0.80
2	Ratio of percentage of alumina to that of iron oxide.	Not less than 0.66

3	Insoluble residue, percent by mass	Not more than 5
4	Magnesia, percent by mass	Not more than 6
5	Total sulphur content calculated as sulphuric anhydride (SO ₃) percent by mass	Not more than 3.5
6	Total loss on ignition	Not more than 4 percent

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

2.5 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.

2.6 Field Test:

The quality of cement shall be confirmed through physical 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.

2.7 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.

2.8 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.

2.9 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.

- 2.10** 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.
- 2.11** 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.
- 2.12** 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.
- 2.13** 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 tother 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.
- 2.14** 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.
- 2.15** 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.
- 2.16** Cement should be measured by weight with MT or Kg as the unit.

M-3 SAND (FINE AGGREGATE):

All fine aggregate shall be natural river sand and shall confirm to IS-383 -2016. Sand shall be of natural river sand having F.M. from 2.1 to 3.2 for all concrete works. It shall be clean, well graded, hard, durable and strong and free from injurious amount of dust, clay, silt, kankar nodules, soft or flaky particles, shale, alkali, salts, organic matter, loam, mica or other deleterious materials.

Grading of the fine aggregate (sand) shall be as per Table – A given below.

(IS-383-page No. 11 table-4)

TABLE - A

IS Sieve designation	PERCENTAGE PASSING FOR			
	Grading Zone -I	Grading Zone -II	Grading Zone -III	Grading Zone -IV
10 mm.	100	100	100	100
4.75 mm.	90-100	90-100	90-100	90-100
2.36 mm.	60-95	75-100	85-100	95-100
1.18 mm.	30-70	55-90	75-100	90-100
600 microns	15-34	35-59	60-79	80-100
300 microns.	5-20	8-30	12-40	15-50
150 microns.	0-10	0-10	0-10	0-15

Sand of grading zone - iv shall not be used for concrete work.

Limits of various deleterious materials in fine aggregate shall be as per mention below. Sand for masonry mortar and plastering work shall only be used after screening through proper number screen and shall confirm to IS-2116 for masonry mortar and to IS-1526 for plaster work.

STORAGE:

The fine aggregate should be stacked carefully on a clean and hard surface so that it should not be get mixed up with deleterious foreign materials, Segregation of heavier particles by sliding down may be not stacking in high conical heaps.

TEST:

The particulars of tests and frequency shall be as mention below.

TABLE - B

Sr. No.	PARTICULARS OF TEST	FREQUENCY	REMARKS
1	Gradation and F.M.	One test per 150 Cum of concrete/masonry work	IS-383-1970- & IS-2386-1963
2	Sp. Gravity and Water Absorption	Once for new quarry/change in source.	IS-383-1970- & IS-2386-1963
3	Silt Content	One test per 150 Cum of concrete/masonry work	IS-383-1970- & IS-2386-1963
4	Impact Value	Once for new quarry/change in source.	IS-383-1970- & IS-2386-1963

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, durable and gritty particles free from injurious amount of dust, clay, silt, kanker, nodules, soft or flaky particles, shale, 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 No. 4**Limits of Deleterious Materials****IS: 383-2016 (Specifications) (Clause 5.2.1 Table No.2 P.No.3)****IS: 2386 (Part-I, II)-1963 (Method of Testing)**

Sr. No.	Deleterious substances and Method of test.	Fine Aggregate percentage by mass Maximum (Uncrushed)	Coarse Aggregate percentage by mass 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-5**Gradation of Fine Aggregate****IS : 383-2016 (Specification) (Clause No.6.3 Table No.9 P.No.7)****IS : 2386 (Part-I)-1963 (Method of testing)**

Sr. No	I.S. Sieve	Percentage(%) passing for			
		Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
1.	10mm	100	100	100	100
2.	4.75mm	90-100	90-100	90-100	95-100
3.	2.36mm	60-95	75-100	85-100	95-100
4.	1.18mm	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 out sides (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 description 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, II and IV for concrete work. The F.M. of sand shall have ranging between 4.00 and 2.11 ($2.11 < \text{F.M.} < 4.00$) 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-6

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: 383-1970 (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.	Once for approval of source of supply subsequently only in case of doubt and change in source.	As per relevant specification & design.

3.2.5 Initially before work commenced the entire test as mentioned in above Table-1 shall be carried out at GERI or Govt Approved 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:

The coarse aggregate for the use of making concrete and other purpose shall be of black stone crushed metal. It shall be clean, hard, durable & free from alkalis and other deleterious substance. The coarse aggregate shall be well grade and generally be cubical in shape. The gradation shall give a dense & water tight concrete of specified strength and consistency. The actual gradation shall be as indicated by the laboratory study.

GRADING:

The grading of the coarse aggregate shall be as per Table – A given below (IS-383:1970 Page No. 9 table - 2).

TABLE - A

IS Sieve designation	% Passing for graded aggregate of nominal size.			
	40 mm.	20 mm.	16 mm.	12.5 mm.
80 mm.	100	-	-	-
63 mm.	-	-	-	-
40 mm.	95 to 100	100	-	-
20 mm.	30 to 70	95 to 100	100	100
16 mm.	-	-	90 to 100	-
12.5 mm.	-	---	-	90 to 100
10 mm.	10 to 35	25 to 55	30 to 70	40 to 85
4.75 mm.	0 to 5	0 to 10	0 to 10	0 to 10
2.36 mm.	-	-	-	-

SIZE OF AGGREGATE:

The size of coarse aggregate for mass concrete shall be as Table – B given below (IS-383- Page No.-10 table – 3).

TABLE – B

CLASS	SIZE	IS Sieve Designation	% Passing
Very large	150 to 80 mm.	150 mm.	90 to 100
		80 mm.	0 to 10
Large	80 to 40 mm.	80 mm.	90 to 100
		40 mm.	0 to 10
Medium	40 to 20 mm	40 mm	90 to 100
		20 mm.	0 to 10
Small	20 to 4.75 mm	20 mm.	90 to 100
		4.75 mm.	0 to 10
		2.36 mm.	0 to 2

The nominal maximum size of coarse aggregate shall not be greater than one fourth of the minimum thickness of the member for PCC work, In case of RCC members maximum size of coarse aggregate shall be such so as concrete can easily place in the members without honey combing. It can be determined as follow.

- (i) One fourth of the minimum thickness of the members.
 - (ii) The minimum clear distance between main bars minus 5 mm.
 - (iii) The minimum cover to the reinforcement minus 5 mm.
- whichever is smaller.

The minimum and maximum size of the aggregate shall be between 4.75 mm. to 80 mm.

