SL: - 04

KIDN-25

GOVERNMENT OF ODISHA

DEPARTMENT OF WATER RESOURCES

OFFICE OF THE EXECUTIVE ENGINEER,
KEONJHAR IRRIGATION DIVISION,KENDUJHAR

P1

TENDER SCHEDULE

FOR THE WORK

Improovement to Jamunaposi Minor from RD 2511m to 2611m (Construction of Troughwall) for the year 2026-27.

EXECUTIVE ENGINEER,
KEONJHAR IRRIGATION
DIVISION,KENDUJHAR

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SECTION – 1
DETAILED TENDER CALL NOTICE/
E-PROCUREMENT NOTICE

GOVERNMENT OF ODISHA
OFFICE OF THE EXECUTIVE ENGINEER, KEONJHAR IRRIGATION DIVISION, KENDUJHAR
Email-id-eekjrirrdivn@gmail.com
'e' Procurement Notice No. 05/2026-27
BID IDENTIFICATION No.EE-KID-05/2026-27

The **Executive Engineer, Keonjhar Irrigation Division, Kendujhar** on behalf of Governor of Odisha invites **P1** (**Percentage Rate)** bids in online mode for the works as detailed in table below from eligible contractor as mentioned in column-6 (S) registered with the state Government and Contractor of equivalent Grade / Class registered with Central Government / MES / Railway or other licensing Authority for execution of civil works on production of definite proof from the appropriate authority.

Procurement Details TABLE – (A)

Sl. No.	Name of work	Value of the Work in Lakhs (Approx) (Excluding GST)	EMD (Rs.) (Online)	Cost of Bid Document (Rs.) (Online)	Class of contractor	Period of completion	Work ID No.
1	2	3	4	5	6	7	
1	Construction of Trough Wall of Chakundapal Sub-Minor-II from RD- 00M to 500 M of Kanjhari Irrigation Project for the year 2026-27.	10.15	₹ 10,200	₹ 6,000	'D' & 'C'	3 Calendar Months	**(KIDN-22)**
2	Improvement to Kathabari Minor from RD 400m to 550m (Construction trough wall) for the year 2026-27.	12.70	₹ 12,700	₹ 6,000	'D' & 'C'	.—do—	**(KIDN-23**
3	Improvement to Poipani Minor from RD 1200m to 1350m (Construction troughwall) for the year 2026-27.	12.65	₹ 12,700	₹ 6,000	'D' & 'C'	.—do—	**(KIDN-24**
4	Improvement to Jamunaposi Minor from RD 2511m to 2611m (Construction of Troughwall) for the year 2026-27.	12.14	₹ 12,200	₹ 6,000	'D' & 'C'	.—do--	**(KIDN-25)**
5	Improvement to Brundabanpur Minor from RD 2700m to 2850m (Construction troughwall) for the year 2026-27.	12.60	₹ 12,600	₹ 6,000	'D' & 'C'	.—do--	**(KIDN-26)**
6	Improvement to Padmapur sub-minor From R.D. 1500m to 1800m of Construction of Trough wall for the year 2026-27.	12.71	₹ 12,800	₹ 6,000	'D' & 'C'	.—do--	**(KIDN-27)**

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1. Bid documents consisting of plans, specifications, the schedule of quantities and the set of terms and conditions of contract and other necessary documents can be seen in the website: www.tendersodisha.gov.in during the bidding period.

2. **The Bidder shall transfer online required E.M.D. / Bid Security amount specified for the works in the table Col- 05 above as part of its bid through process as mentioned in the DTCN vide Office Memorandum No. 17254/W/dated 05.12.2017 of Works Department, Govt. of Odisha. Bidders desirous to hire machineries or equipments from outside the State or owned but deployed outside the state are required to transfer online 2% of the amount put to tender as Bid security.**

3. The Bidder shall transfer **online** the **cost of Bid document** (Non-refundable) amount specified for the works in the table Col-06 above per set towards cost of the bid through process as mentioned in the DTCN vide Office Memorandum No. 17254/W/dated 05.12.2017 of Works Department, Govt. of Odisha.

