ADDITIONAL CONDITIONS OF CONTRACT

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ADDITIONAL CONDITIONS OF CONTRACT

1. QUARRIES AND BORROW AREAS :

All materials for construction which are not available from the excavation shall be obtained from the quarries and borrow areas which shall be got approved from the Engineer. The Government will not make availabe any quany or borrow area. The contractor shall himself explore the quarries and borrow areas required for the work and quote his rate for finished items of work for Schedule B accordingly with all leads and lifts. The leads considered in the sanctioned estimate are for the estimate purposes and shall not be taken as the actual leads for materials during execution. No claims what so ever shall be made non entertained for any extra leads over and above the leads considered in the estimate. No claim of any compensation shall be due to the contractor on any account whatsoever, such as the quarries and borrow areas considered in the estimate being found unsuitable or inadequate in yield, the haulage routes reckoned being found unsuitable, the lead reckoned being found incorrect, the land owners obstructing the procurement and conveyance etc. The Government does not undertake to acquire lands for the quarries and borrow areas. It is the responsibility of the contractor to negotiate with the lands owners and acquire the lands to himself, either permanently or temporarily and procure the required materials. If the quarries / borrow areas do not give sufficient quantity of material, contractor shall make his own arrangements for additional quarries / borrow areas, with the approval of the Engineer and bear cost of investigations, all leads and lifts, Cost of land etc., at his own expense without claim for any payment over and above his tendered rates.

Departmental investigations of the quarries and borrow areas, on the basis of which the departmental estimates of cost are prepared, have been made with the intention of having the most economical leads for the construction of work. If at any time after the entrustment of work, the department finds quarries and borrow areas affording more economical leads and obtains possession of such lands the department reserves the right to order the contractor consequence thereof. In all such cases, whether the contractor complies with the orders or not, the rate of the concerned item of work in Schedule B will be reduced for the quantities executed after two weeks from the date of communication of the order by an amount corresponding to the difference in the lead charges computed on the basis of the departmental schedule of rates adopted for preparing the comparative statement at the time of the acceptance of tender plus or minus the percentage above or below in the original tender rates for that particular item of work.

2. RATES ARE ALL INCLUSIVE :

The rates quoted in Schedule B shall be for finished items of work, complete in all respects, inclusive of all materials, all tools and plant, all labour required for the work, all leads and lift and all incidental charges such as dewatering and desilting, diversion of rain and nala flows, diversion of traffic, and final clearance of site, providing labour amenities etc, and all taxes levies and royalty charges etc. complete. The rates shall held good for all conditions of site moisture, weather etc.

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3. ROYALTY :

Royalty as per prevailing G.O. issued by commerce and industries department of Government of Karnataka of subsequent Government Notifications shall be paid by the contractor by deductions from his bills. The of Royalty charges is annexed

4. INCOME TAX :

Deduction at source towards income tax will be made by the contractor's bills at the rates prevailing at the time of payment as fix by the income tax authorities and the tax deductions certificates will be issued at the end of the financial year.

5. SALES TAX :

Deduction at source towards sales tax will be made as per norms and the statutory order of the Government.

6. DEWATERING, DESILTING AND DIVERSION OF FLOWS :

Any water encountered during the excavation of the work shall be suitably removed by bailing out or pumping and any accumulated silt due to any reason whatsoever, during the execution of work shall be removed and disposed off. All surface flows shall be diverted outside the work area by suitable channel using cross bunding and pumping etc., depending upon the situation and emergencies of work.

7. PROCUREMENT OF CEMENT, STEEL AND BLASTING MATERIALS :

The responsibility of procuring all materials including cement, steel and explosives shall be of registered contractor only.

8. CLEARING THE SITE :

The area to be occupied by the work and quarries and borrow areas shall be cleared off all vegetations including trees, roots, ant hills and other extraneous matters. The site shall be cleared as directed by the Engineer-in-charge. No separate payment is given for clearing the site.

9. ALL PROPERTIES PRECIOUS STONES, METALS AND RELICS TO BE HANDED OVER TO DEPARTMENT :

All gold, silver and all precious stones, treasures and precious similar things that may be discovered on the site shall remain the property of the Government and the contractor shall duly intimate the Engineer-in-charge or any persons authorized by him to receive such property from time to time.

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10. PRESERVATION OF TREES :

The contractor shall preserve all existing trees in and adjacent to the site which do not interfere with the construction as determined by the Executive Engineer.

11. DRAWINGS AND WORKING DETAILS :

The work shall be carried out strictly in accordance with the sanctioned plans and estimates and specifications and as per the instructions of the Engineer-in-charge and no deviations or changes are permitted without the written order of the Engineer. The designs and drawings enclosed with the tender documents are only typical and tentative. The working drawings and the working details of the several components of works will be prepared and made available at the time of execution and contractor shall carry out the work in accordance with such working drawings and working details.

12. OMMISSIONS AND DISCREPANCIES IN DRAWINGS SPECIFICATION AND INSTRUCTIONS :

a) In all the cases of omissions, doubts or discrepancies in the dimensions or discrepancies in the drawings and item of work or specification a reference shall be made to the Executive Engineer, whose elucidation and elaboration shall be considered as authorised.

The contractor shall be held responsible for any error that may occur in the work through lack of such reference and precautions.

b) The contractor shall be responsible for accuracy for all shapes, dimensions and measurement etc., of all the components of the work.

13. TAKING INITIAL LEVELS, MARKING OUT THE LAYOUT AND FIXING THE REFERENCE LINES. :

Before starting the work, the contractor or his authorised agent shall be present while taking the levels of the ground along and across the portion of the Canal works, which the contractor has agreed to execute. He will further be required to sign the field book and also L section and cross section of the works based on the ground levels taken in token of acceptance of the ground levels before the commencement of work or fresh items of excavation below a proceeding item. In case he commences the work without verifying and accepting the cross sections and L sections of the ground, it will be assumed that he has accepted the L sections and cross sections taken by the MID staff and no complaint or claims what so ever to this behalf will be entertained. It shall be the responsibility of the contractor to mark the line out as per the directions of the Engineer-in-Charge. The contractor or his duly authorised agent shall be present at the time of setting out giving profiles etc., and shall supply all the materials and sufficient number of mazdoors required for taking measurements of works, giving line out etc., at his cost.

The stone masonry platforms and reference pillars etc., of suitable size as directed by the Engineer-in-charge with level top shall be built and maintained by the contractor at his cost till the completion of work along the reference lines to facilitate the mark out and layout of various appurtenant works.

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14. COMMENCEMENT OF WORK :

The contractor shall not enter upon or commence any portion of the work except with the written authority of the Engineer, failing which the contractor will have no claim to ask for measurement of payment for work and shall on the other hand be responsible for any claim of damage that may arise due to such unauthorised commencement or entry.

15. PROGRAMME OF WORK :

The schedule or progress mentioned under Clause - 2 of the conditions of contract is only indicative. Within one month from the date of notice to commerce the work, the contractor shall furnish a detailed programme of the schedule that he intends to adopt, which shall show both physical and financial programmed weekly / monthly as desired by the Engineer and abide by it.

16. PLANT LAYOUT, CONTRACTORS OFFICE, MACHINE YARD, LABOUR CAMP ETC.

Within a fortnight of the date of award of the contract, the contractor shall submit to the Executive Engineer for the approval of the department the layout of the construction plant and equipment for execution of work and also the location and layout of contractors office, machine yard, work shop, stores, storage yard, labour camps etc., including the layout of necessary services such as water supply, sanitation etc.

17. ACCESS ROADS, QUARRY ROADS ETC.

All haulage roads, access roads to work spot, quarry roads etc., and all diversion roads found necessary during construction shall be formed and maintained by the contractor at his cost to such standards as may be directed by the Engineer-in-charge as per the requirements of the work, the contractor should make himself thoroughly conversant with the conditions of existing public roads of the area and the existing arrangements for their maintenance. If any damage to the existing public roads is caused due to any natural or other causes or due to bad maintenance, Government will not be held responsible for the inconveniences caused to the contractor including any extra cost or temporary stoppage of work. The existing roads, constructed and maintained by the Government if any shall be used by all concerned contractors. No claim of compensation from any contractor shall be entertained on the excuse of non-maintenance of such roads.

18. POWER SUPPLY FOR THE WORKS :

The contractor has to make at his own cost, all necessary arrangements for the supply of power required for the work and his camps from Karnataka Power Transmission Corporation Ltd. or from any other sources. The Government will not undertake any responsibility with regard to power supply and no claims due to failure or delay in supply or power or variations in voltage in supply will be entertained by the Government.

19. WATER FOR CONSTRUCTION :

Supply of water for construction and for drinking and for camps shall be arranged for by the contractor at his own expense.

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20. AMENTTIES TO LABOURS :

These are covered by clause 24 and 30 to 33 of the conditions of contract, the following are further elucidations.

The contractor shall be responsible for complying with the provisions of the KARNATAKA LABOUR REGULATIONS. Any failure on the part of the contractor in this regard will entail penal action or recovery proceedings or any other action against the contractor as provided for in the said regulations.

i) A shed of 6.1m x 2.05m per family on a platform of 0.15m height

ii) Distance between sheds shall be 4.6m minimum and not more than two rows sheds shall be built back to back

iii) Peripheral roads 6.1m wide shall be built for every 300 families

iv) Necessary surface drainage and sanitary arrangements shall be provided

v) Water supply with one stand post for every 20 sheds.

vi) Electric Street lights at one point for every 61m.

The contractor shall provide layout for the labour camp and arrange water supply and electricity as above. In case of default the Government may provide the same and recover the cost [capital and recurring] from the contractor.

The contractor shall also be responsible for complying with all the requirements of the Labour authorities and Health Department particularly in regard to sanitation, water supply and anti malaria measures in the labour camps as may be directed from time to time.

All the labour employed by him should be got inoculated against cholera once in 6 months and against small pox once in three years. Any new labour employed by him should be got inoculated against cholera and vaccinated against small pox within a fortnight of being employed by contacting the local health authority at his own cost.

On the work spot, at safe distance, adequate number of rest sheds, creches and drinking water arrangements shall be made by the contractor at his cost to the satisfaction of the Engineer-in-charge. If the Government provides the rest sheds, the contractor shall be levied rent at Rs. 30 per sq. m. per month and is bound to avail of such sheds.

21. LAND FOR THE USE OF THE CONTRACTOR'S CAMP :

The contractor shall have to make his own arrangements with regard to land required for construction of quarters at the work spot. However, the Government at its discretion may make land available. In such case necessary charges as fixed by the Engineer-in-charge will be levied.

22. UNDERSIREABLE PERSON TO BE REMOVED FROM SITE :

The contractor shall not employ on site any person who is undesirable. If in the opinion of the Engineer-in-charge the person or persons at site of work employed on behalf of the contractor is / are considered undesirable, the Engineer-in-charge shall notify the contractor to this effect and the contractor will be bound by the decision of the Engineer-in-charge to remove such person or persons from the site of work and from the labour camp. The contractor shall not be entitled to any damage or loss on this account. On the contrary the contractor shall be liable to compensate the Government for any loss or damage to the Government property caused y the employment of such person.

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23. WORK ORDER BOOK :

A work order book shall be maintained by the contractor at the site and all instructions shall be entered in the book in ink. The contractor shall be responsible for obtaining all the orders entered in the work order book and he or his authorised agent shall sign acknowledging the orders issued and shall carry out orders Copies of the orders entered in work order book shall be submitted by the contractor to the concerned officer and to the Executive Engineer within two days for their record.

24. HINDRANCE REGISTER :

A Hindrance register shall be maintained by the contractor at the site of work and all factors causing hindrance to the work, as perceived by him shall be entered by him in that register in ink under his dated signature or of his authorised agent from time to time for being brought to the notice of the Engineer-in-charge and obtaining prompt relief. The signature of the Engineer-in-charge shall be obtained in the register for having noted the entries and record of the factual verifications made by the Engineer-in-charge and of his comments will also be made in the register by the Engineer-in-charge along with instructions, if any issued in the matter. The Engineer-in-charge shall obtain prior approval of the higher authorities where necessary, before issuing instructions.

25. LABOUR STATISTICS :

The contractor shall submit the daily reports on the following

i) Total number of labour imported in to working area

ii) Total number of labour living in the working area

26. EXECUTION OF WORK DURING NIGHT TIME :

The work shall normally be carried out between 8 hours and 17 hours with a break of one hour and when permitted during night period. The second shift shall be between 17 hours and 0 hours with a break of an hour during night. When ordered to work at night, adequate provision for lighting the working area should be made by the contractor at his cost and got approved by Engineer-in-charge.

27. MEDICAL AID :

These are covered by Clause 30(b) and 31(ii) of the conditions of contract. The following are further stipulations.

1) The contractor shall arrange as necessary medical facilities for his staff and labour at his own cost and to the satisfaction of Engineer-in-charge. The contractor shall arrange in his office, work shop, work site and camps facilities of clear potable treated water and arrange for proper drainage and proper disposal of sewage. He shall abide by the rules framed on his behalf by the Engineer-in-charge of Health Officer of the project.

2) The contractor shall also provide for medical supervision of his workers against epidemics. The contractor shall comply with all the directions given by Health officer in this regard.