DELETERIOUS MATERIALS:

Deleterious material as described and its acceptance criteria for coarse aggregate shall be as per IS-383-1970.

TESTING:

The material subjected to tests for gradation, flakiness and elongation, abrasion value, soundness crushing/ impact value, and deleterious materials etc. as per IS-383. Following is the acceptance limit.

- i) Flakiness and elongation : 30 % maximum.
- ii) Abrasion value. : 40 % maximum.
- iii) Soundness. : 12 % loss with Na₂So₄ and 18 % loss with MgSo₄
- iv) Crushing value. : 45 % for concrete and 30 % for wearing surface.
- v) % of deleterious material. : 5 %
- vi) Sp. Gravity. : 2.5 Minimum.
- vii) Water absorption : 1.5 % maximum.

FREQUENCY OF TESTING:

The particulars of tests and its frequency shall be as mention below.

Sr. No.	PARTICULARS OF TEST	FREQUENCY	REMARKS.
1	Gradation	One test per 150 cum. Of concrete work.	IS-383-1970 & IS-2386-1963
2	Sp. Gravity and Water absorption	Once for new quarry/ change in source.	IS-383-1970 & IS-2386-1963
3	Flakiness and elongation.	Once for new quarry/ change in source.	IS-383-1970 & IS-2386-1963
4	Impact value.	Once for new quarry/ change in source.	IS-383-1970 & IS-2386-1963

STORAGE:

The aggregate of different size shall be stacked or batched or stored separately and handle in such a manner as to prevent intermixing of different size of aggregates. No foreign materials shall be allowed to be mixed up with the aggregates.

Coarse aggregate shall be of machine crushed stone (Crushed metal) of black 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.

4.1.1 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 in can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corner of the form. For most work 20mm aggregate is suitable where there is no restriction to the flow of concrete in to section 40mm restriction to the flow of concrete in to section 40mm or larger size may be permitted. In concrete element with thin section, closely space reinforcement or small cover, consideration should be given to the use of 10mm nominal maximum size, Read to above para size of aggregate should be determined as follow.

4.1.2 For plain cement concrete (PCC) :

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

4.1.3 For reinforced cement concrete (RCC) :

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

OR

- | > The minimum cover to the
Reinforcement – 5mm.
Whichever is smaller.

4.1.4 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 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 specification provision.

The particular of tests, frequency and acceptance criteria are shown in Table-7 below.

TABLE-7**Coarse Aggregate (Crushed Metal)****IS : 2386 (Part-1 to 8) if method of test****IS : 383-2016 (Specifications) (Clause No.5.4)**

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	Once for approval of source of supply subsequently in case of doubt and change in source.	30% maximum
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))
5	Alkali Aggregate Reactivity.	Once for approval of source of supply subsequently only in case of doubt and change in source.	As per relevant specification & design.

NB :- The kind of test to be got tested, out of above mentioned various test shall be carried out on the decision of D.E.E. (Q.C.) looking to function and nature of concrete and its usability after work.

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-8
Specification of single size Coarse Aggregate
IS:383-2016 (Clause-6.1 & 6.2 Table No.7 P.No.6)

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				

Course aggregate For mass Concrete Works shall be in the Size Specified in Following Table
Table-9

Size of coarse aggregate for mass concrete
I.S. 383-2016 (Clause-6.1.1 Table No.8 P.No.7)

For Mass Concrete

Sr. No.	Class and size	I. S. Sieve designation	Percentage Passing
1	Very Large 150- 80mm	160mm 80mm	90 to 100 00 to 10
2	Large 80 – 40mm	80mm 40mm	90 to 100 00 to 10
3	Medium 40 – 20mm	40mm 20mm	90 to 100 00 to 10
4	Small 20 – 04.75mm	20mm 04.75mm 0.236mm	90 to 100 00 to 10 00 to 02

M-5 THERMO MECHANICALLY TREATED (TMT)::

The thermo mechanically treated, popularly known as TMT shall conform to IS-1786. The steel shall be procured by the contractor and grade of steel shall be Fe 415 (minimum). The contractor shall make suitable arrangement for storage of the steel at site. In any circumstances steel produced by re-rolling mills shall not be allowed to use. The steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. The contractor shall have to procure steel bars directly from manufacturers having BIS certification or its authorized dealer. The contractor shall have to produce original voucher / bill (Retail invoice or Tax Invoice). For the same along with physical and chemical test report whenever asked by engineer in charge for the same.

The mechanical properties of the steel shall be as mention below.

TABLE - A (IS-1786-2008)

STRENGTH & DESIGNATION	MECHANICAL PROPERTIES			BEND TEST		REBEND TEST	
	YIELD STRESS (YS)	TENSILE STRENGTH (TS)	ELONGATION %, Min, on gauge length	Up to & including 20mm. dia.	Over 20mm. dia	Up to & including 10mm. dia	Over 10mm. dia.
	N/mm ²	N/mm ²	5.65 square root A , Where A is the cross sectional area of the least piec	≤	≤	≤	≤
1	2	3	4	5	6	7	8
Fe415	415	10 % more than the actual 0.2 % Proof Stress/Yield Stress but not less than 485 N/mm ²	14.5	Mandrel Dia=3 mm	Mandrel Dia=4 mm	Mandrel Dia=5 mm	Mandrel Dia=7 mm
Fe500	500	8 % more than the actual 0.2% Proof Stress/Yield Stress but not less than 545 N/mm ²	12	Mandrel Dia=4 mm	Mandrel Dia=5 mm	Mandrel Dia=7 mm	Mandrel Dia=8 mm

NOTE: The sample shall be considered to have passed in the bend test if there is no transverse crack in the bent portion. The sample shall be considered to have passed in the rebend test if there is no fracture in the bent portion.

TABLE-B (IS-1786-2008)				
CONSITITUENT	PERCENTAGE MAXIMUM			As Per IS-1786 2008 Cl 4.2.1 PERMISSIBLE VARIATION AS FOLLOWS
	Fe 415	Fe 500	Fe550	% max
Carbon	0.3	0.3	0.3	0.02
Sulphur	0.06	0.055	0.055	0.005
Phosphorus	0.06	0.055	0.05	0.005
Sulphur & phosphorus	0.11	0.105	0.1	0.010

The chemical composition of the steel shall be as mention below.

TESTING:

Testing of steel shall be done for each size of bars and frequency mentioned below of steel in government or government approved laboratory, to known the physical properties of steel bars, like Nominal mass, 0.2 percentage proof stress/yield stress, Elongation percentage, Tensile strength, Bend and re-bend. The Charges for the same shall be recovered from RA/FINAL BILL of the contractor.