4. The bid is to be submitted through the e-procurement portal with documents such as scanned copies of GST Registration Certificate, valid contractor Registration certificate, PAN card, undertaking/certificates duly filled, Affidavit about the authentication of the tender documents, no relation certificate and documents required as per the relevant clauses of DTCN with Bill of Quantity (Financial Bid).

5. **Additional Performance Security (**As per Works Department **OM No.17941/W dt.08.10.2026)** shall be obtained from the bidder when the bid amount is less than estimated cost put to the tender. In such an event, only the successful bidder who has quoted less bid price / rates than the estimated cost put to tender shall have to furnish the Additional Performance Security as per the following rate.

I. The Additional Performance Security (APS) shall be calculated as a percentage of the accepted Bid Price of the selected bidder.

II. For the purpose of determining the APS, the percentage by which the accepted Bid Price is lower than the Cost Put to Tender shall be calculated and rounded off.

III. The rounded-off percentage so determined shall be referred to as the Rounding Off of Percentage Less (ROPL) of accepted Bid Price and shall form the basis for calculation of the APS in accordance with the applicable incremental rate prescribed under this Office Memorandum.

IV. Rounding Off of Percentage Less (ROPL) of accepted Bid Price, i.e. the percentage by which the accepted Bid Price is less than the Cost Put to Tender, shall be as follows:

- Where the decimal fraction is less than 0.50, the percentage shall be rounded off to the next lower whole percentage.
- Where the decimal fraction is 0.50 or above, the percentage shall be rounded off to the next higher whole percentage.
- For avoidance of doubt, 13.25% less shall be reckoned as 13% less, whereas 13.50% less shall be reckoned as 14% less, for the purpose of determining the applicable APS under this Office Memorandum.

V. Calculation of Additional Performance Security:

- Where the accepted bid price is such that the ROPL is up to (-)10%, no additional performance security is required.

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- where the accepted bid price is such that the ROPL is below (-)10% but not below (-)20%, the additional performance security percentage shall be incremented by 0.2% for every percentage of ROPL below (-)10%; for avoidance of doubt, if ROPL is (-)13%, then APS shall be @ 0.2% x (13-10) = 0.6% of accepted bid price.
- where the accepted bid price is such that the ROPL is below (-)20% but not below (-)30%, the additional performance security percentage shall be incremented by 0.3% for every percentage of ROPL below (-)20% in addition to 2% of the accepted bid price; for avoidance of doubt, if ROPL is (-)24%, then APS shall be @ 0.3% x (24-20) +2% = 1.2% + 2% = 3.2% of accepted bid price.
- Where the accepted bid price is such that the ROPL is below (-)30% or more, the additional performance security percentage shall be incremented by 0.5% for every percentage of ROPL below (-)30% in addition to 5% of the accepted bid price; for avoidance of doubt, if ROPL is (-)37%, then APS shall be @ 0.5% x (37-30) + 5% = 3.5% + 5% = 8.5% of accepted bid price.

VI. The additional performance security shall be treated as part of the performance security.

VII. The provision of additional performance security shall be applicable to all forms of tender except Turnkey Tender.

VIII. This shall take effect from the date of issue of this Office Memorandum.

The codal provision exists in Works Department Office Memorandum No. 14459/W dated 20.09.2018 stands modified to the above extent with effect from the date of Issue of this Office Memorandum.

The security will be refunded after one year on completion of the work in all respect provided the final bill is passed and will not carry any interest. Any defect noticed during the period of one year after the actual date of completion shall be rectified by the contractor at his own cost. Failure to comply such rectification the cost involved to carry out the defective work shall be met from his dues available with Department. (Ref. works Dept. order No. 17823 /US dt. 11.10.2006.

The e-procurement portal system shall generate the award of the contract letter and intimate the bidder in his e-mail after acceptance of the agreement.