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28. SAFETY CODE :

i) These safety provisions should be being to the notice of all concerned by display on notice board by the contract area prominent place at work spot. The persons responsible for compliance of the safety code shall be named therein by the contractor.

ii) To ensure effective enforcement of the rules relating to the safety precautions, the arrangement made by the contractor shall be open to inspection by the Labour Officer, Engineer or their representatives.

iii) All necessary personal safety equipments as considered adequate by the Engineer-in-charge should be kept available for the use of persons employed at the site and maintained in a condition suitable for immediate use and the contractor should take adequate steps to ensure proper use of equipment by those concerned.

a. Workers employed on mixing concrete, cement grout, cement mortar shall be provided with protective footwear and protective goggles and protective gloves.

b. Those engaged in mixing or stacking cement or any materials injurious to the eyes, nose and mouth should be provided with a facemask and protective cover free of cost by the contractor.

c. Those engaged in welding work shall be provided with welder's protective eye shield and gloves.

d. Stonebreakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals

e. Those engaged in binding and fabricating steel shall be provided with protective gloves.

f. Those engaged in deep cuts, tunnels, large rock excavation shall be provided with helmets.

iv) When the work is near any place where there is risk of drowning all necessary equipments shall be kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provisions should be made for prompt First Aid treatment of all injuries likely to be sustained during the course of work.

v) Adequate and suitable caution and danger signal boards shall be prominently exhibited at road/river crossing/ high tension over head line/where heavy electrical machines are working/where over head crances or hoist, derricks, winches are working/where blasting zone is demarcated. The content of the board shall be in English and the local language for easy identification.

vi) All scaffolding, ladder, stairways, gangways, staging, centering, form work and temporary support and safety devices etc, shall be sound in strength and construction and maintained as such thought its use.

vii) No materials on any site of work shall be so stacked as to cause danger or inconvenience to any persons or public.

viii) The contractor shall provide all necessary fencing and lighting to protect the public/working men from accident and shall be bound to bear the expenses of defense of every suit action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and

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to pay any damages and costs, which may be awarded in any such suit action or proceedings to any such persons or which may with consent of the contractor be paid to compensate any claims by any such persons.

ix) No electric cables or apparatus, which is liable to be a source of danger to persons employed from risk of fire or explosives or flooding; No floor, roof or other portions of any building used for residence shall be so over loaded with debris or materials so as to render it unsafe.

x) The final disposal of water used for work or removed from work spot as well as the supply used for domestic consumption shall be as directed by the Executive Engineer.

The contractor shall make his own arrangements for purification of domestic water supply used by his staff and labour colony and used on the site of work to the satisfaction of the Executive Engineer.

xi) The source of drinking water supply / distribution system in workers colony shall be protected from chances of contamination by poisonous materials / epidemic causing infections bacteria etc., by maintaining the source and system under adequate hygienic conditions.

xii) Not withstanding the above clauses (i) to (xii) there is nothing in this to exempt the contractor to exclude the operations of any other Act or Rules in force of the Central or State Government.

29. ENGINEER'S SUPERVISION :

All the works shall be carried out under the direction and to the satisfaction of the Engineer and Engineer-in-charge. Reference lines and reference bench mark will be set up on the site by the Engineer-in-charge based on which the contractor shall at his cost and responsibility, locate and establish lines and grades for all structures of the works according to the drawings and specifications. The Engineer-in-charge may, for satisfying himself carryout checks the contractor shall provide at his own cost all labour materials and instruments that may be required for carrying out the check. Such a check shall not however, absolve the contractor of his responsibility from carrying out the works strictly according to drawings and specifications and as per instructions issued to him by the Engineer-in-charge during the execution of the work.

30. ENGINEER'S DECISION :

In respect of all matters, which are left to the decision of the Engineer/Engineer-in-charge, the Engineer/ Engineer-in-charge shall if required so by the contractor give the decision in writing.

31. DERIVED RATES :

When an item of work appearing in Schedule B is a combination of two or more items appearing in the divisional Schedule of rates, the rate for that item shall, for the purpose of the operation of variation clause of the conditions of contract be derived by combining the current rates of the concerned items in the same proportion as is adopted for arriving at the esimated rates of the concerned items in the same proportion as is adopted at the estimated rate for the comparative statement prepared at the time of acceptance of the tender.

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32. MAINTENANCE OF WORK DURING EXECUTION :

It is the responsibility of the contractor to maintain the work satisfactonly until it is handed over to the Government in a complete manner as per the terms of agreement. Any damages caused during construction to any part of the work due to any reason arising out of his own action or negligence shall be made good at the contractor expenses.

33. RETURN OF GOVERNMENT LAND IN GOOD CONDITION :

The land if any, made available to the contractor for his camps by the Government shall be handed back to the Executive Engineer within three months after the completion of the work under his contract. Also, no land shall be held by the contractor for a longer period than necessary and contractor shall on due notice by the Executive Engineer vacate and return the land which the Executive Engineer may certify as no longer required by the contractor for the purpose of the work the land shall be returned in good condition.

34. DRAINAGE OF QUARRIES AND BORROW PITS ETC.,

The several quarries or borrow pits shall be interconnected to prevent stagnation of water and breeding of mosquitoes. Similarly, if any hindrance is caused by the contractor to the natural drainage of the lands handed over to him for the work and camps it shall be satisfactorily eased out.

35. CO-OPERATION WITH OTHER CONTRACTORS :

The contractor will have to co-operate with the other agency / agencies working in the same or adjoining area. Any inconvenience or interruption in any portion of working area does not make the contractor eligible for any claims. In case of any disputes with the adjacent contractor the decision of the Engineer-in-charge shall be final. No extra payment is admissible on this account.

36. PAYMENT OF PART RATES :

Since the rate quoted for the items are thorough rates, suitable part rates as decided by the Engineer-in-charge will be paid to the contractor in the intermediate running bills. Full rates for these items will be paid after satisfactory completion of the items of work in all respects.

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1. SPECIFICATION (GENERAL) AND DETAILED SPECIFICATION :

1.1 Fixing reference lines : It shall be the responsibility of the contractor to mark the line outs as per directions of the Engineer-in-charge.

1.2 Quarry and other Road : All quarry roads, haul roads and lateral access roads etc., will be constructed and maintained at his cost by the contractor by the Engineer-in-charge to the Departmental standards.

1.3 Contractor's representative and labour : These are covered by Clause 17 and 30 to 33 of Conditions of Contact. The following are further additions.

i) The contractor under intimation to the Engineer shall employ at least one competent representative to carry out and supervise the works. The representative or any one of the such representatives, if any are more than one, shall be on the site during working hours and any written orders or instructions given by the Engineer-in-charge to him shall be deemed to have been lawfully given to the contractor.

ii) The contractor should appoint an Engineering graduate with practical experience of at least two years exclusively for this work.

iii) The contractor shall submit daily reports on the following

a. Total number of labour imported in to working area
b. Total number of local labour in the working area
c. The working area will be defined by the Engineer-in-charge from time to time. The contractor shall also submit any other statistical information regarding the work, which is required by the Department. The contractor shall not employ on site any person at the site of the work on behalf of the contractor is considered undesirable. The Engineer-in-charge shall give in writing and the contractor will be bounded by the decision of the Engineer-in-charge to remove such person or persons from the site of work. The contractor shall be liable to compensate the Government for any loss or damages to the Government property caused by the employment of such persons.
d. A work order book shall be maintained at the site and all instructions got entered in the book in ink.

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1.4 Land for the use of contractors work : The contractor shall have to make his own arrangements with regard to land required for construction of quarters at work spot. However the Government at its discretion may make land available for this purpose. In such a case a charge of Rs. 1.00 per 9.99 square meters of area per annum will be levied.

1.5 Blasting operations ; All blasting done by means of explosives in the project area shall be in conformity with the explosives act and rules there under, as may be formed from time to time.

1.6 Clearing the site after completion of the work : After the completion of the work entrusted to the contractor and before handing over the completed work to the Engineer-in-charge. The contractor shall remove all unused and waste materials, remove temporary structure, ramps, platform, scaffolding etc., lying within a distance of 90m from the edges fo the completed structures and dispose them off as directed by the Engineer-in-charge. Further, the contractor shall also fill up pits cisterns which he might have constructed for storing mortar, water etc., Labour sheds or any other sheds put up by the contractor for the facility of his work, shall be demolished completely and waste materials disposed off as directed by the Engineer-in-charge, in other works the work site and other areas which were in his possession in connection with the execution of works should not present any unsightly or ugly appearance. The completed work will not be taken over by the Engineer-in-charge unless the final clearance of the site is done as mentioned above.

1.7 Any damage caused during execution to any part of the work due to any reasons whatever, shall be made good at the contractor's expense, until the work is turned over in complete manner as per the agreement.

1.8 Description of items, given in Schedule 'B' shall be read along with Conditions of Contract, tender notifications, specifications (General) conditions, detailed specifications relating to the work drawings and all other component parts of the tender documents.

1.9 The contractor will have to make his own arrangements at his cost for the supply of water required for execution and other purposes for the entire working season.

1.10 The levels and dimensions show on in the drawings are approximate and they may vary in the course of execution of the items of work and the contractor will not be entitled for any extra rates of compensation due to such variations.

1.11 RECOVERIES : Recoveries due from the contractor up to the end of the month previous to the one in which the bill is prepare shall be made from the bills approved for payment towards the following.

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1. Deductions of account of security deposit as per Clause 5 for the condition of contract accompanying.
2. Penalty in full if levied
3. Expenditure incurred by Government on behalf of the contractor in full
4. Charges for services such as water supply, power to labour camp etc., if any rendered by Government in full
5. Any other sums due by the contractor to Government on any other accounts whatsoever.

2. DETAILED SPECIFICATION (Materials) :

2.1 The materials should be obtained by the contractor from the quarries specified and approved by the Engineer-in-charge. The department may furnish and indicative quarry plan to the contractor. For materials from quarries either owned or controlled by the Department or from the private quarries or obtained from the excavations for foundations and used in the work covered by these specifications, royalty charges shall be paid by the contractor which will be deducted from the bills. General approval of a source of materials or portion there of the contractor will be held responsible for the specified quality of all such materials used in work.

2.2 If the materials are to be obtained from sources other than those indicated in plan, the same shall be got approved from the Engineer-in-charge.

2.3 In collecting the materials from the source of quarry the Engineer-in-charge will designate depths out of which will result in obtaining uniform quality and grade of the materials and the cut shall be made to such designated depths. Materials including stripping of overburden removed from deposits owned or controlled by the department and not used in the work covered by the specifications shall be disposed off as directed.

2.4 MATERIALS FOR EMBANKMENT :

2.4.1 The Engineer-in-charge will indicate the depth of cuts in all parts of borrow pits with the object of obtaining the desired quality of materials and the cut should be made only to such designated depth by the Engineer-in-charge with regard to embankment. The several borrow pits shall be interconnected to prevent stagnation of water.

2.4.2 A plan showing the borrow areas ear-marked for this work therein enclosed to inspect the borrow area before quoting and satisfy himself as to the quality and quantity of material. The contractor shall exploit one or more borrow areas of any type of material at a time only after obtaining period approval of the Engineer-in-charge. The sequence and manner of exploitation of the borrow areas shall be as directed by the Engineer-in-charge. If due to any reason it is found that the materials in

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the ear marked borrow area are not sufficient, it will be the responsibility of the contractor to bring suitable material from the area other than the specified after obtaining the prior approval of the Engineer-in-charge in writing indicating the places from which he proposes to bring the materials on receipt of the intimation. The Engineer-in-charge with arrange for exploitation of the areas, on receipt of the written approval from the Engineer-in-charge only the contractor can make use of such areas. In any case, new borrow area should be exploited within a distance of 183 m (600') from the embankment. The items of earthwork to bound cover all lead and lift within a radius of the lead mentioned in the quarry map. The contractor should use first all the suitable material available within a radius of 1 Km. After this material is fully exhausted and after obtaining the written permission of the Engineer-in-charge the contractor should bring materials a radius of 2nd Km and so on.

2.5 Rubble : All stones shall be quarried from the approved quarries only. The stones shall be clean, hard, durable, dense and tough and shall be free from decay, weathered portions of glossy surfaces, skin veins, flaws, cracks, cavities, vessel and other defects. The stones shall be as far as possible shall be uniform in colour. Texture stones shall be fine and medium grained, bright in colour, breaking within clear fracture, making ringing sound when struck with a hammer. They shall be roughly cubical in shape and no individual rubble piece for use in the masonry shall weigh less than 36 Kgs. The crushing strength in unconfined compression test on 150 mm cubes shall not be less than 2000 tons/sqm tested in any plane. The specific gravity would not be less than porous stones. Absorbing water more than one percent of dry weight after 24 hours submersion in water, shall be rejected.

2.6 Chisel dressed face stones for cut - Stone work : stones of approved quality shall be used, the faces shall be three line dressed and all other sides shall be one line dressed to a width of 150 mm from the face and chisel dressed portion shall be at right angle to the faces. The sides shall be sloped back slightly and no hump beyond this portion above the chisel dressed shall be permitted. The face stone shall be 300 mm minimum height, 300 mm to 450 mm in width and length shall vary from 636 to 838 mm. They should be suitable for being built as headers and stretchers in alternative layers. The thickness of joint should not exceed 12.5 mm (1/2") in chisel dressed portion and 20 mm (3/4") beyond. No portion of one line chisel dressed face shall be more than 3 mm (1/8") from the edge of the straight edge laid along the face of the stone in any direction. Sectional area of the stone at the tail shall not be less than half the area at its face.

2.7 Chisel dressed and hammer dressed stones : These stones shall be of the characteristics as stated above. The bushing on the faces of the stones shall not project more than 40 mm width. These stones shall be of 300 mm height and 300 mm to 450 mm width and length varies from 686 mm to 838 mm. They shall be chisel dressed around for width of 75 mm. The tail end of the stones shall have at least half of the area at the

face. The fineness of hammer dressing shall be such that when a straight edge is placed across the depression of elevation shall not be more than 12 mm.

2.8 Bond stones : Bond stones for chisel and hammer dressed face stone masonry shall satisfy specifications in the respective paragraphs and shall not be in tail less than 2.5 times the height of the course in the case of the face stone work.

2.9 Sand : The sand shall confirm to the latest IS specifications no IS 383/8 - 1920. Sand for mortar shall be either from approved natural courses or crushed from sound quartz or granite chips or a mixture of a natural and crushed sand, the maximum size of the particles being limited to 5 mm. Fine dust resulting in excess of the specified limits shall be removed by screening or washing. Weathered, decayed, sort or otherwise unsatisfactory stones shall not be used for crushing of sand. Natural or crushed sand shall conform to the Indian Standard specifications for the fine aggregates. The sand shall have a fineness modulus ranging between 2.0 to. 2.5 for masonry work and between 2.6 to 3.0 for cement concrete work, the gradation shall be so controlled to give dense mortar.

The maximum percentage of deleterious substances in sand as delivered for the use on work shall not exceed the following values :

Materials passing a No. 200 screen	% of weight
Av. Screen opening 0.0029’	4%
Shales	1%
Clay lumps	1%
Total of the other deleterious substances such as alkali mica	2.T.