TABLE-E (Table-5,Page-17 of IS-1786)		
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 10 mm	One sample from each 25 tonnes or part thereof	One sample from each 40 tonnes or part thereof
10 mm to 16 mm inclusive	One sample from each 35 tonnes or part thereof	One sample from each 45 tonnes or part thereof
Over 16 mm	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 confirm to IS: 1786. The steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter.

TESTING CHARGES:

The testing charges shall be recovered from RA/FINAL BILL of the contractor as per clause No.77 of B-1 form of tender.

MEASUREMENT:

For the purpose of payment, the bar shall be measured correct up to 10mm in length Unit weight of bars shall be computed as per weight given in IS-1786-2008.

Specification for Indian steel or at the rate specified below:

TABLE-D (Table-1, Page-11 of IS-1786)			
BAR DIA.	UNIT WEIGHT	BAR DIA.	UNIT WEIGHT
In mm	Kg / Rmt.	In mm	Kg / Rmt.
6	0.222	28	4.83
8	0.395	32	6.31
10	0.617	36	7.99
12	0.888	40	9.86
16	1.58		
20	2.47		
25	3.85		

M-6 Portland slag Cement:

CEMENT:

The cement shall be used in Tetrapod Portland Slag cement conforming to Indian Standard Specification IS:455:2015

The cement to be used in works of tetrapod under this contract shall conform in all respects to IS 455:2015 (Portland Slag Cement – Specification). The quality, manufacture, storage, handling, testing, and acceptance of cement shall strictly comply with all applicable provisions, requirements, and clauses of the said Indian Standard. No cement shall be used in the tetrapod work unless it satisfies the requirements laid down in IS 455:2015 and is approved by the Engineer-in-Charge. The contractor shall ensure that all cement brought to site is accompanied by manufacturer's test certificates and shall be liable to produce additional samples for testing whenever required as per relevant IS codes

As per IS 455:2015 Portland Slag Cement (PSC), Clause 8 deals with storage requirements of cement to ensure that its quality is not affected before use.

Sampling of cement shall be carried out in accordance with **IS 455:2015 Clause 12**

The physical and chemical requirements of Portland slag Cement is tabulated overleaf. The cement may be rejected, if it does not comply with any of these requirements. The sample shall be taken within three weeks of the delivery and all the tests shall be commenced within one week of sampling. When it is not possible to test the sample within one week, the sample shall be packed and stored in air tight containers and tested at the earliest but not later than 3 months since the receipt of sample for testing. Cement remaining in bulk storage at the factory, prior to shipment, for more than six months, or cement in bags, in local storage such as, in the hands of vendor for more than 03 months after completion of tests, shall be re-tested before use. The testing of the cement shall be done for each lot / consignment received on site. The frequency of the test shall be as under.

TESTING OF CEMENT:**Physical Analysis:**

All physical test required as per IS: 4031 (Part-2 to 8)- 1988 shall be carried out

TABLE NO : 2**Physical Requirements for Portland Slag cement.****I.S. 455-2015 (Specifications) (Clause-7 Table No.2 P.No.2)****I.S. 4031-1968 (Physical tests)**

Sr.No.	Physical Properties	Requirements as per I.S. 269-2015
1	Fineness (Specific Surface Area)	Not less than 225 M ² /Kg
2	Compressive Strength	
(a)	03 days (72 ± 1 h)	Not less than 16 Mpa (N/mm ²)
(b)	07 days (168 ± 2 h)	Not less than 22 Mpa (N/mm ²)
(c)	28 days (672 ± 4 h)	Not less than 33 Mpa- (N/mm ²)
3	Setting time (vacate apparatus)	
(a)	Initial	Not less than 30 minutes
(b)	Final	Not more than 600 minutes
4	Soundness	
(a)	By Le Chatelier method	Note more than 10mm
(b)	By Autoclave test	Not more than 0.8%
5	Consistency of Standard cement paste (Standard consistency)	The quantity of water required to produce a paste of standard consistency to be used for determination of water content of mortar for the compressive strength tests and for the determination of soundness and setting time.

Chemical Requirements: -

TABLE NO. 3

Chemical Requirements for Portland slag cement

I.S. 455-2015 (Specifications) (Clause-6 Table No.1 P.No.3)

I.S. 4032-1985 (Chemical analysis)

Sr. No.	Characteristic	Requirement
1	Insoluble residue, percent by mass	Not more than 4.0
2	Magnesia, percent by mass	Not more than 10
3	Total Sulfid shlpur content calculated as sulphuric anhydride (SO ₃) percent by mass	Not more than 1.5
4	Total loss on ignition	Not more than 5.0 percent
5	Sulphide sulphur (S), Max	Not more than 1.5
6	Chloride content, percent by mass. (Max)	Not more than 0.1 percent

The quality of cement shall be confirmed through physical 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.

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. 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.

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

M-7 BINDING WIRE:

The binding wire for tying reinforcement shall be of soft & annealed mild steel confirming to IS-280. The diameter of wire shall be of 1.63 mm 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-8 PVC PIPE:

P.V.C. pipe shall confirm to I.S. 4985. PVC pipe shall be of ISI mark with minimum 4.0 Kg/Cm² Pressure quality and Contractor must be submit manufacturing company certificate for P.V.C. pipe.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER – V

Supplying & Laying Trap Rubble Stone

CHAPTER-V

Supplying & Laying Trap Rubble Stone

Rock Source, testing and approval

Rock quarry shall be selected by the contractor and obtain approval from EIC prior to quarrying rock from the source. Contractor is responsible for obtaining all necessary approval from the government agencies for quarrying rock.

The Contractor shall submit rock selection and quality control procedures including the following.

- (a) Method of blasting & quarrying
- (b) Segregation of rocks into various sizes
- (c) Stockpiling
- (d) Transportation
- (e) Stockpiling at site
- (f) Testing of rocks for physical and chemical properties
- (g) Density

Contractor shall be responsible for testing as above in a NABL/government approved laboratory at his own cost. Contractor shall submit the following prior to delivery of rocks to the site.

- a) Test results of rocks by an NABL/government approved laboratory on a minimum of three separate samples for each proposed source to confirm that the rock complies with the specified parameters.
- b) The methods used to quarry, select, grade, handle, load, transport and place the rock and the quality control procedures to be adopted at the quarry, during delivery and on Site.
- C) Arrange a meeting at the quarry at which the EIC, the Contractor and the quarry managers are present to discuss and agree the methods to be used, to inspect samples of the rock and to witness gradation and weight tests on the samples.