6. Security for the due fulfillment of a contract should invariably be taken. The security may be taken in shape of N.S.C / Post office Savings Bank Account/Post Office Time Deposit Account/ Kissan Vikas Patra/Bank Guarantee in favour ofthe Divisional Officer from any Nationalized/ Scheduled Bank in India counter guaranteed by its local branch at Bhubaneswar towards Initial security deposit/any other security deposit from the contractor or supplier.
7. The bidder must possess compatible Digital Signature Certificate (DSC) of Class-II or Class-III.
8. Other details can be seen in the bidding documents, "e" procurement portal which is available in web-site; "https://www.tendersodisha.gov.in".
9. The Bidders should ensure clarity/ legibility of the documents uploaded by them to the portal. Non-submission of legible documents may render the bid Non-Responsive.
10. The bid for the work shall remain valid for a period of 90 days from the last date of receipt of bid. If any bidder/ tenderer withdraws his bid / tender before the said period or makes any modification in the terms and conditions of the bid, the EMD deposited at the time of submission of tender shall stand forfeited.
11. Period of availability of tender On-line/ Date and time of bidding on-line/ Last date of seeking clarification/ Date of opening of tender etc. Details as follows –

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Procurement Officer	e-procurement Notice No.	Availability of tender in the website: www.tendersodisha.gov.in for online bidding.		Date & time of opening of tender	Last Date & time of Seeking clarification
		From	To		
1	2	3	4	5	6
Executive Engineer, Keonjhar Irrigation Division, Kendujhar	**EE-KID 05 / 2026-27**	**29.10.2026 11.30 AM**	**05.11.2026 11.30 AM**	**06.11.2026 11.30. AM**	**03.11.2026 5.00. PM**

12. No Engineer of Gazetted rank or other Gazetted officer employed in Engineering or Administrative duties in an Engineering Department of the State Government is allowed to work as a contractor within a period of two years after his retirement from Government service without Government permission.
13. Engineer contractor who wants to avail **EMD Exemption** shall have to furnish scan copy of affidavit along with tender in on-line to the effect that he/she has not yet availed the facility for more than two works during the current financial year. The name of the work for which and the authority to whom the tenders have been submitted, must be mentioned in the affidavit and he/she should produce his original registration certificate at the time of opening of tender failing which the tender will be liable for rejection. SC/ST contractors desires of availing benefit as per works Department resolution No 27748 dated 11.10.1977 must submit affidavit for the same along with attested copy of caste certificate.
14. SC/ST contractors desires of availing benefit as per works Department resolution No 27748 dated 11.10.1977 must submit affidavit for the same along with attested copy of caste certificate.

15. As Goods and Service Tax has come into force with effect from 01.07.2017, GST as applicable will be paid extra after gross bill amount prepared vide Section-15 and Section-142 (11-C) of Odisha Goods and Service Tax Act 2017. The rates of individual items of work are exclusive of GST and bidders are to quote their rates exclusive of GST.
16. Copy of valid GSTIN shall be uploaded along with the tender documents for considering the tender.
17. GST as applicable (Presently TDS-2%) on the gross amount of the bill will be deducted from the contractor's bill while making payment, where agreement value exceeds rupees two lakh fifty thousand as per memorandum no. 30797/ Dt. 25.09.2018 of Finance Department, Govt. of Odisha.
18. GST on works contract as applicable at the time of payment shall be paid extra over the gross amount of the running bill amount. (vide section 15 and section 142 (11) © of Odisha goods and services Tax Act 2017).
19. Commercial invoice should be submitted by the contractor at the time of preparation of the work bill to the concerned Junior Engineer with a copy to the office of Executive Engineer for enabling the Division to make necessary payment, failing which no GST payment can be made.
20. All the existing provisions of OPWD code with amendment from time to time will be applicable in deciding the tender.All correspondence regarding the tender process will be communicated by registered post/ e-mail address. All are requested to check the e-mail from time to time regarding the tender. No claim whatsoever will entertain for non-receipt of communication in hard copy.
21. The Addendum/ Corrigendum/ Cancellation of above tender if any will be hoisted in the website & notice board only.

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22. Agreement shall be drawn only after due verification of ISD & APS of the successful bidder. If any fake instruments are detected, Criminal proceedings will be initiated against the defaulting bidder and action will be initiated for blacklisting through the license issuing Authority.