..... Graite and soft, slaky materials.

The sum of the percentage of all deleterious substances shall not exceed 5% by weight. The sand shall be free from injurious amounts of organic materials etc., and the sand producing the colour darker than the standard in the colorimeter test for organic impurities shall be rejected. Stand shall be washed before use. Sand shall be tested for silt content at the rate of once in a day and additional if the source is changed. The tests for surface moisture content (hot plate method) bulking on sand shall be conducted at the rate of one per shirt per stick pile.

2.10 THE COARSE AGGREGATE : The aggregate shall be as per latest IS specification no. I.S. 383 - 1970. The aggregate for filter media and drains shall consist of graded metal from approved quarry and shall be hard, dense, durable, uncoated rock fragment and shall be free from injuries amount of soft, friable, thin, elongated or laminated pieces, alkali, organic matter etc., Rounded pebbles, finally and decayed stones

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shall not be used size and gradation shall be as per design approved and as directed by the Engineer-in-charge. The course aggregate for concrete shall consist of metal from approved quarry and shall be hard dense, durable, uncoated crushed rock, fragment and shall be free from injurious amounts of soft, friable thin elongated or laminated pieces. Alkali organic matter or other substances rounded pebbles flaky and decayed stone shall not be used. The broken stone shall be free from all dust and dirt and washed if necessary to ensure that all faces of broken stones are perfectly clean. The maximum percentage of deleterious substances in any size of course aggregate as delivered to the mixer shall not exceed the following values.

	% of weight
Materrial passing No. 100 screen	1
Shale	1
Soft fragments	1
Clay lumps	0.25
Other deleterious substances	1

The sum of the percentage of all deleterious substances in any size shall not exceed 5% by weight. The exact grading of course aggregate for cement concrete work shall be as may be approved by the Engineer-in-charge. The grading shall be generally as per IS code 383-1970. The exact grading of course aggregate for different types of cement concrete work shall be directed by the Engineer-in-charge based on tests. Aggregate shall be properly graded restricting the oversize fraction within permissible limits. Segregation in stockpiles shall be avoided by separating the aggregates with several size fractions by batching them separately.

When any size aggregates is tested immediately before batching the amount of materials passing the screen 5/6 times the minimum specified size shall not exceed 3% and the amount retained on the 1/6 times the maximum specified size shall not exceed 3% the method of testing coarse aggregates shall conform IS.

The tests for (i) particle size analysis (ii) flakiness index (iii) deleterious substances shall be conducted at the rate of once in a fornight additional if source is changed.

2.11 Stacking of materials the materials directed to be stacked shall be so stacked including the useful materials of excavations within reasonable leads as directed by the Engineer-in-charge in different heaps so as to permit taking of measurements conveniently. The stack shall not obstruct the transportaion or in carrying out any other operations connected with the works.

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2.12 Storage of materials : Cement shall be stored on the ground in a dry ventilated building as per standing instructions with at least minimum space between stacked heaps. All aggregates shall be stock piled in such a manner so as to prevent inclusion of undesirable foreign matter. Reinforcing steel shall be stored under cover and protected, from rusting oil, grease or distortion.

2.13 Water : Water used for consolidation of embankment masonry, concrete, mortar, washing and curing shall be clean and free from objectionable quantities of silt, organic matter, alkalies, salts oil and other impurities, which are likely to be injurious to works.

2.14 Portland Cement : Cement shall unless otherwise specified conform to the Indian Standards specifications No. 159-1967 for ordinary Portland cement.

2.15 Reinforcement : All Reinforcement bars shall confirm to the I.S. 432-1966 and IS 786 1966 for ribbed steel. Reinforcement shall be free from pitting due to corrosion rust, oil, grease or any other materials.

2.16 Cement Mortar : All ingredients of cement mortar shall strictly conform to the relevant specifications described in above paras Cement mortar shall consist of an intimate mixture of sand, cement and water mixed thoroughly in an approved type of mixer for a period of at least 1.5 to 2 minutes or as may be directed by the Engineer-in-charge the cement and sand shall be in proportion as specified by the Engineer-in-charge by weight. The proportion of sand is mixed with cement by weight in dry stage, after making necessary allowance for bulkage due to moisture as directed by the Engineer-in-charge. Water cement ratio shall be as determined by the Engineer-in-charge. The mortar shall be used within 30 minutes of its being mixed. Set mortar shall be rejected. The compressive strength of cement mortar tested on cubes at 28 days shall not be less than 84.37 Kgs/cum. The entire mortar shall be of dense variety.

2.17 Test piece : Tests on mortar will be conducted by the Department and the contractor should afford all facilities for taking test samples of mortar and his representative should invariably be present while taking the samples.

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DETAILED SPECIFICATIONS FOR ITEMS INCORPORATED IN SCHEDULE 'B' ITEMS

3.1.1 Excavation

3.1.2 The contractor or his representative shall be present during the classification of materials excavated. The excavation consists of stripping the dam base, excavations for cut of trench, excavation of grip trenches and foundation for greed spill way, stilling basin side, channel spillway etc., The excavation shall be carried out according to the directions of the Engineer-in-charge.

3.1.3 All open cut excavations shall be performed in accordance with the following specifications. Assumed excavation lines for the dam and other appurtenant works are shown in the drawings, but the final excavation may vary from the lines shown.

3.1.4 Slopes all excavations to remain permanently exposed shall be dressed and finished to the prescribed lines in a careful manner.

3.1.5 The excavation for foundation of cut-off trench at all elevations shall be shaped as determined by the Engineer-in-charge so as to produce the desirable surface or contact between the fill material and the foundation rock.

3.1.6 At all stages of the excavation work, all necessary precaution shall be taken to preserve the rock below and beyond the lines of excavations in the soundest possible conditions. All blasting operations and depth and size of holes and size and characteristics of the charge shall be subject to the approval of the Engineer-in-charge. The explosive used in the excavation shall be of such quality and power as will neither damage nor crack the rock outside the prescribed limits of excavation and shall be subject tot the approval of the Engineer-in-charge. Further blasting may disturb the rock upon which earth is to be dumped. The use of explosive shall be discontinued and the excavation shall be completed by wedging, chiseling, line drilling and breaking or other suitable methods, all at the expense of the contractor as directed by the Engineer-in-charge. All those shattered or disintegrated materials shall be removed.

3.1.7 Any damages done to the work due to the contractor's operations including shattering the materials beyond the excavation line shall be repaired by the contractor at his expense. All excess excavation, if any, performed for the convenience of the contractor or over excavation performed by the contractor for any purpose or reason except as may be ordered in writing by the Engineer-in-charge and whether or not due to fault of the contractor, shall be at the expense of the contractor. When required to complete the work all such excess excavation shall be refilled with suitable materials as directed by the Engineer-in-charge by the contractor at his expense. Grading in the vicinity of structures shall be controlled to prevent surface water running in to the excavated areas.

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3.1.8 Preparation of foundation : After the excavation work is completed, the final foundation surface shall present a rough outline and all smooth surfaces shall be rounded. The surface shall be free from steep angles and top edges of benches and line chamfered approximately to 45% sharp projections and knobs shall be flattened out. Neither along the length nor across the foundation shall have a slope exceeding the angle of friction of rock masonry / concrete. Where slopes are steep, the rock shall be benched to give necessary horizontal seating, the benches themselves sloping down towards upstream at about 1 in 10. All loose which give dull sound when struck with hammer should be removed.

The final preparation of foundation surfaces shall be done immediately prior to placing of concrete /masonry immediately prior to the starting of placing of concrete / masonry. The foundation shall be thoroughly cleared off all loose particles including the fines of chips, sand, dirt and slightest film of oil or grease. The whole surface including the corners, crevices and joints shall be thoroughly cleaned by means of air and water jet under pressure. The foundation shall be kept free from any stagnation of water prior to placing concrete and till the concrete sets.

Removal of slush by pan or bucket under watery situation including the stuff as directed in the specified dump area including all lead and lift and including river diversion and bailing out water etc.,

3.1.9 Specification : The area where slush under watery situation is to be removed shall be concerned off with a diversion leak proof bund. There after the water level in the area is depleted by putting a sump at lowest point. As the dewatering progresses slush has to be removed by pan or bucket excavating hard strala wherever necessary. All small boulders or less than 0.3 cum in volume shall also be removed. The slush in watery situation shall be removed by pan or bucket and conveyed by head loads or any type of conveyance and shall be deposited in the specified dump area. The rate for these items of river diversion and bailing water.

3.1.10 Disposal of excavated materials : The excavated materials shall be disposed off in the manner as directed by the Engineer-in-charge. All the useful materials (in the opinion of the Engineer-in-charge) obtained from excavation shall be stacked in the dump area as directed by the Engineer-in-charge and it is incumbent on the part of the contractor to make use of the same as directed by the Engineer-in-charge.

3.1.11 Blasting : Any blasting done by means of explosives in the project areas including the storages shall be in conformity with the explosives act and rules there under as may be framed from time to time. Blasting shall be so done as not to shatter or endanger the foundation rock. It shall be done as directed by the Engineer-in-charge.

3.1.12 Classification of excavation :

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1. All kinds of soils : This shall include ordinary soil, sandy soil, silt and clay soil, stiff clay, red soil murrum, hard murrum mixed with pebbles or kankar, slush (wherever specification mentioned in the item) consolidated debris and boulders of any size and such other types of soil and removable without resorting to blasting. It shall include excavation of soft or disintegrated rock which can be removed without blasting.
2. All kinds of medium rock : This includes all weathered rock an disintegrated rocks and fissured rocks of all varieties which can be removed with or without resort to blasting. This shall also include hard rock boulders removed during excavation greater than 0.30 cum. But less than 0.764 cum in volume, such boulders shall be suitably stocked for purpose of payment.
3. Hard rock : This shall include rock formation of all geological descriptions which in the opinion of the Engineer-in-charge could best be removed by blasting. This also includes removal of hard rock boulder greater than 0.764 cum in volume.

3.1.13 Measurement of payments : For the purpose of measurement of excavation in boulders, the materials obtained from the excavation shall be stacked in measurable heaps with minimum volume of voids practicable. Deduction of 40% for voids shall be made from overall measurement of the heaps and net quantity arrived at for determining the excavations done in boulders. If the stack are not constructed with minimum voids (to account for 40% voids). Suitable extra for voids shall be deducted apart from 40% voids and not quantity paid for the discretion of the Engineer-in-charge.

Prior to the beginning of the excavation work and after clearing the site by the contractor, sections of the existing ground at every 3 m interval or close where necessary and normal to the excise of the reference line of the embankment shall be present during taking of ground levels and shall sign in the field book and plan of levels prepared in the token of acceptance of ground levels. Quantities of excavation completed from the above inviolate documents shall be binding on the contractor.

Excavation items will be measured for payment on the line on which the work has been executed as per the directions of the Engineer-in-charge or as desired in these specifications and paid at the unit rates quoted in Schedule ‘B’. If any work is ordered to be done beyond the dimensions marked in the drawings, no extra rate other than the rate for the unit of work quoted by the contractor shall be paid. The said of the excavation shall be done to stable slopes as directed by the Engineer-in-charge, payment for the excavation will be limited to such stable slopes due to any cause whatsoever shall be removed by the contractor at his own cost. The rates quoted for excavation includes the cost of preparation of foundation bed back filling of the trench.

All items of excavation are inclusive of bailing out water and all lead and lift and no separate payments are admissible.

The decision of the Engineer-in-charge as regards classifications of the starry materials within excavation shall be final and shall be binding on the contractor

3.1.14 Embankment :

The embankment shall be constructed to the lines and grades as shown in the approved drawings or as directed by the Engineer-in-charge. Before commencing the work of the embankment all lines, the marking of extremities, berms, various zones etc. shall be marked with respect to a reference base line which shall be

established outside the dam seat. The base line shall have pucca concrete of masonry pillars with chainages, levels etc., marked properly. The base line shall be got checked and approved by the department.

The embankment shall be constructed to the lines and grades as shown in the drawings. The embankment shall be constructed to the height shown on the drawing plus 2.5% to all for settlement. The total height after deduction of 2.5% towards settlements shall be equal to designed height.

It is proposed to install various equipments for observing the structural behavior of the Dam embankment etc., the cotractor shall ensure that installation work is not hampered and no damage is caused to the construction by the machinery employed by him.

Borrow pits shall be opened at the locations and to the limits indicated by the Engineer-in-charge. For guidance of the contractor a quarry map is attached. The date prescribed therein is to be taken only as guidance and no claim shall be entertained in future due to lack of conformity between the nature of materials actually met with during construction and to the indicated in borrow area plan. The contractor is expected to have his own prospecting carried out before tendering for the works.

All areas required for borrow pits for selected materials, shall be cleared of all trees and stumps and all roots and objectionable materials etc., All organic matter shall be excluded from the material which is to be placed in the Dam embankment. The cleared area shall be maintained free of vegetable growth during the progress of work.

Borrow pits shall be stripped to the depth necessary to obtain material of desired quality, wherever borrow pits are opened. Where borrow pits are opened adjacent to Dam, the edge of excavation shall not approach the toe of the Dam closer than 183 meters (600 feet). The depth of borrow pits should be however so fixed that the bottom of borrow pits anywhere does not intercept the 1 in 611 lines as drawn from the toe for the dam. The formation of pools shall be avoided and all borrow pits shall be drained as necessary by ditches to the nearest outfalls.

Whenever it is necessary to remove over-burden to get the required materials suitable for embankment, the same shall be done. Further, any oversize material or material not up to the required specification met within the borrow area even after removal of over burden shall sorted out and only the material satisfying the required specification should be brought to site. The contractor is not entitled for any extra payment for any of the above operations. The above condition applies to use of excavated material shall be sorted out before utilising the excavated material on embankment. No extra payment is admissible for this. The top soil from borrow pits for a depth of 20 to 25 cms should be thrown and not to be used for constructing the bund

All pits shall be arranged with a certain amount of regularly having regard to the convenience of the work during the execution and to its safety and appearance of finish after the completion

Temporary quarry roads and ramps leading and from the respective borrow area to the site of embankment or cut off trench where the materials are required to be posed shall be constructed and maintained by the contractor at his own expense.