Filter Layer rock (50 to 100 Kg Stones):

Filter layer is used to place a bedding layer on the existing seabed for preparation to place core rock. Filter layer shall consist of rocks from 50 kg to 100 kg. Not more than 50% of rock shall be less than 75 kg and all rocks shall within the range of 50 kg to 100 kg. Stone supplied above 100 Kg. will not be allowed to dump and same are to be removed from the site by the contractor at his risk and cost. Core rocks shall not contain any foreign material, clay, sand, dust and any other material and shall be free of all.

Core Layer rock (20 to 100 Kg Stones):

The core rocks are used form the shape of the main cross section of the breakwater. Have the following grading using stone of class C shall be supplied in the range of weight 20 kg. to 100 Kg. Not more than 50% of rock shall be less than 60 kg and all rocks shall within the range of 20 kg to 100 kg. Stone supplied above 100 Kg. will not be allowed to dump and same are to be removed from the site by the contractor at his risk and cost. Core rocks shall not contain any foreign material, clay, sand, dust and any other material and shall be free of all.

Layer rock (500 to 1000 Kg Stones):

The core rocks are used form the shape of the main cross section of the breakwater. Have the following grading using stone of class C shall be supplied in the range of weight 20 kg. to 100 Kg. Not more than 50% of rock shall be less than 750 kg and all rocks shall within the range of 500 kg to 1000 kg. Stone supplied above 1000 Kg. will not be allowed to dump and same are to be removed from the site by the contractor at his risk and cost. Core rocks shall not contain any foreign material, clay, sand, dust and any other material and shall be free of all.

Toe burm Layer rock (2000 to 3000 Kg Stones):

The core rocks are used form the shape of the main cross section of the breakwater. Have the following

grading using stone of class B shall be supplied in the range of weight 2000 kg. to 3000 Kg. Not more than 50% of rock shall be less than 2500 kg and all rocks shall within the range of 2000 kg to 3000 kg. Stone supplied above 3000 Kg. will not be allowed to dump and same are to be removed from the site by the contractor at his risk and cost. Core rocks shall not contain any foreign material, clay, sand, dust and any other material and shall be free of all.

Testing of rocks

Codes and standards The stones for breakwater shall be clean, tough, durable, and free from other soft or decomposed material or quarry rubbish and obtained from approved quarries. The stones generally shall be cubical as far as possible obtained using blasting. Contractor shall carry out tests on rock samples to satisfy the requirements at his own cost. Following tests are mandatory for rocks.

- (a) Soundness test : In accordance with the latest BIS 383/1952 Appendix 'A' as applicable for massive rock.
- (b) Abrasion test : In accordance with the latest BIS. 383/1952. Appendix 'A'.
- (c) Crushing strength : : In accordance with the latest BIS 812/1951.
- (d) Specific Gravity : : In accordance with latest BIS code 1124.
- (e) Water absorption : : In accordance with latest BIS code 1124.

Indian Standards shall generally be followed and wherever the details for parts of Works are not defined adequately in Indian Standards, relevant acceptable International Standards shall be adopted in the order of preference as given below:

- i) BS: 6349 Part 7 – Guide to Design and Construction of Breakwaters
- ii) CIRIA, "The Rock Manual" and US Army Corps of Engineers, EM 1110-2-1100 Coastal Engineering Manual.
- iii) Eurotop Manual – 'Wave overtopping of Sea Defences and Related Structures'
- iv) CIRIA, C660 – Control of Contraction Induced Cracking in Concrete

Length to thickness ratio

All rock grades except core rock shall not contain more than 50% by weight of stone with a length to thickness (L/ d) ratio greater than 2. Not more than 5% of the rocks shall have a length to thickness (L/ d) ratio greater than 3, where the length, L, is defined as the greatest distance between two points on the stone and the thickness, d, as the minimum distance between two enclosing parallel planes through which the stone can just pass. Testing for shape ratio determination shall be undertaken on samples of at least 50 pieces taken at random from stones of mass W15 or greater.

Density

The average rock density shall be greater than 2,630 kg/ m³ with 90% of the stones having a density of at least 2,600 kg/ m³ when sampled, tested and reported. Each test shall use ten density determinations, each determination being carried out on a different randomly selected stone where such stone shall have a volume of at least 50ml and if any stone is too large, a representative part of at least 50ml shall be taken.

Resistance to Wear

The micro-Deval coefficient shall not be greater than 15 (MDE15, Clause 5.4, EN 13383-1:2002) when tested in accordance with EN 1097-1:1996.

Water Absorption

The average water absorption shall be not more than 0.5% for all rock grades except core rock where average water absorption shall not be more than 2%. Each test shall use ten water-absorption determinations, each determination being carried out on a different randomly selected stone where such stone shall have a volume of between 50 and 150ml and if any stone is larger than 150ml, a representative part of between 50 and 150ml shall be taken.

Resistance to Weathering

Magnesium Sulphate Soundness for sampling testing and reporting in accordance with BS 812, Part 121: 1984 shall be less than 12%.

Impact Resistance

The aggregate impact value shall be less than 30% for the standard test fraction when tested in accordance with BS 812 Part 112: 1990.

Crushing Resistance

The force required to produce 10% fines shall not be less than 170kN when tested in accordance with BS 812 Part 111: 1990, and either (i) the Franklin Point Load Index (ISS0) (ISRM) shall not be less than 5 MPa for all rock grades. or (ii) the uniaxial compressive strength (ISRM) shall be greater than 90 MPa for all rock grades except core rock for which the uniaxial compressive strength shall be greater than 60 MPa.

Block Integrity

Blocks shall be free from visually observable cracks, veins, fissures, shale layers, seams, laminations, foliation planes, cleavage planes, unit contacts or other such flaws which could lead to breakage during loading, unloading or placing. The Drop Test Breakage Index shall be less than 5% when sampled, tested and reported.

Impurities

Rock shall not include any impurities in a quantity such that damage will occur to the structure or the environment in which it is to be used.

Frequency of Testing

Testing shall be carried out regularly by the Contractor throughout the Contract to monitor the quality of rock on samples selected by EIC. The Contractor shall carry out the testing promptly and shall report the results without delay. Visual inspection and impurities and measurement shall be carried out continuously on all rocks. The other characteristics such as density, specific gravity, compressive strength and water absorption etc. shall be tested for each grade of rock for every 5000 MT. Additional or more frequent testing may be required if the material varies or the quarry is worked inconsistently.

Stockpiling of rocks at site

Rock shall be transported to the Site along an approved route. The Contractor shall:

- Obtain the approval of the Engineer and the appropriate Authorities before using the public highway.
- Avoid damage to public or private roads and shall repair any damage that does occur.
- Trucks used to transport rock for this Contract shall be of a type specifically constructed for hauling rock and shall have tail boards or scow-ends. No other mode of rock transportation may be employed unless first approved by the Engineer and the relevant Authorities.
- If sea transportation is used, ensure all barges are seaworthy and have the necessary safety certificates and insurance. Permission for safe mooring of sea transport vessels shall be obtained from the relevant Authorities. The Contractor shall have an emergency procedure in place should there be an imminent threat of sea and wind conditions beyond the safe mooring design conditions.
- If river transportation is used, ensure that the barges and vessels have the necessary safety certificates and insurance issued by the relevant Authorities.