23. Tenderers have to pay earnest money as required as per Works Deptt. Lr No.15443 dt. 01.08.2005 for an amount of Rs.215 of the estimated cost as mentioned in clo.5 mentioned in the respective column no.5 of DTCN(The amount specified in the tender notice) at the time of submitting the tender. Contractors desirous of hring machineries from outside the State are required to furnish EMD @ 2% of the amount put to tender at the time of submission of tender. Further sum of such amount towards initial security as would, together with the earnest money, make 2% to 3% of the cost of the work as the case may be as per the accepted tender has to be furnished prior to execution of agreement. Tender not accompanied with the earnest money deposit in the approved forms of security duly pledged in favour of the concerned authorities as specified in tender call notice shall not be considered at all.

    Initial security deposit should be in shape of pledged NSC/Post Office Time Deposit Account/Post Office Saving Bank Account/KVP/Deposit receipt of Scheduled Bank . In case the actual cost of work exceeds the original cost of work as per the accepted tender the amount to be recovered from bills of the contractors will be such as to make together with deposits already realized an amount equal to the prescribed percentage of the actual copst of work executed.

    Besides the Earnest money Deposit & Initial security deposit, contractors of B Class above will be required to furnish security deposit by way of deduction from their bill at the rate of 5% of the gross amount or eachbill where as in case of C & D class contractor such deduction will be made at the rate of 3% of gross amount of each bill. Thus the total security deposit from contractors will be 7% for Super class, Special class A & B Class and 5% for C & D Class Contractors.

24. The authority will not be held responsible for any technical snag or network failure during online bidding. Bidders areadvised to submit their bids well in advance within the stipulated period.

25. Bids received online shall be opened in the office of Executive Engineer, Keonjhar Irrigation Division, Kendujhar on **Dt. 06.11.2026 at 11.30 AM**. If the Office happens to be closed on the date of opening of the technical bids as specified the bids will be opened on the next working day at the same time and venue.

26. Government of Odisha has mandated online registration of all categories of contractors in CDMS portal (www.cdmsodisha.gov.in) vide O.M. No. 12934 dt.23.08.2018 of Works Department. As per the codal provision vide clause No. **12.4** of Appendix IX (A) of O.P.W.D. code Vol.(II) all classes of contractors are requested to register themselves in CDMS Portal. **Tender Inviting Authority will not accept any tender if contractors shall not registered under CDMS portal & their tenders will be rejected.**

27. All correspondences & information if any required will be sent to the bidders in their provided e-Mail address in his DSC bid submission confirmation.

28. Other details can be seen in the bidding documents.

29. The authority reserves the right to cancel any or all the bids without assigning any reasons thereof.

30. The Bidders have to participate in ONLINE bidding only. Further details can be seen from the e-procurement portal: www.tendersodisha.gov.in .Any addendum/corrigendum/cancellation of tenders can be seen from the above portal.

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Availability of tender online for bidding is from **Dt. 29.10.2026** at 11.30 A.M to **Dt. 05.11.2026** up to 11.30 AM. The Bids will be opened on **Dt. 06.11.2026 at 11.30AM**..

After opening of Tender, the further process will carried out as per prescribed rules & guideline of Govt.

Further details can be seen from the Govt. website www.tendersorissa.gov.in/ www.dowrodisha.gov.in. Addendum/ Corrigendum/ Cancellation if any required will be published in Govt. website only.

Executive Engineer,
Keonjhar Irrigation Division,
Kendujhar

CONTRACTOR **EXECUTIVE ENGINEER**

GOVERNMENT OF ODISHA
DEPARTMENT OF WATER RESOURCES,

O/O THE SUPERINTENDING ENGINEER,
BAITARANI IRRIGATION DIVISION, SALAPADA

DETAILED TENDER CALL NOTICE

BID IDENTIFICATION NO.EE-KID 05 OF 2026-27

1. ***THE EXECUTIVE ENGINEER, KEONJHAR IRRIGATION DIVISION, KENDUJHAR*** on behalf of Hon'ble Governor of Odisha invites e-tender on percentage rate in the prescribed form to be eventually drawn in P.W.D. form no. P1 from **"D & C" Class** Contractors Registered with the Govt. of Odisha or from contractors of equivalent grade / class registered with other State Govt. / Central Govt. / M.E.S. / Railways or other Govt. undertakings. All the contractors are to be registered in the State portal and must posses' compatible digital signature certificate of Class-II and III for online bidding. The website for online bidding is http://tendersorissa.gov.in for the work **"Improovement to Jamunaposi Minor from RD 2511m to 2611m (Construction of Troughwall) for the year 2026-27."**