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3.2.1 PREPARATION OF FOUNDATIONS :

i) The foundation except rock surfaces of the earth fill shall be prepared by ploughing, leveling and rolling after adding water if necessary so that the surface materials in foundation will be compacted and well bounded with the first layer of the fill as herein specified for the subsequent layer of the earth fill. The following precautions shall be taken for benching for earthendam with bed role, loose sand and boulders shall be removed from the entire section of the Dam.

ii) All decomposed weathered and soft rock shall be removed by hammering or very light charges of blasting.

iii) Fissures and cracks shall be opened to sufficient depth to take tamping.

iv) Sharp projection of solid rocks shall be hammered and leveled.

v) All local leakages shall be sealed confining them to vertical pipes and finally plugging the pipe with cement mortar.

vi) The rock surface shall be soaked and impervious material with high moisture content used at the contact zone between impervious material and rock.

vii) Wherever rolling is not possible, the thickness of layer shall be reduced to 76 mm to 102 mm and compaction can be done by hand and remaining by mechanical tampers.

The concrete surface at the back of retaining wall and cut off walls against which earth fill is to be placed shall be cleaned and moisture prior to placing of the earth fill. The foundation immediately adjacent to the concrete structures shall be thoroughly cleaned of loose materials and moistured. The surface of each portion of the foundation immediately prior to receiving any material for earth fill shall be moist and sufficiently cleaned to obtain a suitable bond with the embankment. Pools of standing water will not be permitted in foundation of the embankment and shall be drained prior to placing the first layer of embankment.

3.2.2 PLACING OF MATERIALS :

The approved materials shall be conveyed and laid in the appropriate zones of embankment as directed in successive uniform and continuous layer, thickness of which shall be 200 mm (1 dose) 150 mm thick after compaction when compacted with wheeled power rollers of 8 to 10 tons capacity as directed by the Engineer-in-charge. No lumps or stones or pebbles having maximum dimension of 75 mm shall be permitted to be used and shall not exceed 5% the percentage in respect of every 2.83 cum of batch material conveyed to the place of placement. The work in various zones shall as far as possible be raised simultaneously or as directed by the Engineer-in-charge.

No materials shall be placed in the section of the embankment until foundation has been unwatered and suitably prepared. Written permission of the Engineer-in-charge shall be obtained before laying the first layer.

The suitability or otherwise of the materials excavated from the strippings, gap trenches and cut off trench for the embankment shall be determined by the Engineer-in-charge.

The materials from the borrow area which are situated further from the embankment shall be utilised last. In other works the borrow areas shall be worked from the farthest to the nearest, thereby involving maximum leads for the low levels of embankment and minimum leads for higher elevations of the embankment as may be directed by the Engineer-in-charge.

3.2.3 PLACING OF EARTH FILL :

The finished fill shall be free from loose pockets, etc., streaks of layers of materially different substantially in texture of gradation from the surrounding material. The successive load of the materials shall be dumped on the earth fill so as to produce best practicable distribution of the materials subject to the approval of the Engineer-in-charge and for this purpose, he may designate the location in the earth fill. The earth fill all over the surface should be kept approximately the same level during construction or kept graded slightly from the centre to the edge to avoid pools of water forming due to rains. Before a new layer is deposited the surface of the previous layer shall be scarified and roughened by dishing or ploughing, if so directed by the Engineer-in-charge, charge so that a good bond may be obtained with the material to be superimposed. The material shall be deposited starting from the lowest portion of the foundation in rows of approximately parallel to the axis of the Dam and spread in to uniform layer. The placing operation shall be such that the material when complicate will be blended as to secure the best practicable degree of compaction impermeability and stability.

In order that proper compaction can be done up to the edge of the designed section. The section shall be widened on either side by 600 mm, except in the region just above rock toe (where compacted face shall have to be ensured by other means). After the required degree of compaction has been attained the extra width shall be dressed and brought to the desired slope. Measurements shall be taken for the finished items only. No extra cost shall be claimed by the contractor for the widths done before dressing and is deemed to be included in the rate of this item. The rate is also inclusive of dressing the banks to the final designed shape and slopes.

4. CONCRETE :

Concrete shall be composed of intimate mixture of cement, sand and broken stones and water.

4.1 CEMENT :

Cement shall be as specified vide 2.14 clause of the detailed specification

4.2 WATER

Water shall be as specified vide 2.13 clause of the detailed specification

4.3 COARSE AGGREGATE :

Coarse aggregate shall be as specified vide clause 2.10 of the detailed specifications

4.4 SAND :

Sand shall be as per specifications vide clause 2.9 of the detailed specifications.

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Test and analysis of the aggregates and resulting concreting shall be made at frequent intervals and the preparations of aggregates shall be changed wherever necessary as directed by the Engineer-in-charge to secure the required workability impermeability and strength together with maximum practical economy.

It is contemplated that the concrete will range in character from mass concrete having maximum size aggregate of 40 mm to heavily reinforced cement concrete having 20 mm and down size (3/4') size aggregate suitable as directed by the Engineer-in-charge. Tests and analysis of the aggregate and the resulting concrete shall be made by the Department and the contractor shall afford all facilities for taking these samples free of cost and the contractor or his representative shall be present while taking the samples.

The admixture of air entertaining agent of approved quality and in such proportions as directed by the Engineer-in-charge shall be added to the concrete at the contractor's cost to maintain the air content of the concrete within desired limits.

The optimum proportions of the ingredients will be determined after conducting laboratory tests on the sample aggregates produced by the contractor. The preliminary tests shall be completed at least 30 days prior to the beginning of concrete operations. The proportion shall be fixed so as to give dense and workable mass with adequate extra rate shall be payable of any such modification in the proportion. The materials required for carrying out these analysis shall be supplied free of cost by contractor. The stacking of materials forming the constituents shall be stocked in different heaps and in adequate quantities much in advance of using on works, so as to facilitate carrying or of prior tests on materials and concrete as directed by the Engineer-in-charge.

4.5 CLASSIFICATION :

Except where required to meet special conditions all concrete shall conform to one of the classification given below, according to minimum 28 days strength, maximum size aggregate and minimum and maximum slumps.

The minimum 28 days strength of concrete shown in the following classification table shall be taken as the average of at least 3 test specimen taken from a single batch of concrete provided that not more the 10% of specimen tested shall have a compressive strength less than 90% of the required strength and the average of all tests for a given period shall be equal to or exceed the required strength.

The compression strength of concrete will be determined through the medium of tests on 15.24 cms x 30.48 cms (6" x 12") cylinder of 15.24 cms (6 inches)

Cubes as may be directed by the Engineer-in-charge.

The method of tests on concrete shall conform to IS

The slump test shall be at the rate of one per every two hour working per mixer. The test for density and air content of fresh concrete shall be at the rates of one per mixer per month and additional if source of aggregate is changed. The tests for compressive strength of moulded cement concrete specimen shall be at the rate of one per shift per mixer (separately for each mix proportion)

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Maximum size of aggregate	Slump range	Proportion of Concrete	Location of Concrete
40 mm	5.08 to 10.16 cm (2" to 4")	M 100	Bed concrete
25 mm	5.08 to 10.16 cm (2" to 4")	M 150	Bed and slides
20 mm	5.08 t0 10.16 cm (2" to 4")	M 150	For RCC works

4.6 BATCHING :

Plant and equipment shall be provided by contractor as required to determine and control accurately the relative weights of the various materials including water, cement, sand and each individual size of coarse aggregate entering the concrete. The amount of cement and other ingredients shall be determined by weighing. The measured materials must be properly and carefully handled so that batches reaching the mixer will be uniform and complete when released by the measuring equipment. Concrete ingredients must be weighted as directed with approved equipment. Standardised test weight and measures should always be used in checking.

4.7 MACHINES MIXING AT RATE :

The mixing of concrete shall be done in habit mixers of such approved type as will ensure the homogeneous distribution of all the ingredients. Unless otherwise permitted, machine mixing of each both shall continue for not less than period indicated below.

CAPACITY OF MIXER	MIN TIME OF MIXING
2.2937 Cum (3 CYD) and more	2½ minutes
1.5292 Cum (2CYD)	2 minutes
0.7646 Cum (1 CYD) or smaller	1½ minutes

The mixing time shall be increased beyond the figures given. If the mixing operations fail to produce a uniform consistent quality of concrete or as directed by the Engineer-in-charge.

As far as possible tilting mixer shall be used since they cause less segregation. The mixer shall not be overloaded say more than 10% of its rated capacity. The addition of water to dry mix shall be controlled at the rate of 10% before 80% during and 10% after mixing. Water being added by accurate measures.

In general, the entire batch and full contents of the drum shall be discharged quickly so as to avoid segregation.

The retampering partially hardened concrete or mortars requiring renewed mixing or without addition of cement, aggregates or water will not be permitted.

4.8 PLACING OF CONCRETE :

Concrete shall be placed only in location, where authorised and on concrete or mortar shall be placed until form work, installation of embedded parts, preparations of surface and necessary clean up has been and checked to be in conformity with specifications and drawings, rock surface of rigid masonry as directed by the Engineer-in-charge.

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All concrete shall be placed directly in its final position within 30 minutes, after being mixed any concrete, which has become so stiff that proper placing cannot be assured without retampering, shall be wasted. Segregation of aggregates shall be avoided. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable without any objectionable separation or less of aggregates.

When ever the length of haul from mixing paint to the place of deposit it such that the concrete unduly compacts or segregates during handling, suitable agitators shall be installed in the conveying system. Where concrete is being conveyed in chutes or belts, the free fall or drop shall be limited to 1.52 meters or 5 ft. unless otherwise permitted. All surface of form sand metal work including reinforcement bars that have become incrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar of grout before the surrounding or adjacent concrete is placed. Concrete shall be deposited in continuous horizontal layers, not exceeding in thickness from approximately 30.48 cms (12") in R.C.C. work and 45.7 cms (18") for mass concrete.

4.9 PLACING OF CONCRETE FOR THE REINFORCED CEMENT CONCRETE WORKS :

The concrete shall be placed in layers of 15.24 cms (6") to 30.48 cms (12") in its final position before setting has commenced. It shall not be subsequently disturbed. A record of the time and date of placing of concrete in each position shall be maintained.

4.10 RATE OF PLACING :

No concrete shall be placed until the place of deposit has been thoroughly inspected and approved. All reinforcements, inserts and embedded metal properly secured in position and checked and of mrs through watered or oiled. No concrete shall be deposited at any time except in the presence of an authorised department supervisor nor shall concrete be placed outside the regular working hours unless due notification there of is given in sufficient time to make proper position for inspection.

Plastic concrete shall be deposited continuously on plastic concrete after starting the poor and the placing of concrete shall continue without interruption until the structure or section is completed or until satisfactory construction joints can be made.

Columns at sections shall be poured slowly to allow for shrinkage and continuously to prevent pour joints. No stoppage planes or cold joints will be permitted. No concrete shall be deposited on other concrete, which has been hardened sufficiently to cause the formation of seams of planes of weakness between permissible joints nor shall the rate of placement be sufficiently rapid to cause any movement of forms or adjacent masonry concrete and in such manner that no planes of weakness or unnecessary seams occur in the structures.

The temperature of concrete when it is being placed shall not be more than 90F. During hot weather no concrete shall be deposited when, the temperature with the form in more than 120F. During continuous rainy weather or heavy down pours, all freshly placed concrete shall be covered and protected against surface wash.

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4.11 COMPACTION :

Fresh plastic concrete during and immediately after depositing shall be thoroughly compacted by vibration. Concrete shall be spread and vibrated with approved mechanical vibrator to maximum sub silence without segregation and adjacent to forms and joints. Needle vibrator of approved quality shall be used as directed by the Engineer-in-charge. Vibrating of concrete shall be controlled by placing the needle 0.6 to 0.9 m c/c and for a duration of 5 to 30 seconds at a time.

The vibrator shall be withdrawn at a rate of 80 mm / second such that the hole formed while withdrawing the needle is gradually closed by the flow of free concrete and that no air is entrapped in such operations. The concrete shall be worked round all reinforcement, embedded fixture and in to corners of the form. Every precaution shall be taken to keep the reinforcement and embedded metal in the proper position to prevent distortions over vibrating leading to bleeding, vibration of such concrete layer shall be avoided.

4.12 CHIPPING AND ROUGHENING CONCRETE SURFACE :

Surface upon which additional concrete is to be placed shall be chipped and roughened to a depth not greater than 25 mm on the surface. The roughening shall be performed by chipping or other satisfactory methods and in such manner as not to loosen, crack or shatter any parts of the concrete beyond the roughened surface. After being roughened the surface any parts of the concrete beyond the roughened surfaces. After being roughened, the surface of the concrete shall be cleaned thoroughly of all loose fragments, dirt and other objectionable substances and shall be sound and hard and in such condition as to assure good mechanical bond between old and new concrete. All concrete, which is not hard, dense and durable, shall be removed to the depth required to secure a satisfactory surface.

4.13 CURING AND PROTECTION :

All concrete shall be protected against injury until final acceptance; exposed finished surface of concrete shall be protected against heating and drying from such form for at least 72 hours after placement. Concrete shall be cured by keeping it continuously moist for 21 days. Construction joints shall be cured in the same way as other concrete and shall be done on all other concrete surface by means of sprays or sprinklers. Forms shall be kept sprinkled until removal in limited areas and for special purposes, the use of a properly approved sealing compound shall be protected from traffic or injury of the seal coat until the expiry of the curing period. All methods used for curing shall leave the concrete free from any discoloration dirt of damage to the concrete application. Sealing concrete shall be preceded by 24 hours of water curing when maximum daily atmosphere temperature ranges from 35^{o}C to 40.55^{o}C water curing when maximum daily atmosphere temperature ranges from 35^{o}C to 40.56^{o}C (105^{o}F)

4.14 FIXING DOWEL BARS :

Dowel bars shall be ribbed HYSD. Torsteel, free from rust, scale and any stickly substances, particular care shall be taken to see that all the bars are placed in the exact position as shown in the approved drawing and remain in position during concreting. The bars shall be of single length only. Bars shall be 25 mm dia. And 3 mtr in length. Holes of 50 mm dia, shall be drilled by mechanical means (percussion drilling) upto a depth of 1.5m at places shown by the Engineer-in-charge and the bars shall be placed inside the holes and embedded inside the foundation rock. The drilled holes shall be then filled, up with cement mortar 1:1 proportion . The balance length of bar shall then be embedded inside the concrete.