The Contractor may be permitted to stockpile rock at or near the Site. Separate stockpiles shall be made for different grades of rock. The stockpiles shall be formed so that they do not constitute a hazard; the locations, side slopes and heights and other factors affecting safety shall be as approved

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-VI

GENERAL SPECIFICATION OF REINFORCEMENT

CHAPTER-VI

GENERAL SPECIFICATION FOR REINFORCEMENT WORK

1.0) MATERIALS:

1.1) M. S. BARS

1.2) TMT BARS

1.3) BINDING WIRES

2.0) SCOPE OF WORK:

Scope of work shall include supplying all materials and labour for cutting, bending, binding, 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 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 straightened 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 bar bender, 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 10cms, depends upon type of structures and exposure condition.

5.0 BINDING:

Wire for tying reinforcement shall confirm 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 provided 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 suitably 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.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-VII

GENERAL SPECIFICATION OF CONCRETE

CHAPTER-VII

GENERAL SPECIFICATION OF CONCRETE

1.0) MATERIALS:

- 1.1) CEMENT: Specification m-2 of specification of material section shall apply.
- 1.2) WATER: Specification m-1 of specification of material section shall apply.
- 1.3) FINE AGGREGATE (SAND): Specification m-3 of specification of material section shall apply.
- 1.4) COARSE AGGREGATE: Specification m-4 of specification of material section shall apply.

2.0 SCOPE OF WORK:

The work covered by this chapter consists of furnishing all materials, equipment and labour for the manufacturing, transporting, placing, finishing and curing of concrete in the structure included in these specifications and performing all the functions necessary and ancillary to the work. The item of concrete may be split up into several items according to the grade of concrete to be used and its location and shall be measured and paid for accordingly. The general specifications described hereafter shall; however, be relevantly apply to all concrete items.

3.0 COMPOSITION:

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

4.0 PREPARATION FOR PLACING CONCRETE:

Specification laid down in IS-457 shall be applicable. Generally, no concrete shall be placed until all form works, installation to parts to be embedded and preparation of surface involved in the placing have been approved. Method of depositing the concrete shall be subject to approval. All surface of forms and embedded materials that have become encrusted with dried mortar or grout and from the concrete previously place, shall be cleaned. The foundation bed and sides shall be carefully cleaned stiff brooms, picks, jets of water and air applied at high velocity or other effective means, followed by thorough washing. Before placing of concrete, water shall be removed from depositions and foundation surface shall be left uniformly damp. All that surfaces shall then be coated with mortar about 2cms thick in case of rock surface and cement slurry in case of concrete/masonry surface.

5.0 PLACING OF CONCRETE:

Specification laid down in IS-457 shall be applicable. Placing of concrete shall only be undertaken in presence of authorized representative of engineer in charge. Contractor shall have to inform department well in advance and in writing, so that necessary inspection, before placing concrete can be taken over and only after approval of engineer in charge, placing of concrete can be done.

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. Method of placing should be such as to preclude segregation. Care should be taken to avoid displacement of reinforcement or movement of formwork. As a general guidance, the maximum permissible free fall of concrete may be taken as 1.50mt.

6.0 CLASSIFICATION:

For all items of concrete in any portion of the structure or its associated works, shall be of nominal mix or design mix as specified in specification of item or as decided by engineer in charge as per provision made in IS-456 Page No-23 clause-9.3. The cement concrete works to be carried out are classified in grades as mentioned 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 carry outwork without claiming any extra cost. The cement level mention in the Table:- AA, given below are tentative and for general guidance only. The design mix or nominal mix for different grade of concrete to be used will be furnished by the department.

Table:- AA

SR .N O	GRADE OF CONCR ETE	MSA	Min.Avg. Comp. sterength of 3- specimen AT FIELD ON 15 X 15X 15 cms CUBE	Min.Avg. Comp. sterengt h of 3- specime n AT LAB. ON 15 X 15X 15 cms PRELI MINARY TEST CUBE	MIN. CEMEN T LEVEL REQ.AS PER IS PCC/RC C	CEMENT LEVEL CONSID ER IN THE RATE PCC/RC C	MAX. W/C RATIO PCC/ RCC	REMARK S
1	2	3	4	5	6	7	8	9
		mm	Kg/cm2 at 28 day	Kg/cm2 at 28 days	Kg/cum	Kg/cum		
1	M-10	40	133	161	Not Available	205	0.6	For P.C.C. Mild exposure condition
						-	-	
		80	133	161	Not Available	190	0.6	
						-	-	
2	M-15	20	184	212	240	300	0.6	For P.C.C.

					N/A	300	-	Mild exposure condition
		40	184	212	210	280	0.6	
		80	184	212	N/A	280	-	
					N/A	240	0.6	
3	M-20	20	245	272	N/A	240	-	For P.C.C. severe to very severe & for R.C.C. mild exposure condition
					N/A	240	-	
		40	245	272	250	360	0.5	
					300	360	0.55	
		80	245	272	220	330	0.5	
					270	330	0.55	
4	M-25	20	296	323	N/A	-	-	For P.C.C. Extra & for R.C.C. moderate exposure condition
					N/A	310	-	
		40	296	323	280	380	0.4	
					300	380	0.5	
		80	296	323	250	360	0.4	
					270	450	0.5	
5	M-30	20	357	390	N/A	-	-	For R.C.C. Sever Exposure condition
					N/A	450	-	
		40	357	390	280	380	0.4	
					300	380	0.5	
		80	357	390	250	360	0.4	
					270	450	0.5	

NOTES: (Conditions)

- 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 characteristic compressive strength given in table-2, based on clause No.-15.1.1, Page-29 of IS-2000. And it is the average characteristic compressive strength of three specimens.
- 3** Compressive strengths mentioned in column no-5 is based on para-9.2.2 (page no-22) of IS-456-2000 (The target mean strength of conc. 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 as per IS-456, Page-23, 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 & target mean strength mentioned in column No-5, are based on 'GOOD QUALITY CONTROL' and MODERATE exposure 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 design mix, **the recovery shall be made at Rs. 7.70 per kg of cement excluding GST.** 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 design mix, NO EXTRA payment shall be made.
- 7** Curing period shall be 14 days (min.)
- 8** Above details are primarily given for the guidance of contractor while quoting their tender rate and is only informative for the general requirement of concrete.