2. The tender documents can be downloaded from the website identified as http://tendersorissa.gov.in from **11.30 Hours of 29.10.2026 to 05.11.2026 up to 11.30 Hours**. The bidder for participation in on line bidding will have to pay **Rs. 6,000/-** (Rupees six thousand) only **(Online)** as per detailed guideline in the DTCN as issued by Works Department vide **Notification No.17254 dated 05.12.2017.** The Bid will be received through e-procurement portal **11.30 Hours of 29.10.2026 to 05.11.2026 up to 11.30 Hours**. Each set of bid document and an intelligent bill of quantity in MS-Excel format. The Bid will be opened on **06.11.2026 at 11.30 hours** in the **Executive Engineer, Keonjhar Irrigation Division, Kendujhar** in presence of the tenderer or their authorized agents. The bidders who participated in the online bidding can witness opening of the bid from any system logging on to the portal away from opening place. The bids can only be opened by the pre-designated officials only after the opening time mentioned in the bid. In the event of the specified date of bid opening being declared a holiday the bid will be opened at the appointed time and location in the next working day.

3. The value of the work tendered for is **Rs. 12,13,952.00**

4. The bidders shall prepare the documents and upload the scanned typed document in PDF format and BOQ in excel format (or as specified in the portal) in appropriate place.

5. No bidders will be permitted to furnish their tender in their own manuscript.

6. a)Earnest money Deposit@ 1%of the amount put to tender for General Contractors i.e.**Rs.12200/-,** 0.5% of the amount put to tender for SC/ST Contractor i.e.**Rs.6100/-,** exempted for eligible Engineering Contractors and Physically Handicapped contractors. The "E.M.D."shall be paid online by the bidder by using internet banking enabled account with designated banks(SBI, ICICI, HDFC Bank) or their aggregator banks. A bidder having account in other banks can made payment using NEFT/RTGS facilities of designated banks such as SBI, ICICI, and HDFC Banks. For submission of bids through e-procurement portal, the bidder shall scan all the required documents such as Affidavit, Contractor License, Pan Card, GST Registration, & Financial Bid.

7. a) Providing facilities to the Engineer Contractor :-

i) As per works Department No.FR-11/2001/10003/00 Bhubaneswar dtd 24.5.01, 5% price preference allowed to the Engineer contractor in the tender rates has been withdrawn.

ii) The Engineer contractor shall have to execute the work if awarded to him under his direct supervision and he will not be allowed to execute such work through his Power of Attorney Holder.

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(b) Adjustment of earnest money given with other tenders previously and submitted in other tenders shall not be entertained.

(c) Engineering Contractor desirous to avail EMD exemption have to submit affidavit with uploading the same in the e-procurement portal declaring therein to the effect that they have not yet availed 3 (three) nos. of EMD exemption during the financial year 2026-27 and to show the original registration certificate to the tender inviting authority as and when required for confirmation.

8. The work is to be completed in all respect within **90 Days** from the date of issue of work order.
9. The plans specifications and scope for the work can be seen in the office of the **Executive Engineer, Keonjhar Irrigation Division, Kendujhar** during any working days.
10. The bidders shall carefully study the tentative drawings and specifications applicable to the contract and all documents which form part of the agreement to be entered into by the accepted bidder and detailed specifications for Odisha and other relevant specifications and drawings which are available with the tender document or with the **Executive Engineer, Keonjhar Irrigation Division, Kendujhar**

    Complaints on the plans and specifications on a future date will not be entertained.
11. The bidder can resubmit his bid through online e-procurement mode out of which the system shall consider only the last bid submitted to the portal.
12. Every bidder is expected before quoting his rates to inspect the site of the proposed work. He should also inspect the quarries and approach road to quarries and locality of the work and satisfy himself about the quality and availability of materials including the medical aids, labour and foodstuff etc. In every case the materials must comply with the relevant specifications. The contractor would however, be responsible for procurement of materials from authorized sources and voluntarily disclose the source of procurement for the purpose billing. Besides, the bidder would be required to submit the details of quarry for procurement while submitting the bills.