4.15 MEASUREMENT AND PAYMENT : Measurement will be made in numbers of dowel bars fixed at site.

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4.15 CONSTRUCTION JOINTS :

The location and type of all construction joints shall be as shown in the drawings and as directed by Engineer-in-charge at the time of construction. These shall be neatly formed against forms and shall either be shared or rebated. The width and depth of rebate shall either be sharp or rebated. The width and depth of rebate shall be about 1/3 and 1/9 respectively of the thickness of member. The clean up of the surface shall be done at the proper time during the setting of concrete so as to remove all excess paste and mortar and expose clean aggregates surfaces. Surface upon or against which additional concrete is to expose clean aggregates surface. Surface upon or against which additional concrete is to be placed shall be chipped and roughened to a depth not greater than 25.4mm (1") on the surface. The roughening shall be performed by sand blasting or chipping or other satisfactory methods as directed by the Engineer-in-charge and in done in such a manner as not to loosen crack or shattering part of the concrete beyond the limit. Roughened surface shall be cleaned thoroughly of all loose fragments, dirt and other objectionable materials and shall be sound and hard and in such condition as to assure good mechanical bond between old and new concrete. All concrete, which in not hard, dense and durable, shall be removed to the depth required to secure a satisfactory surface. Brushing shall be done by jabbing than merely sweeping. The whole process shall be conducted in such a manner as not to loosen a fresh, clean cut concrete surface, free from laitance, paste excess mortar or levelling.

Immediately before depositing fresh concrete the contact, surface shall again be cleaned to remove all debris and loose materials. The surface shall be coated with about 12.5 mm (1/2") thick mortar the mix and water cement ratio being same of regular mixture and spread evenly without flowing. Fresh concrete shall be placed immediately upon fresh mortar before it attains initial set.

The above clean up for masonry joints and bonding new concrete to old shall apply to all horizontal and vertical construction joints.

4.16 FINISHING :

Finishing of formed and informed surface shall be performed only by skilled workmen. All exposed concrete surface shall be cleaned off, all encrustations of cement mortar of grout and unsightly stains shall be removed.

4.16 (a) FORMED SURFACE :

Surface of concrete finished against forms shall be smooth, free from projections and filled thoroughly with mortar. Immediately upon removed of forms, all unsightly ridges or fins shall be removed and any local bulging on exposed surfaces shall be removed and remedial by routing and rubbing. All holes left by the removal off as tenders from the rods shall after being rammed with a toothed hammer be neatly filed with dry patching mortar. All porous and fractured concrete and surface concrete to which additions are required to bring in to the prescribed lines shall be removed by chipping opening in to the concrete. The chipped opening shall be sharp edged and caved and shall be filling to the required lines with fresh concrete or dry patching mortar of approved proportions where concrete is used for filling the chipped openings shall not be less than 7.62 cms (3") in depth and the concrete filling shall be reinforced and dowelled to the surface of the openings.

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Except otherwise specified or directed, shall permanently exposed concrete surface and other water way surface requiring, durability under water shall be finished in the following manner. Immediately upon removal of the forms the surface shall be wetted and composed of fine sand and cement in to the pits with burrs so as to secure a uniformly dense and smooth surface. The rebutting shall be performed in such a manner as to leave the surface free from mortar not used for filling the pits. All operations in connection with filling of the concrete and mortar filling are exposed to drying. When the treatment of a surface has been completed the surface shall be cured. All patches and mortar filled pits on exposed surface shall be neat and of the same texture as the adjoining concrete.

4.16 (b) : FINISHING UNIFORMED SURFACE. :

Uniformed surface shall be finished by one or more of the operations of screeching, floating and trowelling and working of the surfaces should be done at the proper time, employing experienced men and should be just sufficient to produce the desired finished as directed by the Engineer-in-charge. Screeching which gives the surface its approximate shape by striking off surplus concrete immediately after completion should be accompanied by moving a straight edge of template. Where the surface is curved, a special screech should be used.

Shortly after the concrete is screeched, the surface should be brought true to form and grade by working it sparingly with a wooden float.

4.16 (c) SMOOTH DENSE FINISH :

This shall be done to interior face of through, etc., and at other location as directed by the Engineer-in-charge. Imperfect surface where strength is not impaired may be rubbed smooth with corundum brick, small voids if any shall be filled with 1.2, mortar pressed into holes and floated smooth.

Plastering and steel trowelling shall be allowed. The desired smooth surface to ensure ‘n’ value of 0.018 shall be obtained by use of form work most appropriate to the situation, proper placement of form work during centering and careful concreting

4.17 WATER TIGHT JOINTS :

Where horizontal construction joints are subject to water pressure special care shall be taken to bond the next lift of concrete. The consistency of concrete shall be carefully controlled so as to avoid sand sinking and after compaction no free show any where along the joint. The surface shall be carefully cured. Before placing lift, the joint shall be cleaned and prepared as specified in para 4.7.14

4.18 FORMS :

The contractor shall provide forms at his expense that will produce correctly aligned concrete and surface finish. The forms shall be sufficiently strong to carry the dead weight of the concrete as the concrete as a liquid without deflections light enough to prevent leakage of water. The forms shall be approved, steel thoroughly cleaned and tied together with approved corrosion resistance device.

The formwork shall be plumb and true, leveled strips shall be provided in form angles and in corners of column and beam boxes for chamfering of corners as shown in drawing or as directed. The inside of forms shall be coated with approved oil before reinforcement is placed.

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Any hollow left removing the embedded rods or ties shall be rammed with suitable toothed reamers and back filled with dry mortar. All forms shall be surely and tightly fixed so as to prevent buckling failure or leakage. Forms shall be kept in place for long period as necessary for the concrete to develop adequate strength to stand by itself without any damage. The removal shall be done only after it is authorised by the Engineer-in-charge, but this no way absolves the contractor of his responsibility for the safety of the work. Before reuse of once used forms, the surface and corners of all the forms shall be thoroughly scraped clean of adhesive concrete, laitance, mortar etc., wrinkles and jumps in plates used and surface well cleared.

Temporary openings for cleaning and inspection shall be provided at the base of vertical forms and at other places where they are necessary. Forms may be removed at the following minimum times, shall be subject to the Engineer's requirements.

	At 70^{o} - 95^{o} F
Walls	1 day
Columns	2 days
Beam Soffits	4 days
Slabs 5" thick or less	5 days
Slabs over 5" thick	6 days

All concrete shall be inspected for quality before forms are removed. When struck by a carpenter's hammer it shall ring like stone upon removal of forms the contractor shall place adequate reshores to prevent injury to the concrete by construction loads, the contractor shall be responsible for safe practice in removing forms and shorting and for placing adequate reshores. All forms shall be passed by the Engineer-in-charge before concreting is commenced.

4.19 CENTERING AND FORM WORK :

The centering shall be true and rigid and thoroughly braced both horizontally and diagonally. Rigid care shall be exercised in seeing that all columns are plum and true and thoroughly cross braced to keep them so. The members shall be designed to carry the dead weight of the concrete as liquid without deflection. All centering shall be passed by the Engineer-in-charge before concreting is allowed. The provisions of safety code shall be carefully complied with in respect of centering.

4.20 MEASUREMENTS AND PAYMENT FOR CONCRETE ITEMS :

Measurements for payment and concrete required to be placed directly upon or against surface of excavation will be made to the lines for which payment for excavation is made. Measurement for payment of all other concrete will be made to the near lines of the structure, unless otherwise specifically shown on the drawing or prescribed in these specifications. In measuring concrete for payments, the volume got all openings recesses ducts embedded pipe work and metal work (Each or which is larger than 113 Sqm in cross section) will be deducted. Payment shall be made for this item of work at unit price quoted by the contractor in the schedule.

CONTRACTOR EXECUTIVE ENGINEER

5. FABRICATION OF REINFORCEMENT ETC.

5.1 FABRICATION : ITEM :

The high yield strength deformed reinforced bars shall conform to latest IS code Specification 1978-79 and its latest amendments

Ribbed steel or M.S. rounds will not be issued for the work from the department. Only fabrication charges which shall include cutting, banding, lapping, placing in position including all lead and lift and cost of binding wire are payable. The contractor shall fabricate and do the welding, if necessary and no extra claim for welding will be entertained. When R.T. Steel of 20 mm diameter and above are to be added on the work in length greater than the length supplied and joint shall be welded if directed to do so by electric or welding as per standard specification and the welded samples shall be tested for tension. In the case of ribbed steel welding shall be by electric flash including (all diameter). Arc welding, as double V Belt joints shall be done for 20 mm dia and above are welded. Only OXYACETYLENE welding is not permitted. The extreme end to be twisted of the ribbed bar should be cut off before welding. In the case of Arc welding, a little gap should be left between extreme side of bar for good fan, also a pause should be given after food alternate fans to cool the bars to bank warmth. The diameter of the welded joints should be approximately 1.2 times the bar dia. In the case of welded lap joints, each run should be not longer than 5 times the bar dia. The diameter of the electrode recommended is as below.

BAR	ELECRODE
7 mm dia	2 mm dia
10 mm dia	2.5 mm dia
20 mm dia	3.25 mm dia
32 mm dia	5 mm dia

The welding including cost of electrodes and testing, transporting and incidental charges shall be done at the contractor and included in the rate quoted for reinforced cement concrete work.

If such a welding can not be done by the contractor it shall be got done by the Engineer-in-charge of the work either departmentally or through other agency and all the agency and all the cost thereof shall be borne by the contractor being recoverable from his all inclusive rates. Steel reinforcement bars shall be placed in the concrete wherever shown in the drawings or where directed or as per working drawings to be available from time to time.

Before steel reinforcement is placed in the surface of the reinforcement shall be cleaned of scale, dirt, grease or other objectionable foreign substances. Before the reinforcement bars are fixed in position it shall be verified that they are of the specific sizes and are cut end point in accordance with the plans. They shall be accurately placed and secured in position by means of built in concrete blocks, metal chains, hangers spacers or other suitable devices at sufficiently close intervals so that they will not sag either between supports or be displaces during the placing of the concrete or by any operations of the work. Special care shall be exercised to prevent any disturbance or reinforcements in concrete that has been placed. The reinforcement after being placed in position shall be maitained in clean condition unitil it is completely embedded in concrete.

CONTRACTOR EXECUTIVE ENGINEER

Reinforcement shall not be straightened or bent in a manner that will injure or weaken the materials. Bar shall be bent cold to the shape and dimension shown in the drawing or as directed. Heating or reinforcement bars to facilitate bending shall not be permitted. The reinforcement available from rejected reinforcement bars to facilitate bending shall not be permitted. The reinforcement available from rejected reinforced concrete shall be used. Wire for tying the reinforcement should be of soft annealed steel of (18 SWG) 1.219 mm and of approved quality.

Sufficient concrete average shall be provided to protect reinforcement from corrosion as indicated in the drawings. All protecting bars from concrete to which other bars are to be supplied shall be protected from rusting by a thin coat of neat cement grout. Accurate records shall be kept at all times of the number, sizes, lengths and weights of bars placed in position for different parts of the work and quantity shall be in quintals or M.T. on of commuted weights of the bars placed. All joints shall be lap joints and the lap being as directed.

After being placed in position all reinforcement shall be approved in writing by the Engineer-in-charge before concreting. The payment for the steel used for reinforcement shall be made on the basis of the weight of the actual reinforcement placed in position and only to the extent shown in the approved drawings at the rates accepted. The rates include the cost of fabrication, binding wire ties and metal supports, hauling, sorting, bending, cleaning, straightening, placing and scoring and maintaining in position all reinforcement bars. The rates shall also include for the wastage etc., of steel bars.

5.2 MEASUREMENT AND PAYMENT :

Measurement shall be taken for the reinforcement after they are placed and secured in position. Length of each size of the reinforcement shall be measured in between the neat lines of the structures of the frame work and shall be converted in to weight. Before starting concreting the contractor shall make certain that the measurements of the reinforcement placed have been recorded and the Engineer-in-charge has certified the correctness of the reinforcement. Placed to do so, might mean no payment or payment at the discretion of the Engineer-in-charge for the reinforcement concerned. The weight of steel used shall be determined on the diameter of bars and unit weight of steel taken 7849 Kgs per cum (490.1 lbs per cft)

CONTRACTOR EXECUTIVE ENGINEER

6. STONE REVETMENT :

Before commencing the revetment work, the profile of the upstream embankment shall be brought to the specified slope as directed by the Engineer-in-charge.

The profile shall be defined at 6.50 m or at closer intervals as directed by the Engineer-in-charge by means of bamboos and strings. The top surface of the revetment shall confirm to the profile so provided and profile shall be maintained at all times by the contractor at his own cost. To receive the stone revetment, the slope shall be prepared by scrapping the slopes enmbankment to the required lines and grades as shown in the drawing or as directed by the Engineer-in-charge and revetment laid on a filterbed of 400 mm thick. The earth slopes to receive the filter shall be properly formed.

The thickness of stones for revetment should not be less than 300 mm thick measured at right angles to the slope, slight variation in the thickness within the following limits of tolerance will be pemitted more than specified thickness maximum allowable (+100 mm), the over size stones shall not however be more than 10% of total be provided at every 4.6 sq.m (50 sft) of pitched surface or as approved by Engineer-in-charge.

The stones shall as for as practicable large flat surface of not less than 0.047 sq.m. so as to obtain a fairly even surface and have minimum voids. The stones shall be placed on the edge with broadest and in contact with the slope and face normal to the slope beginning at the bottom of the slope, the stones shall be laid compactly and with broken joints in all directions so matched an inter locked that they are to be keyed together with a minimum of joint space. Rock fragment spalls shall be tightly driven in to interstics to wedge the revetment in place and to close the direct opening to the underlying slopes. Such filling shall be carried on simultaneously with the placing in position of large stones and shall in no case be permitted to fall behind. The wedging shall be done with large of chips, each chip being well driven with hammer so that no chips be picked or removed by hand. The distribution of stones of larger size shall be uniform. The smaller size stones required for filling interstics and wedging shall be to the actual requirements for such works and shall not be used in two or more layers as substitute for full thickness of stones. High irregular points shall be knocked off. Finished revetment shall present neat smooth and uniform surface free from loose stones. Pin headers for every 4.6 sq.m of pitched surface shall be provided and all pin headers shall be 450 to 550 mm long. Such pin headers shall project beyond the slope up to minimum length of 150 mm to set as wave breakers at location approved by the Engineer-in-charge.