7.0 ACCEPTANCE CRITERIA:

- i) **COMPRESSIVE STRENGTH:** The concrete shall be deemed to comply with the strength requirements when both the following conditions 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-11 given on Page No-30 of IS-456-2000.
 - b) Any individual test results comply with the appropriate limits in col-3 of Table-11 given on Page No-30 of IS-456-2000.

8.0 PROPORTIONS FOR NOMINAL MIX CONCRETE:

The proportion of materials for nominal mix concrete shall be in accordance with IS - 456 - 2000, Page NO-23, Table-9, given in following table:

GRADE OF CONCRETE	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, Max
1	2	3	4
M-10	480	GENERALLY, 1:2 BUT SUBJECT TO AN UPPER LIMIT OF 1:1.5 AND A LOWER OF 1:2.5	34
M-15	330		32
M-20	250		30

NOTE: 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 and the 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 / Govt. Approved laboratory, in case of field laboratory facility not available. In such case, the charges of the same shall be borne by the department.

The details are further tabulated in the table below.

GRADE OF CONCRETE	MSA IN mm	TOTAL QUANTITY OF DRY AGGREGATE (COARSE+FINE) BY MASS PER 50Kg OF CEMENT	WEIGHT OF COARSE AGGREGATE	WEIGHT OF FINE AGGREGATE	Cement	WATER-CEMENT RATIO
1	2	3	4	5	6	7
M-10	20	480Kg	320Kg	160Kg	50Kg	NOT MORE THAN 0.68
	40	480Kg	343Kg	137Kg	50Kg	
	80	480Kg	343Kg	137Kg	50Kg	
M-15	20	330Kg	220Kg	110Kg	50Kg	NOT MORE THAN 0.64
	40	330Kg	235Kg	95Kg	50Kg	
	80	330Kg	235Kg	95Kg	50Kg	
M-20	20	250Kg	166Kg	84Kg	50Kg	NOT MORE THAN 0.60
	40	250Kg	178Kg	72Kg	50Kg	
	80	250Kg	178Kg	72Kg	50Kg	

- NOTE: 1) FINE AGGREGATE(SAND) SHALL CONFIRM TO ZONE-II OF TABLE-4 OF IS-383(FM 2.21 TO 3
- 2) GRADED COARSE AGGREGATE SHALL BE USED. FOLLOWING DATA ARE FOR GENERAL GUIDANCE ONLY.

MSA	PROPORTION OF COARSE AGGREGATE IN %			
in mm	4.75-10mm	10-20mm	20-40mm	40-80mm
1	2	3	4	5
80mm	10	15	35	40
40mm	15	35	50	-
20mm	40	60	-	-

- 3) PRELIMINARY TEST CUBES OF SIZE 15X15X15cms SHALL BE CASTED AND TESTED FOR 7 DAYS AND 28 DAYS WELL BEFORE STARTING OF ACTUAL WORK.

- 4) MIX DESIGN IS NOT NECESSARY FOR NOMINAL MIX.

9.0 DESIGN MIX CONCRETE:

The design mix shall be designed 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 table-AA column-4 & 5 respectively. Mix design done earlier not prior to one year may be considered adequate for later work provided there is no change in source and quality of the materials. The design mix shall be carried out in Govt. laboratory (GERI) / Govt. Approved laboratory at the cost of the department and as per prevailing norms as per IS-10262.

10.0 FORMS FOR CONCRETE:

IS-457 shall be applicable.

i) GENERAL:

The forms for concrete work shall have sufficient strength and rigidity to hold and to withstand the pressure of fresh concrete during compaction, incl. live load and shaped to the required line within the tolerance specified. The tolerances specified are for finished concrete surface and not for the forms. For further details regarding design, details, etc reference may be made to IS-14687. As far as possible; the forms shall be of steel material. The supports shall be so arranged to keep the maximum deflection within 1/360 of the span. Suitable devices shall be used to hold corners, adjacent ends of panels of other forms together in accurate alignment, during compaction of concrete by vibrator or other means. The forms and their joints shall be tight enough to prevent loss of mortar or water from

concrete while vibrating The contractor shall prepare detail design and drawings for the execution of formwork, centering, support system and temporary works as per IS requirement and shall have to submit well in advance for approval to the engineer in charge The contractor shall be responsible and liable to pay all claims and compensation arising from any loss or damage to life and property due to any deficiency, failure of centering or the temporary works.

ii) FORM SHEATHING OR LINING:

In general, forms for permanently exposed surface shall consist of or shall be lined with steel plate metal or with water resistant plywood or wooden sheathing of lining shall be so treated or coated that there will be no chemical deterioration of formed concrete surface. The forms shall able to withstand restorations caused by placement and vibration of concrete and the workmanship used in the form construction shall be such that formed surface after being treated will confirm to the requirement of these specifications.

iii) ABSORPTIVE FORM LINING:

Absorptive form lining, where directed to be used, shall be of the type and quality approved by the engineer in charge The form lining shall be highly absorptive to air and water and through its absorptive capacity shall be able to eliminate voids, pits and common defects from concrete and without damage to the surface. The lining itself and treatment employed in its manufactures shall neither discolour the concrete nor interfere with normal chemical reaction of the cement. Specification laid down in IS-457 shall be applicable for absorptive form lining.

iv) FORM TIE:

Embedded metal rods used for holding the forms shall remain embedded and shall terminate not less than 30mm for MSA-40mm and 50mm for MSA-80mm clear of the formed faces of concrete. Embedded wire ties for holding forms shall only be permitted. Specifications laid down in IS-457 shall be applicable.

v) CLEANING AND TREATMENT OF FORMWORK:

Surface of forms shall be kept free from encrustations, mortar, sawdust, chippings etc that would contaminate the concrete. The surface of formwork in contact with the concrete shall be cleaned and treated with form release agent approved by engineer in charge. Release agents should be applied so as to provide a thin uniform coating to the forms without coating the reinforcement.

vi) **ERRECTION OF FORMS:**

Where forms for continuous surface are placed in successive units, the forms shall fit tightly over the complete surface, so as to prevent leakage of mortar from the concrete and to maintain accurate alignment of the surface. Forming of block joints to the concrete portion shall be done carefully to ensure smooth joints and avoid sharp deviation, projections or edges and particulars attention shall be paid in setting and tightening the forms to ensure that the contraction joint's surfaces are in accurate alignment & plumbs. Specifications laid down in IS-457 shall be applicable.

vii) **REMOVAL OF FORMS:**

In general specifications laid down in IS-457 and IS-456-2000 shall be applicable. However stripping time will be decided by engineer in charge based on minimum strength to be attained by the concrete for safe removal of forms. Following is for general guidance only.

a) Concrete not subject to appreciable bending or direct stress or not reliant on forms for vertical supports. (Vertical face):24 Hrs after final setting or not liable to injury due to form removal.

b) Concrete subject to appreciable bending & direct stress & partially reliant on forms for vertical support:

i) Vertical surfaces, unloaded columns, walls etc: 3 days.

ii) Galleries, arches, loaded columns and walls etc. :10 days.

iii) Roof of floor slabs, walkways, platforms etc: 20 days

iv) Heavily reinforced beams, bridge deck slabs and girder and other heavy sections: 30 to 38 days or as instructed by engineer in charge.