6.1 MEASUREMENT AND PAYMENT :

Measurement for the items shall be cubical contents. Payment shall be made on the superficial area at the unit price quoted by the contractor in schedule ‘B’. The rate quoted shall be inclusive of trimming the slopes for providing filter media. Measurement shall be taken along the upstream slope in the section of 100ft. or at closer intervals at the direction of the Engineer-in-charge. The depth of revetment shall be measured at right angles to the slope of revetment.

CONTRACTOR

EXECUTIVE ENGINEER
M.I. DIVISION :

7. VERTICAL LIFT GATE

The vertical lift gates are for the Barrage gates. The dimensions and the out line arrangements tender are tentative.

The gate shall be manufactured using plates and rolling sections of structural steel. The great shall be lowered and lifted in between vents provided with M.S. frames. The M.S. Frames are to be embedded in between main and dummy pier concrete.

The contractor shall make his own arrangements for procuring materials. Contractor shall produce necessary I.S.I. certificate for all materials procured from sources other than departmental stores.

The gates shall be fabricated in workman like manner and in accordance to relevant I.S. specifications and transported to work site carefully. Erection shall commence only after inspection and approval by the Engineer-in-charge.

The gated shall be painted with two coats of anticorrosive paint of approved quality over a coat of red oxide primer.

Trial operations of the gate shall be made in the presence of Engineer-in-charge and any defects noticed shall be set right promptly

7.1 MEASUREMENTS AND PAYMENT :

The measurement of components of gates fabricated using structural steel only received at site will be weighted for its actual weight for preparing bill for payment separate payment for special steels, bearings, seals, castings bought out items will not be made as the rate quoted is inclusive of provisions for these items.

The schedule of payment shall be as under :-

a)	After design fabrication Transportation	50% of the unit rate will be released
b)	After Erection	15% of the unit rate will be released
c)	After Commisionary test operation and acceptance.	35% of the unit rate will be released

CONTRACTOR

EXECUTIVE ENGINEER
M.I. DIVISION :

8. P.V.C. WATERSTOPS :

The water stops should be fabricated from a plastic compound, the basic resins of which shall be poly vinyl chloride (PVC).The compound shall contain any additional resins plasticizers, inhibitors or other materials such that the material is compounded. It shall meet the performance requirements given in the table below

TABLE

Sl. No.	Characteristics	Units	Values
1	Tensile strength	Kg/sq.m	116 Min
2	Ultimate elongation	%	300 Min
3	Tear resistance	Kg/sq.m	49 Min
4	Stiffness in flexure	Kg/sq.m	24.6 Min
5	Accelerated Extraction		
	a) Tensile strength	Kg/sq.m	105 Min
	b) Ultimate elongation	%	250 Min
6	Effect of alkali - 10 days		
	a) Weight increase	%	0.25 Max
	b) Weight decrease	%	0.10 Max
	c) Hardness change	Point	+ 5
7	Effect of alkali - 20 days		
	a) Weight increase	%	0.4 Max
	b) Weight decrease	%	0.3 Max
	c) Dimension change	%	+ 1

8.1 MEASUREMENT AND PAYMENT :

Item shall be measured and paid on the basis of running meter. The quoted rate shall include the cost of all the materials and labour.

CONTRACTOR

EXECUTIVE ENGINEER
M.I. DIVISION :

ADDITIONAL SPECIFICATION OF KIRALBOGI PLANKS

1. **PLANKS SHOULD BE KIRALBOGI WOOD :** The wood shall be well seasoned. Planks shall be free from cracks, knots, bends, white patches etc. Planks shall be neatly cut to the required size and shape. Materials shall be got approved by Competent Authority before use.

2. **CONCRETING UNDER WATER :** When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of mix to be used shall be got approved from the Engineer before any work is started. Concrete shall contain 10 percent more cement than that required for the same mix placed in the dry.

   Concrete shall not be placed in water having a temperature below 5 degree Celsius. The temperature of the concrete, when deposited shall not be less than 16 degree Celsius, not more than 40 degrees.

3. Coffer dams or forms shall be sufficiently water tight and in any case to reduce the flow of water less than 3 meters per minute through the space into which concrete to be deposited. Coffer dams or forms in still water shall be sufficiently have to prevent loss of mortar through the joints in the walls. Pumping will not be done while concrete is being placed, or until 24 hours time after. To minimize the formation of laitence great care shall exercised not to disturb the concrete as far as possible while it is being deposited.

CONTRACTOR EXECUTIVE ENGINEER

LABOUR I - REGULATION ACT

The Labour Regulations published by Karnataka Government Order No. PW 206/BMD 60 Dt. 14th June 1962 vide Annexure I. II and III shall be binding on the contractor

Name of the work :

ANNEXURE - 1

The Karnataka P.W.D. Contractor Labour Regulations :

1. SHORT TITLE : Those regulations may be called the Karnataka P.W.D. contractor Labour Regulations.

2. DEFINITIONS : In these regulations unless otherwise expressed or indicated the following words and expression shall have the meaning hereby assigned to them respectively, that is to say.

i) "Labour" means workers employed by a contractor of the KARNATAKA P.W.D. direct or indirectly through a sub-contractor by other persons or by as agent on his behalf on a payment not exceeding Rs. 4,000/- per month and will not include supervisory staff like overseas etc.

ii) "Fair Wages" means wage whether for time or piece work notified at the time of inviting tenders for the work and where such wages have not been so notified. The wages prescribed by the P.W.D. for the District in which the work is done.

iii) "Contractor" shall include every person whether a sub-contractor or head man or agent, employing labour on the work taken on contract.

iv) "Wages" shall have the same meanings as defined in the payment of the wages act 1936 and includes time and piece rate wages.

3. WORKING HOURS :

If women are employed, separate latrines and urinals screened from those for men shall be provided in the same scale.

Except in work sites provided with water flushed latrines connected with a water borne sewage system which shall be cleaned at least four times daily atleast twice during working hours and kept in strictly sanitary condition. The receptacles shall be tarred in side and atleast once a year.

The excreta from the latrine shall be disposed off at the contactor's expense in outlay pits approved by the Public Health Authority. The contractor shall employ adequate number scavengers and conservancy sand to keep latrines and urinals in clean condition.

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4. SHELTERS DURING REST :

At the work site there shall be provided free of cost two suitable sheds, one for meals and other for rest for the use of workers.

5. CHECBEL :

At every work site 50 or more women workers are ordinary employed there shall be provided two suit of suitable size for the use of children under the age of 5 year belonging to such women or huts shall be used for infant's games and play and other in their bed room.

The hut shall not be constructed on a standard lower than the following

i) Thatched roofs
ii) Mud floor & walls
iii) Planks spread over the mud floor and covered with matting. The surrounding of the tile huts shall be restricted to children their attender and mother of the children.

6. CANTEENS :

A cooked food canteen on a moderate scale shall be provided for the benefit of workers.

7. SHED FOR WORKERS :

The contractor should provide at his own expenses, needs for housing the workers. The sheds shall be on a standard not less than the cheap shelters type of live in which the workers in the locality are accustomed. The shed are to be in rows with space between shed and clear space between roofs if conditions permit. The works camp shall be laid out in units of 400 persons each unit to have a clear space of 40 each side.

8. LAND REQUIRED TEMPORARILY FOR STORING CONTRACTOR'S MATERIALS OR FOR HOUSING THEIR STAFF :

The contractor should make his own arrangements for temporary acquisitions of land required for storing his materials and for housing his staff at his own expenses.

The contractor shall maintain a wage book of each worker in such form as may be convenient at the place of work and the same shall include the following particulars.

a) Name of the worker
b) Rate of daily and monthly wages
c) Nature of work on which employed
d) Total number of days worked during each wage period
e) Dates and period for which worked over time
f) Gross wages payable for the work during each wage period

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g) All deduction made from the wages with an indicaion in case of the ground for which the deductions is made.
h) Wages actually paid for which wage period.
i) Signature or thumb impression of the worker.

1) The contractor shall also issue a wage slip containing the aforesaid particulars to each worker employed by him on the work at least a day prior to the day of disbursement.

2) The contractor shall issue all employment card in form III to each worker on the day of workers entry into his employment if the worker has already any such card with him issued from the previous employer the contractor shall merely endorse that employment card shall again be endorsed by the contractor and returned to the worker.

9. REGISTER OF UNPAID WAGES :

The contractor shall maintain a register of unpaid wages in such forms as may be convenient at the place of work but the same shall include the following particulars.

a) Full particulars of the labourers whose wages have not been paid
b) Reference number of the muster roll and wage register
c) Rate of wages
d) Wages period
e) Total amount not paid
f) Reasons for not making payment
g) How the amount unpaid wages was utilized
h) Acquittance with date

10. REGISTER OF ACCIDENTS :

The contractor shall maintain a register of accident in form as may be convenient at the work place but the same should include the following particulars.

a) Full particulars of the labourers who met with accident
b) Rate of wages
c) Sex
d) Age
e) Nature of accident and cause of accident
f) Time and date of accident
g) Date and time when admitted in hospital
h) Date of discharge from the hospital
i) Period of teratment, result of treatment
j) Percentage of loss or earning capacity & disability as assessed by Medical Officer
k) Claim required to be paid under 'Workmen' and compensation Act
l) Date of payment of compensation
m) Amount paid, with details of the persons to whom the same was paid
n) Authority by whom the compensation was assesseed
o) Remarks.

CONTRACTOR EXECUTIVE ENGINEER

11. FINES & DEDUCTIONS WHICH MAY BE MADE FROM WAGES :

1. The wages of workers shall be paid to him without any deductions at any kind except the following.

I) FINES

a) Deductions for absence from duty i.e. from the place where the terms of his employments he is required to work. The amount of deductions shall be in proportion to be the period for which he was absent.

b) Deductions for damage to a loss good expressly entrusted to the employee persons for custody or for loss of money or any other deduction which he is required to account where such damage or loss is directly attributable to his neglect or default.

c) Deductions for recovery of advance for adjustment of over payment of wages. Advance grants shall be entered in register

d) Any other deductions which the Govt. may from time allowed.

II) No fine shall imposed on any worker and respect of such acts and commission on his part as have been approved by the commissioner for labour.

III) No fine shall imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has give an opportunity of showing cause against such fines of deductions.

IV) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to 5 paise in a rupee on the wages payable to him in respect of that wage period.

V) No fine imposed on any worker shall be recovered from his installments or after expiry of 60 days from the date on which it was imposed.

VI) Every fine shall be deemed to have been imposed by the way of Act of commission in respect to which it was imposed

12. REGISTER OF FINES ETC :

1. The contractor shall maintain register of fines & register of deduction for damage or loss in Form No. I and II respectively which shall be kept at the place of work.

2. The contractor shall maintain both in English & Local languages a list approved by the commissioner for labour clearly stating the acts & Commission for which penalty of fine may be imposed on a workman display in good condition in conspicuous place on the work.

13. PRESERVATION OF REGISTER :

The wages book, the wages slips, the register of fines deductions required to be maintain under those regulations shall be preserved for 12 months after the date of last entry in them & shall be made available for inspection by the Engineer-in-charge. Labour Welfare Officer or any other officer Authorised by the Minister of W.H. & S in this behalf.

CONTRACTOR EXECUTIVE ENGINEER

14. POWER OF LABOUR WELFARE OFFICER TO MAKE INVESTIGATION FOR ENQUIRY :

The labour welfare officer or any other persons authorised by the Government on their behalf shall have power to make enquiry with a view to ascertaining and enforcing due and proper observance. The wages causes and the provisions of these regulations. He shall investigate into any complaint regarding the default made by the contractor or sub contractor in regard to such provision.

15. REPORT OF LABOUR WELFARE OFFICER

1. The labour welfare officer or other persons authorised aforesaid shall submit a report of the results of his investigation or enquiry to the Executive Engineer concerned indicating the extent. If any to which the default has been committed with a note that necessary deductions from the contractor will be made & wages & other due be paid to the labourers concerned. In case an appeal is made by the contractor under clause of 14 of these regulations actual payment to the labourers will be made by the Executive Engineer after the Regional Labour Commissioner has given his decision on such appeal.

2. The Executive Engineer shall arrange payments to the labourers concerned within 45 days from the receipt of the report from the Labour Welfare Officer or the Regional Labour Commissioner as the case may be.

16. APPEAL AGAINST THE DECISION OF LABOUR WELFARE OFFICER :

Any persons aggrieved by the decision and recommendation of the labour Welfare Officer or other persons to authorised may appeal against such decisions to the Regional Labour Commissioner concerned within 30 days from the date of decision forwarding simultaneously a copy of this appeal to the Executive Engineer concerned but subject to such appeal the decision of the officer shall be final and binding upon the contract.

17. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER :

I) A workman shall be entitled to be represented in any investigation or enquiry under those regulations by

a) An officer of register trade union of which he is a member

b) An officer of federation of trade union of which the trade union referred to in clause (a) is affiliated.

c) Where the worker is not a member of any register trade union by an officer of a registered trade union connected with or by any other workman employed in the industry in which the worker is employed.

II) An employer shall be entitled to be represented in and investigations or enquiry under these regulations by :

a) An officer of an Association of employers of which he is a member

b) An officer of federation of an association of employees to which the association referred to in a clause (2) is affiliated

c) Where the employer is not a member of any association of employees by an officer of an association of employed connected with or by any other employer engaged in the industry which the employer is engaged.

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18. INSPECTION OF BOOKS & SLIPS :

The contractor shall allow inspection of the wage books and wage slips, the register of unpaid wages, the register of accident and register of fines and deduction to any of the worker or to his agent at a convenient time and place after due notice is received by the Govt. in his behalf.

19. SUBMISSION OF RETURNS :

The contractor shall submit periodical returns as may be specified from time to time.

20. The Govt. may from time to time add to or amend the regulation and to any questions as the application interpretation on effect of these regulations. The decision of the commissioner for labour, deputy commissioner for labour to the Govt. in that behalf shall be final.

Annexure - II

Labour Clause 19 :- No Female labour shall be employed within the limit of cantonment.
Clause 19 A : No Labourer below the age of 14 years shall be employed on the work.
Clause 19 B : Payment of wages to labourers.

a) The contractor shall pay not less than fair wages to labourers engaged by him on the work.

EXPLANATION

a) 'Fair Wage' means wage whether for time or piece work noticed at the time of inviting tenders for the work and where such wages have not been so notified, the wages prescribed by Karnataka PWD for the district the work is done in consultation with officers of the industrial relation machinery located in the respective areas and will not be less than the maximum rates of same type of work in the same area.

b) The contractor shall not withstanding the provision of any contract to the contrary, cause to be paid fair wages to labourers directly engaged on the work including any labour engaged by his sub contractors in connection with the same work, as if the labourers had been immediately employed by him.

c) In respect of all labour directly or indirectly employed in the works for the performance of the contractors part of this agreement, the contract shall comply with or cause to be complied with the Karnataka PWD contractors Labour regulations made by Govt. time to time in regard to payment of wages period deduction from wages, recovery of wages not paid and deductions unauthorisedly, made maintenance of wage book, wage slip, publication of scale of wages and other terms employments inspection and submission of periodical returns and all other matters of like nature.

d) The Executive Engineer or Sub-Divisional officer concerned shall have the right to deduct from the moneys due to the contractor and sum required or estimated to be required for making good the loss suffered by worker or workers by reasons of non fulfillment of the condition of the contract for the benefit of the workers non payment of wages or deductions made from his or their wages which are not justified by their terms of the contract or non observance of the regulations.

e) Under the provisions of the Minimum Wages Act 1948 and the minimum wages (control) Rules 1959 the Contractor is bound to allow or cause to be allowed to the labourers directly or indirectly employed in the works one day rest for the six days continuous work and pay wages at the same rates as for duty in the event of default the Executive Engineer or sub-divisional officer concerned shall have the right to deduct the sum-or sums not paid on account of wages for weekly holidays to any labourers and pay the same to the person entitled there to from any money due to the contractor.

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ANNEXURE - III

MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY

ARRANGEMENTS WORKERS EMPLOYED BY THE KARNATAKA PUBLIC WORKS DEPARTMENT OR ITS CONTRACTORS :

1. APPLICATION : The rules apply to all building and construction works in charge of Karnataka Public Work Department.

2. DEFINITIONS : 1. "Work place" means a place at which on an average fifty or more workers are employed in connection with construction work.

2. "Large Work Place" means a place at which on an average 500 or more workers are employed in connection with construction work.

3. FIRST AID :

a) At every work place, there shall be maintained in a readily accessible place, first aid appliances including an adequate supply of sterilised dressing and sterilised cotton wool, the appliances shall be kept in good order and in large work places, they shall be place under the charge of a responsible person who shall be readily available during working hours.

b) At larger work places, where hospital facilities are not available within easy, distance of the works, first aid posts shall be established may be run by a trained compounder.

c) Where large work places are remote from hospitals, an indoor ward shall be provided with one bed for every 250 employees.

d) Where large places, are situated in cities, town or in their suburbs and no beds are considered necessary owing to the proximity or city or town hospitals suitable transport shall be provided to facilitate removal of urgent cases to these hospitals at other work-places some conveyance facilities such as a car shall be kept readily available to take injured person or persons suddenly taken seriously ill to the nearest hospitals.

4. DRINKING WATER :

a) In every work place there shall be provided and maintained suitable places easily accessible to labour a sufficient supply of cold water fit for drinking.

b) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water could be stored.

c) Every water supply of storage shall be at a distance of not less than 50 ft. from any latrine drain or other source of pollution where water has to be drawn from an existing well, which is within such proximity of latrine drain or and other source of pollution the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed and be provided with trap door which shall be dust and water proof.

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d) A reliable pump shall be fitted to each covered well the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once in a month.

5. WASHING AND BATHING PLACE :

i) Adequate washing & bathing places shall be provided separately for men and women
ii) Such places shall be kept in clean and drained condition.

6. SCALE OF ACCOMMODATION LATRINES AND URINALS :

There shall be provided within the precincts of ever work place latrines and urinals in and accessible place and the accommodation separately for each of them shall not be less than the following scale.

a) Where number of persons does not exceed 50
b) Where the number of persons exceed 50 but does not exceed 100
c) For every additional 100, 3 per 100 in particular cases, the Executive Engineer have the power to vary the scale where necessary.

7. LATRINES AND URINALS FOR WOMEN :

If women are employed separate latrines and urinals screened from those for men and marked in the vernacular in conspicuous letters. For “Women only” shall be provided in the scale laid in rules 6. These for men shall be similarly “For Men only”. A poster showing the figure of a Man and Woman shall be exhibited at the entrance of latrines for each sex. There shall adequate supply of water closed to the urinals and latrines.

8. LATRINES AND URINALS :

Except in work places provided with water flushed latrine connected with a water borne sewage system, all latrine shall be provided with receptacle on dry earth system shall be cleared at least four times daily and atleast twice during working hours & kept in strict sanitary condition the receptacles shall be tarred inside and outside atleast once at year.

9. CONSTRUCTION OF LATRINES :

The inside walls shall be constructed a masonry or some suitable heat resisting non-absorbent materials and shall be cement washed inside and outside atleast once a year. The dates of cement washing shall be noted in the register maintained for this purpose and kept available for inspection latrine not be a standard lower than borehole system.

10. PROVISION OF SHELTER DURING REST :

At every work place there shall be provided free of cost two sheds one for meals and the other for rest separately for men and women for the use of labour the height of the shelter shall not be less than 11 ft. from the floor level to the lowest part of the roof.

The shed should be roofed with atleast thatch and mud flooring will be provided with a draft wall around not less than 2½ ft. shall be kept clean and the space shall be on the basis of atleast 5 Sq.ft. per head.

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11. CRECHES :

a) At every work place, at which 50 or more women workers are ordinarily employed there shall be provided two huts for the use of children under age of 6 years belonging to such women. One hut shall be used for infants games place and other as their bed room. The house shall not be constructed on a lower standard than the followings.

i) Thatched roofs ii) Mud Floored and walls

iii) Planks spread over the mud floor and covered with matting

The huts shall be provided with sufficient openings for light & ventilation. There shall be adequate provision of sweepers to keep the place clean. There shall be two boys in attendance. Sanitary utensils will be provided with satisfaction of the Health officer of the area concerned.

b) Where the number of women workers is more the 25 but not less than 50 the contractors shall provide at least one hut and one boy to look after the children of women workers.

c) The size of creche or creches shall vary according to the number of women workers.

d) The creche or creches shall be properly maintained and necessary requirement like toys etc. shall be provided

12. CANTEEN :

A cooked food canteen on moderate scale shall be provided for the benefit of workers wherever it is considered necessary.

13. The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an in integral part of the contractors.

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APPENDIX TO GENERAL SPECIFICATIONS

The different tests may require shall conform to the IS appended below :

1.	IS 2720 - (Part - I to 41) 1980 to 1985	Method of tests for soils
2.	IS 5529 (Part - I) - 1985	Field permeability method of earthen dam (Post construction method)
3.	IS 5529 (Part - II) - 1985	Grounding procedure in masonry & Concrete dams
4.	IS 516 - 1959	Strength of concrete
5.	IS 10262 - 1982	Recommended guide lines for mix Design by IS method
6.	IS 269 - 1989	Specification for O.D.D. & low heat portland cement
7.	IS 3085 - 1965	Method of tests for permeanbility for cement and fine aggregates.
8.	IS 383 - 1970	Gradation tests for course and fine aggregates.
9.	IS 286 - 1963 (Part - I to IX)	Method of testing of aggregates.
10.	IS 432 (Part - I) - 1982	M.S. & Medium tensile steel bars & hand drawn steel wire for concrete reinforcement
11.	IS 432 (Part - II) 1982	Specification for hard drawn steel wire
12.	IS 3031 - (Part - I to XV) 1988-1999	Method of physical tests for hydraulic cement
13.	IS 456 - 2000	Code of practice for plain and Reinforced cement concrete

Note : IS No. mentioned above or its latest editions and any other IS found necessary will be applicable

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Employment Card (Regulation 6 (III)

Contractor

Name & Sex of the worker
Father's Name

Age & Date of Birth
Identification Marks

Specify Village Dist. & State

Sl. No.	Name & Address of employers (Specify whether a contractor)	Particulars of location Work site & decription of work	Total period for which the worker employed from to	Annual No. of days worked	Leave taken No. of days should be specified
1	2	3	4	5	6

Given Sl. No. as on reverse	Nature of work wage done by wage period of worker	Wage rate (with particulars of unit in case of piece work)	Total wages earned by the worker during the period shown under col.	Remarks	Signature of the employer
1	2	3	4	5	6

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If the worker is employed both on piece and the rates relevant entries in each should made separately.

Contractor

Form - I

Register of Fines (Regulations 10)

Sl. No.	Name	Father's Name husband name	Sex	Department	Nature & date of the offence for which fine imposed	Whether work men showned cause against fine or not if enter date	Rate of Wages	Date of amount of fine imposed	Date on which fine released
1	2	3	4	5	6	7	8	9	10

Form - II

Regulation 19 (a) Employer

REGISTER OF DEDUCTION FOR DAMAGE LOSS CAUSED TO THE EMPLOYED THE DEFAULT OF THE EMPLOYED PERSON

Sl. No.	Name	Father's Name husband name	Sex	Department	Damage or loss cause with date cause against	Whether Worker should imposed deduction if so, date enter	Date & Amount of deduction	No. of install-ments if any	Date on which amount released	Remarks
1	2	3	4	5	6	7	8	9	10	11

Executive Engineer

XVI. CONTROLLED BLASTING

(1) The objectives of controlled blasting techniques include

a) Minimisation of overbreaks and or fracturing of rock beyond the designed boundary of excavation so as to achieve smooth post blast surface for the canal and a sound foundation for the canal structure.
b) Control of flyrock and or ground vibration within permissible limits and
C) To serve both the above purposes.

(2) TECHNIQUES FOR MINIMISING ROCK DAMAGE

The main purpose of controlled blasting is to minimise fracturing and loosening of the rock mass beyond the predetermined excavation line/profile.The objective is normally achieved by minimising and judicious use of explosives in the blast holes. Several controlled blasting techniques such as line drilling, presplitting, smooth blasting, cushion blasting and buffer blasting are used to achieve the objective.

LINE DRILLING :

The line drilling may be one of the techniques used for overbreak control. In line drilling, a single row of closely spaced, unloaded, small diameter holes is drilled along the neat excavation line. This provides a plane of weakness to which the primary blast can break and to some extent reflects the shock waves created by the blast, reducing the shattering and stressing in the finished wall. Line drilling is best suited to homogenous formations where bedding planes, joints, and seams are at a minimum.

Line drilling has very limited application. The only place where it is applicable is in areas where even the light explosive loads associated with other controlled blasting techniques may cause damage beyond the excavation limit, or where line drilling is used between loaded holes to promote shearing and guide the presplit line.

PRESPLITTING :

Presplitting involves a single row of holes drilled along the excavation line. Presplit in the rock forms a discontinuous one which minimises or eliminates overbreak from the subsequent primary blast and produces a smooth, finished rock wall. Presplitting is also used to reduce ground vibration in some critical cases.

SMOOTH BLASTING :

Smooth blasting is sometimes referred to as contour blasting, perimeter blasting, or sculpture blasting. This method is widely accepted method for controlling overbreak in canal, underground headings and slopes. In smooth blasting the holes are drilled along the excavation limits, lightly loaded with well distributed charges, and fired after the main excavation is removed. By firing instantaneously or with minimum delay between the holes, a shearing action is obtained which gives smooth walls minimum overbrek.

Smooth blasting, presplitting etc., techniques differ mainly from the line drilling principle in that some or all of the holes are loaded with relatively light, well distributed charges of explosives. The fact that the firing of these charges tends to crack or split the rock between the holes permits wider hole spacings than when line drilling. Consequently drilling costs are reduced and in many cases better control of overbreak is obtained. However in the case of presplitting, it is difficult to determine results until excavatioin of the primary blast is complete to the finished wall.

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CUSHION BLASTING :

Cushion blasting is sometimes referred to as trimming, slabbing, or slashing. Late smooth wall blasting, a single row of holes is drilled along the excavation line, loaded with light, well distributed charges, and fired after the main excavation is removed. In cushion blasting, the charged holes are further decoupled by reducing the diameter or using stemming material of crushed stone or sand to provide crushing effect. This "cushions" the shock from the finished wall as the holes are detonated and minimises the stresses and fractures in the finished wall. This technique is rarely used today because the reduction in decoupling could be achieved by the use of small diameter explosive cartridges which serves the same purpose. The holes are blasted using the last delay number in the same blasting round preferably with jumping delay of 50 Ms.

The suitable parameters for controlled blasting for minimising rock damage shall be established through trial blasts. Usually it needs to establish the optimum hole spacings and the charge per hole. Slopes of the canals are designed and prescribed by the Engineer in accordance with the geology of the rock. The controlled blasting methods shall be such as would enable maintain the prescribed slope.

(3) GROUND VIBRATION CONTROL TECHNIQUES

When an explosive charge is detonated inside a blast hole it is instantly converted into hot gases and the expanding gases exert intense pressure on the blast hole walls. A high intensity shock wave travels through the rock mass which attenuates sharply with distance. Simultaneously the rock around the blast hole upto twice the radius of the original hole gets completely crushed. Expanding gases continue to work on the rock, extending the cracks and moving the rock.