11.0 SAMPLING AND STRENGTH OF DESIGNED CONCRETE MIX/NOMINAL MIX.

(Provision of IS: 457-1957)

General :

Samples from fresh concrete shall be taken as per IS: 1199 and cubes shall be made, cured and tested at 7 days and 28 days in accordance with IS: 516.

Sampling procedure :

A random sampling procedure shall be adopted .

Frequency : (IS : 457-1957) (Reaffirmed 2005)

The minimum frequency of sampling of concrete of each grade for compressive strength shall be in accordance with the following

Quantity of concrete in the work, m ³		Numbers of samples.
(i)	Approximately each 380 m ³ of mass plain cement concrete.	One sample for 7-days and one sample for 28-days per shift per mixing unit per day.
(ii)	Approximately each 190m ³ of mass Reinforced cement concrete / one's per day.	----- do -----

Test Specimen :-

Three test specimens shall be made for each sample for testing at 7-days and 28 days.

Test Results of sample :

The test results of the sample shall be the average of the strength of three specimens.

The individual variation should not be more than + 15% of the average. If more, the test results of the sample are invalid.

12.0 COMPACTION:

Concrete shall be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures and into corners of the formwork. Concrete shall be compacted using

mechanical vibrators, over vibration and under vibration of concrete should be avoided.

13.0 FINISHES AND FINISHING:

Specification laid down in IS-456 & IS-457 shall be applicable.

14.0 CONCRETING FOR R.C.C.:

Concreting for R.C.C. Shall be applicable as per concern IS code considering amendments there in. It shall also apply general specification of concrete for diaphragm appended here with.

15.0 CURING AND PROTECTION:

Concrete shall be protected against injury until final acceptance. Unhardened concrete shall be protected from heavy rains and flowing water. No fire or excessive load shall be permitted near or indirect contact with the concrete at any time Expose finish surface of concrete shall be protected from the direct rays of the sun for at least first three days after placement. Concrete shall be kept continuously moist for 14 days or as instructed by

engineer in charge Curing compound can be utilized for vertical and sloping surface. If curing compound is to be used, it shall be of approved quality and shall be tested in the laboratory, at the cost of the contractor.

16.0 REPAIRS TO CONCRETE:

Repairing of concrete shall be carried out at contractors cost by skilled workers. All imperfections of the concrete surface shall be corrected to obtain the surface of concrete that confirm to the Repairs of imperfection in concrete shall be completed with- in 24 hrs. After removal of forms. Concrete with excessive surface depression or suppression, honeycombed, fractured or other- wise defective concrete shall be removed and redone at contractor's cost. Specification laid down in IS-457 shall be applicable.

14.0 BATCHING AND MIXING EQUIPMENTS:

All ingredients of the concrete should be used by mass only except water. Batching shall be done either by automatic computerized/electronic weigh batcher or by mechanical weigh batcher attached with concrete mixer each size of aggregate & sand shall be weighed separately. The equipment and its operation shall at all times be subject to the approval of the engineer in charge. Calibration of weigh batching shall be done periodically. Steel measuring boxes of adjustable bottom shall only be allowed in special circumstances, for very small quantity of concrete and subjected to prior written permission of engineer in charge.

15.0 MIXING:

Specification laid down in IS-457 shall be applicable. The mixing of concrete shall be done in a batch mixer of such approved type as will ensure the homogeneous mixing of ingredients. The ingredients shall be fed into the mixer simultaneously. A small portion (5 to 10%) of water be fed first and remaining water shall be added uniformly and simultaneously when all other materials are in the mixer. Mixing time shall be generally 2 minutes or as instructed by the engineer in charge.

16.0 HANDLING AND CONNVEYING:

Specification laid down in IS-457 shall be applicable. The handling and conveying of concrete from the mixer to the place of final deposit shall be done as rapidly as practicable and without any objectionable separation or loss of ingredients. Whenever the length of haul from the mixing plant to the place of deposit is such that the concrete unduly compacted or

segregates, suitable agitator's type conveying system shall be used. Where, concrete is being conveyed on chutes or on belts, the free fall or drop shall be limited to 1.50mt unless

otherwise permitted. Concrete shall be placed within 30 minutes after mixing and by method which will prevent segregation and loss of ingredients. The distance between the mixer and place of concreting and also mode of transport of concrete shall be subject to the prior approval.

17.0 DEPOSITING CONCRETE UNDER WATER:

Specification laid down in IS-457 shall be applicable. Concrete shall not be deposited under water, if it is practicable to dewater the area and place the concrete in a regular manner. If it is found necessary to deposit any concrete under water, the method, equipment, materials and mix shall first be approved by the engineer in charge. Concrete shall not be placed in running water.

18.0 QUALITY CONTROL RELATED:

Contractor shall have to provide skilled laborer's, materials and facilities for all type of field and laboratory, quality control tests, transporting materials and c.c. cubes from field to laboratories shall have to be carried out by the contractors. No extra payment shall be made for this. The specifications laid down in relevant IS shall be applicable for method of taking test samples, method of testing and test equipments etc.

i) **COMPRESSIVE STRENGTH TEST AND FREQUENCY OF TEST:**

The concrete for test specimens for compressive strength shall be collected at random. The compressive strength test of concrete shall be conducted on 150x150x150mm size cubes. The frequency of test sample shall be as per IS-457 for massive structures and components like dams and its related works, canal structures, bridges, and other massive structures. Generally, not less than one set of samples (six cubes) shall be taken from approximately each 380 cum or part of it per day per shift per mixer for plain concrete and from 190 cum or part of it per day per shift per mixer for R.C. concrete for massive structures as per IS-457. For non-massive structures, building and its related works, canal lining etc, frequency of test shall be as per IS-456-2000 as shown in the table-DD below.