Outward and upward. These activities consume a major part of the explosive energy. However, a small left over portion passes beyond the zone of intended work in the form of elastic ground vibrations. As seismic waves travel through the rock mass, they generate particle motions which are termed as ground vibratoins. The velocity of oscillation of rock particles is called "particle velocity" and its maximum value is called "peak particle velocity (PPV)". Internationally, peak particle velocity is used to express the intensity of ground vibrations from blasting. Damage caused by ground vibration is dependent on the ground velocity and on the frequency of the ground motion. Even though, the use of explosives has unwanted side effect in the form of vibration, explosives provide an inexpensive source of energy for rock excavation in mining and civil engineering projects.

The principal factors that effect vibration levels at a given point of interest are the maximum charge per delay, the distance from the blast, the delay period used and the blast geometry.

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SAFE LIMITS OF VIBRATION :

The permissible peak particle velocity (mm/s) at the foundation level of structures is as follows :

Type of Structures	Dominant excitation Frequency, Hz		
	<8 Hz	8-25 Hz	>25 Hz
Buildings/Structures not belonging to the owner			
(i) Domestic houses/structures (Kutcha, Brick & Cement)	5	10	15
(ii) Industrial Buildings (RCC & Framed Structures)	10	20	25
(iii) Objects of historical importance & Sensitive structures	2	5	10
(A) **Buildings belonging to the owner with limited span of life**			
(i) Domestic houses/structures (Kutcha, Brick & Cement)	10	15	25
(ii) Industrial Buildings (RCC & Framed Structures)	15	25	50

VIBRATION CONTROL PROCEDURES :

1. The most common method of controlling ground vibration is by minimising the charge weight per delay. Delay blasting permits to divide total charge into smaller charges, which are detonated in a predetermined sequence at specified intervals. Blasting without delay or sufficient delay numbers increases ground vibrations due to increases in maximum charge per delay.

2. The vibration can be significantly reduced by optimising blast design parameters. The contractor shall establish optimum burden, hole spacing, powder factor and hookup to control vibration in the vicinity of the existing structures.

(4) FLY ROCK CONTROL TECHNIQUES

The rock fragments ejected from the blast "flyrock" is a serious hazard of blasting operations, particularly when the blast is conducted in the vicinity of village and structures. The factors which influence the flyrock distance include :

1) Height of stemming column in the blast holes and type/quality of stemming material.
2) Irregular shape of free face
3) Excessive large burden or blasting without free face
4) Muffling of the blast area and the muffling material type
5) Scattering and overlapping of delay timings of the delay detonators/relays.
6) Presence of water in blastholes.

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The first four parameters can be controlled by properly designing the blasting pattern whereas the last two parameters are not easily controllable.

Flyrock shall be controlled by proper blast design and by muffling/covering. From the experience it is found that unless blast design is proper, muffling will not be effective. Proper blast design and accurate implementation of the blast are the two areas of fundamental concern for controlling the flyrock. The third impontant parameter is understanding the local geology and adjusting the explosive charge with regard to the geological features.

The reliable and effective method of controlling flyrock fragments from the mouth of the blast holes (vertical flyrock on the rear side) is the height of stemming column. It has been observed that the flyrock, particularly towards the rear side, was effectively controlled by maintaining the height of stemming column in all holes greater than the burden. The height of stemming column should be 1.2 to 1.5 times the true burden in all holes.

A good stemming material should retain borehole pressure till the burden rock starts to move. Dry angular material under the effect of the impulsive gas pressure tends to form a compaction arch which locks into the wall of a blast hole, thus increases its resistance to ejection. In general, drill cutting is better stemming material as compared to sand and should be preferred except in case of watery holes. In case of watery holes only sand free of clayey materials should be used as stemming material.

If flyrock is originating from the face and flying far distance, it could be an indication that too little burden is used or that mud seams or other geological. Discontinuities are prevalent. Most flyrock however, is not produced from the face. It is produced from the top.

When the flyrock towards the face side is also to be contained, the blasting should be done using the technique of buffer blasting along with muffling. Buffer blasting is a technique in which a buffer of blasted rock of 4 to6m thick should be left against the next round of blast.

Muffling or covering of holes including entired area to be blasted is one of the most common method to contain the distance of travel of flying fragments particularly when blasting is done within the danger zone as specified by DGMS.

In mining blasts, the most common practice is cover the blast using wire mesh of 50 mm x 50 mm to 75mm x 75 mm. Gunny bags and cartridge empty boxes 4 to 5 numbers are filled with sand or drill cuttings and placed over the wire mesh. Sometimes the entire area to be blasted is covered by old belt conveyors over the wire net which was found to be more effective as compared to wire nets alone. Gunny bags filled with sand, free of pebbles, weighing at last 30 to 40 kg are placed over the belt conveyor which is placed over the wire nets at an interval of 2 m between and within the rows. This method will contain the vertical fly to a great extent.

Flying fragments is excessive when blasting is done in shallow holes and where bench height or hole depth is less than two times the burden. Therefore for controlling flyrock, the bench height must be greater than two times the true burden and preferably three times the burden. The fly rock is also excessive in watery holes.

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Muffling or covering of holes including entire area to be blasted is one of the most common method to contain the distance of travel of flying fragments particularly when blasting is done within the danger Zone.

The Contractor shall establish by trial blasting suitable technique for the control of flyrocks wherever necessary. The techniques adopted shall be got approved from the Engineer. For excavation within the danger zone the prior approval of the blasting methods shall be obtained from the Chief Engineer.

(5) ALL ITEMS OF ROCK EXCAVATION RATES TO INCLUDE COST OF CONTROLLED BLASTING FOR MINIMISING ROCK DAMAGE

The contractor shall quote his rates for items of rock excavations in Schedule B inclusive of the cost of controlled blasting to minimise rock damages as per the technique described in para (2) above. The payment for carrying out controlled blasting for minimising the rock damages will not be made separately. The Controlled blasting to minimise the rock damages all along the canal in all chainages and in all foundation excavations of structures shall be deemed as part of excavation itself.

(6) EXTRA PAYMENT FOR CONTROLLED BLASTING TO CONTROL VIBRATION AND FLY ROCK IN CERTAIN SPECIFIED REACHES.

An extra item towards hard rock excavation under control blasting (HRCB) to control vibration and fly rocks while blasting in the vicinty of high tension power lines, structures and village/town limits in respect of main canals, large distributaries and foundations of structures is to be provided for in Schedule B. The chainages of canal and foundation reaches between which HRCB is to be executed shall be mentioned and shown in tender drawings. The Contractor shall quote his rates for excavation in hard rock requiring controlled blasting considering all the necessary controls and all precautions to be taken. This extra item and related payment is admissible for excavation in hard rock only. It is not permissible in soft rock excavated with blasting, notwithstanding the fact that the control of blasting to control vibration and fly rocks might have been involved.

Notwithstanding the provision made for HRCB in Schedule - B, the actual execution of the work to control vibration and fly rocks shall be in accordance with the guidelines contained in Government Circular No. ID 40 KBN 98 dated 13. 10. 1998 or its latest version.

1.8 CLASSIFICATION OF EXCAVATED MATERIALS

1.8.1 CLASSIFICATION

All materials of excavation shall be classified by the Engineer- in - charge in the following groups.

(a) SOIL : This shall include the following

I. Ordinary soils, viz vegetable or organic soil, turf, sand, silt, loam clay, mud, peat, black cotton soil soft shale, loose murrum, a mixture of all these and similar materials which yield to the ordinary application of pick and shovel rake or other ordinary digging implement. Removal of gravel or any other nodular material having diameter in any one direction not exceeding 75 mm. occurring in such strata shall be deemed to be covered under this category.

II. Hard soils viz. stiff/heavy clay, soft shale, or compact murrum requiring grafting tool or pick or both and shovel, closely applied.

III. Gravel, cobble stone, soft laterite, kankar and boulders having maximum diameter in any one direction upto 520 mm.

IV. Soft conglomerate, where the stones may be detached from the matrix with picks;

V. Soling of roads, water bound maccodam layers, asphalted roads.

VI. Lime concrete and stone masonry in lime mortar or in lean cement mortar.

VII. Marshy soil excavated below the original ground level of marshers and swamps and soils excavated from other areas requiring continuous pumping or baling of water.

VIII. Generally any material which requires the close applicatioin of picks, or scarifiers to loosen and not affording resistance to digging greater than any items mentioned in (I) to (VII) above.

(b) **SOFT ROCK WITH OR WITHOUT BLASTING:**

This shall include

i) Highly disintegrated granite, trap or lime stone where the rock material is completely disintegrated except for a few unweathered rock fragments.

ii) sand stone, hard laterite, laminated limestone, heavily jointed trap, breccia, red bole, hard shale, hard conglomerite and moderately to highly weathered granite.

iii) Closely jointed fissured and fractured hard rocks.

iv) Unreinforced cement concrete beds of lean proportions upto and including C.C.1:3:6 and stone masonry in C.M. 1:3 or of richer mix lying below ground level.

v) Generally any material or combinatiion of materials which requires excavating efforts similar to excavation of items (i) to (iv) above.

Soft rocks are of such hardness that they can not be excavated by picks and hand shovels. They may be either (a) quarried or split with crow bars, or (b) excavated by drilling and blasting, depending upon jointing pattern, the degree of weathering and moisture content.

(c) HARD ROCK WITH BLASTING

It includes

i) Massive and sheet rock formatioins of lime stone, granite, quartzite, trap, dolerite, pegmatite, gneiss and any other hard rock formation.

ii) Slighly weathred to fresh hard rock formations of limestones, granite quartzite, trap, dolerite, pegmatite, gneiss and any other hard rock formatiion.

iii) Hard rock boulders of size more than 520mm (0.14 cum) requiring blasting for removal.

iv) C.C. of 1:2:4 proportion or of richer proportion and R.C.C.

v) Any material requiring excavating efforts similar to items i.) to iv.) above.

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1.8.2 Under the hard rock, there may be one more classification for the purpose of measurements and payments, when the Schedule B provides for an item of extra payment for controlled blasting to control fly rock and vibrations vide para 1.7.xvi above.

1.8.3 **AUTHORITY FOR CLASSIFIVATION**

The classification of exeacation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the Contractor. Merely the use of explosives in excavation will not be considered as a reason fo higher classification unless blasting is clearly necessary in the opinion of the Engineer-in-charge.

The excavated materials from hard rock shall be stacked on the site as directed by the Engineer-in-charge for facilitating measurements. The stacks shall be measured and 40% deducted for voids. The quantity arrived at by section measurement shall be verified with the quantity of stacks. In special circumstances, stacking may be dispensed with, with the approval of the Chief Engineer in which case suitable deduction towards the stacking charges will be made based on the current schedule of rate. When stacking is not waived by Chief Engineer, the cost of rubble and stacking charges are to be recoverd.

1.9 EXCAVATION FOR CANAL

1.9.1 GENERAL

(a) Excavation for canals in rock shall be to the underside of the lining shown on the drawings. Excavation for canals in materials other than rock shall be left 200 mm. above the underside of the concrete lining until immediately before placing the concrete lining. Before placing the concrete lining the sub-grade shall be wetted if necessary and compacted at optimum moisture content and carefully excavated to the underside of the grade M15 concrete lining. The Employer reserves the right, during the progress of the work, to vary slopes of excavation and the dimensions dependent thereon.

(b) Blasting shall be done in such a manner so as not to cause over-breakage which in the opinion of the Engineer-in-charge is excessive. Special care shall be taken to prevent over-breakage or loosening of material on bottom and side slopes against which concrete lining is to be placed. To achieve this, techniques for minimising rock damage as specified in para 1.7.xvi shall be followed for the sides and bed of the canal. The smooth blasting shall be such that on the finished surface at least 50% of the drill hole marks could be seen. If satisfactory rock surface is not obtained through controlled blasting the final cutting may be by chisselling or with the help of pavement breakers. All these operations shall be carried out at contractor's cost without any claim for separate payment.

If excavation is required to be done within 50 meters from existing transmission/power lines or 300 meters from village limits and if it is not considered expedient by the department to shift the power lines or the village to safer distances or otherwise extend protection, the excavation shall be carried out with extra care to control the ground vibrations and fly rock as specified in paras 1.7.xvi(3) and 1.7.xvi(4) and the payment are regulated as in para 1.7.xvi(6).

(c) Except the areas of rock, all areas to be excavated for canal sections shall be prewetted so that at the time of excavation moisture content shall be about optimum. However, in case the excavated materials from canal is not to be used for embankment, such prewetting need not be done.

(d) The contractor shall not be entitled to any additional rate above the rates quoted in schedule B on account of the requirement for allowing additonal time for drying, stock-piling and rehandling the excavated material which have been deposited temporarily and stock-piled for reuse.

1.9.2 CONVEYANCE AND DISPOSAL OF EXCAVATED MATERIALS

The usable excavated material available from the canal excavation shall be used in the appropriate zone of the canal embankment by conveying the same with all basic leads and lifts are included in the excavation items and the additional lead charges, if any, shall be included in the respective items of embankment. If usable excavation material is in excess of the requirements of banking the same shall be used for the construction of approaches to the road bridges, and for selected bedding materials and back fill around structures for which payment will be made at the rates entered in schedule B. Remaining material from the excavation shall be used to strengthen the embankment on either side of canal, or deposited in low areas on either side of canal to back fill borrow pits or spread in other approved location as directed by the Engineer-in-charge. Usable rubble available from hard rock excavation shall be sorted out and arranged in separate regular stacks without any extra charges as and where directed by the Engineer-in-charge. The balance excavated stuff will be deposited in Spoil banks. The Spoil banks shall not be constructed continuous. A gap of 10 mtrs. shall be provided at 150 mtrs. interval. Spoil banks shall not be allowed within 30 mtrs. on either side of the structure on both the banks of canal unless otherwise directed by the Engineer-in-charge.

1.9.3 DEWATERING CANAL TRENCHES AND EXCAVATION UNDER WET CONDITION

Water encountered in canal excavation shall be diverted to nearby drain and nalas by cutting an open channel within the canel section to be excavated. When the drain/nala bed is higher than the encountered water level this water shall be evacuated into the nala by pumpling and no separate payment will be made for dewatering by pumping. No distinction shall be made in payment whether the material being excavated is dry, moist or wet. Removal of accumulated silt, slush, and dewatering shall be done by the Contractor, without any extra cost till the work is finally handed over to the Department or till the expiry of the contract period, whichever is earlier.