TABLE –DD AS PER IS-456-2000

QTY OF CONC. IN THE WORK	No OF SAMPLE(SET) FOR TEST
1-5 CUM	1
6-15 CUM	2
16-30 CUM	3
31-50 CUM	4
51 AND ABOVE	4+1 FOR EACH ADDITIONAL 50CUM OR PART THEREOF

NOTE: At least one sample shall be taken from each shift, where concrete is produced at continuous production unit, such as RMC plant. or as instructed by engineer in charge. The 28 days field and laboratory average compressive strength shall not be less than that mention in table-AA above.

i) SLUMP TEST:

In order to test the consistency of the mixed concrete, slump test shall be taken as per IS-456-2000

ii) PRELIMINARY TEST:

The exact proportions in which the different ingredients are to be used for different parts of the work shall be determined by the dep't, well before the actual work starts. During the progress of work, preliminary tests shall be conducted periodically by the department apart from the field tests, to ascertain the 7 day and 28-day laboratory compressive strength

iii) OTHER TEST:

Additional tests, if deemed necessary for concrete to determining unit weight & air content, will also be carried out by the department. The frequency of all the tests mentioned above shall depend on the nature of job & will be decided by the engineer in charge. The contractor shall have to provide all necessary facilities and materials etc. for these tests. No extra payment shall be made for these.

iv) ACCESS TO TESTING:

The contractor or his representative shall have access to and to associate with sampling and tests of trial mixes, and other field and laboratory tests. It shall be the responsibility of the contractor to associate himself with the work of test in govt. lab. And in the field and shall have to sign record. It shall be responsibility of the contractor to obtain on work, the concrete of quality density and strength corresponding to laboratory designs.

v) CHECK TESTS FOR EQUIPMENTS:

The contractor shall provide standard test, weigh and other necessary equipment required for checking the performance of each scale or other measuring device. The test shall be made in presence of representative of engineer in charge and frequency of such tests shall be in general fortnightly or as decided by the engineer in charge.

vi) RECORD OF CONCRETING OPERATIONS:

A systematic joint record in the form approved by the engineer in charge shall be maintained to record the details regarding weighing, number of mixes of concrete, rejected mixes and locations at which concrete is used.

19.0 ANCHOR IN CONCRETE:

Anchor bolts, rods, structural shapes, plate & bearing required in connection with installation of gates etc. and other apparatus of the same shall be supplied free of cost by department and shall be placed, erected and embedded in concrete by the contractor for which no extra shall be made to facilitate first stage and second stage concrete. Due care shall be taken to obtain well finished surface after removal of forms, eliminating the necessity of subsequent repairs. The responsibility to maintain level and position of embedded parts during and after concreting and removal of centering shall rest with contractor. Full co - operation for the embedment of main anchorage for gate, horizontal and vertical girders, bottom and side seal girders, track plants, guide rails etc. and hoisting mechanism inclusive of the shaft arrangement, hoist platform etc. shall be extended by the contractor.

20.0 UNACCEPTABLE WORK:

All defective concreting work including but not limited to defects arising out of honey cost without claiming any extra payment. Acceptance criteria will be in accordance with provisions of IS-456 and IS-457

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-VIII

GENERAL SPECIFICATION OF BACK FILLING

Chapter-VIII

GENERAL SPECIFICATION OF BACK FILLING

1.0 BACK FILLING THE TRENCHES:

Back fill is defined as excavation refilled up to the ground line by embankment material which is required to be placed in the excavation space after the structure is built up above the normal ground level. All back fill shall be carefully brought to the line and grades as shown or as directed.

All back filling shall be compacted around the structure by means of rollers of mechanical, pneumatic and/or hand tampers including requisite watering. This back fill shall be either of the excavated stuff or from borrow areas of selected soil specified as under:

2.0 EXCAVATED STUFF:

Back fill, with excavated stuff in the foundation trenches and other works, wing wall, training walls, etc. when not filled up by concrete shall be filled up by heavy rubble as per drawing and as per direction of Engineer-in-charge shall be filled up by impervious type of soil free from other deleterious materials obtained from excavation. It shall be back filled and compacted as shown on the drawing or as directed by the engineer. The rubble shall be used from excavated materials as per the as quantity specified in Schedule-A & also instruction of Engineer In charge. Measurement shall be taken on cross sectional basis as stated in the relevant Para under excavation for foundation and payment will be made on volume measurement of the computed fill for specified lead and all lifts.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**

CHAPTER-IX

GENERAL SPECIFICATION OF CLEARING THE SITE AND EXCAVATION FOR FOUNDATION

CLEARING THE SITE AND EXCAVATION FOR FOUNDATION.

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.

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.

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 indurate 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 category of hard murrum and boulders.

EXCAVATION IN HARD ROCK / BHATH ROCK:

This shall includes all excavation in rock occurring in masses. This shall also includes rock required to be removed by chiseling, as blasting is not permitted. As this work is to be carried out near existing structure

blasting should not permitted.

THE DECISION:

The decision of the Engineer-In-Charge for classification of strata in case of dispute shall be final and binding to the contractor.

UTILSATION OF EXCAVATED STUFF:

The materials found suitable by the Engineer-in-charge shall be carted and deposited for the use in the temporary structures. The material not found useful, shall be disposed off by agency at his own risk and cost from the site or as directed by engineer in charge.

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 pay line. 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. The pay line be as per the excavation for the foundation shall be carried out in line, level as per Plan, Design or as directed by Engineer-in-charge. Over cuts, beyond specified pay of excavation carried out by the contractor for any purpose or reason, unless directed by Engineer-In-Charge shall be at the cost of the contractor, refilling this over cuts if required shall be with contractor or masonry and that shall be at that cost of the contractor.

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.

SLIPS: GOVERNMENT NOT RESPONSIBLE. :

Slips in excavation shall be avoided by means of any necessary shoring and strutting required during excavation. No extra payment shall be made for any such operation. However if any slips occur.

DISPOSAL OF EXCAVATED STUFF:

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 downstream. Waste shall be leveled and trimmed to a reasonable regular line and level.

All spoil stuff of excavation shall be removed from foundation and deposited by the contractor as per instruction of Engineer-In-Charge. The deposited of spoil stuff shall be carefully planned so as not to obstruct traffic lines required for transport of the construction materials or flow of the water and shall be dumped beyond AHFL line or lead 100 Mt. otherwise specified and sufficiently away from the edges of excavation to avoid danger in stability, to permit ample space for lorry installation or lifting and pumping devices, stacking construction materials etc. All theseoperation are included in corresponding item of excavation and no extra payment shall be made for

this.

FINAL FINISHED SURFACE OF FOUNDATION :

After rough excavation to the required depth is completed, scaling & 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.

LEAD AND LIFT:

Excavated material would be deposited within lead and lift as specified in the item and in spoil or canal bank in particular section or at a space as directed by the Engineer-In-Charge.

Signature of Contractor

**Executive Engineer
Gir Somnath Irrigation Division
Veraval**