    The tenderer will be deemed to have satisfied himself that the rates quoted by him in the tender will be adequate to complete the work according to the specifications and conditions attached to and that he has taken into account all conditions, difficulties that may be encountered during its progress and to have quoted labour rates and materials, entry tax and other duties, leads, lifts, loading and unloading and freight for materials and all other charges necessary for the completion of the work to the entire satisfaction of the Engineer-in-charges of the work and his authorized subordinates. In the course of awarding a work the Department may desire the analysis of the rate so arrived for against any items of work.
13. Each bidder must quote a definite percentage rate for the work which will be included in the contract. Tenders containing indefinite terms such as estimated rates or schedule of rates will not be considered. Rates should be for finished items of work unless otherwise mentioned in the Tender Schedule to be quoted at a certain percentage on the estimated cost.
14. If any further necessary information is required the bidder can seek clarification on the bids within 7 days from the start of sale of bid document. The employer response for the queries raised by the bidder will be posted in the portal.
15. The percentage / item rate should be furnished for finished items of work unless otherwise mentioned in the tender schedule.
16. BOQ in MS Excel format shall be made available to the bidder through e-procurement portal. The bidder shall download that particular excel sheet and fill in the rates in figures at the appropriate location. The line item total in words and the total amounting in case of item rate tenders shall be calculated automatically and shall be visible to the bidder. The bidder is not supposed to change or modify the format of the excel sheet in any form.

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Bidders are to submit only the original BOQ updated by the publisher after entering the relevant fields without any alteration / deletion / modification. Simple BOQ submission shall lead to cancellation of Bid. If the bidder does not fill rates for any items it will be considered that he has quoted the rates combined in some other items. In case of item rate tender, bidder shall fill in their rates other than zero value in specified cells. In the percentage rate tender, the bidder quoting zero value is valid and will be taken as schedule of rates.

17. The bidder shall submit the documents in the designated locations of bid. Submission of bid documents shall be effected by using DSC of appropriate class and thus shall be in encrypted form. The bidder shall only submit single copy of the document. He is required to check the documents uploaded with the requirement asked for in the bid. Only after satisfying that all the documents have been uploaded he should activate submit button. His bid shall not be considered responsive and action as per relevant clause shall be taken if he does not provide the required documents or provides illegible documents. Clarity of the document may be ensured by taking out a sample printing.

18. Bidders desirous to hire machineries or equipments from outside the State are required to furnish **2% (Two percent) of the amount put to tender as bid security**. Tender not accompanied with bid security and security for hired machineries as specified above shall be liable for rejection.

19. The bidder may at his option quote reasonable rate for each item of work carefully so that, the rate for one item should not be unworkably low and for others too high.

20. All taxes, fees, royalties payable under the local rule including, Cess, income taxes & Surcharges as applicable will be borne by the contractor as admissible. It is implied that the quoted rates are inclusive of such elements.

21. Labour welfare Cess @ 1% will be deducted from the work bill of the contractor as per resolution number 12563 dated 15.12.08 of Labour and Employment Department, Govt. of Odisha.

22. Request for raising and lowering the rates or dealing with any point in connection with the tender will not be considered.

23. Conditional Tender will not be taken into consideration.

24. The tender containing extraneous conditions not covered by the tender notice are liable for rejection and quotations should be strictly in accordance with the Tender Call Notice. Any change in the wording will not be accepted.

25. It is allowed to modify the bid through the e-procurement portal. The bidder shall have to log in the system and resubmit the documents as asked for by the system including the price bid. In doing so, the bids already submitted by the bidder will be removed automatically from the system and latest bid only will be admitted. But the bidder should avoid modification of the bid at the last moment to avoid system failure or malfunction of the internet or traffic jam. If the bidder fails to submit his modified bids within the designated time of receipt, the bids already in the system shall be taken for evaluation.

26. Withdrawal of bid is also allowed in the e-procurement portal. The bidder has to click on the “withdraw” button and record the necessary justification for the same in the space provided. In addition to this he has to write a letter addressed to officer inviting the bid and upload the scanned document from portal in respective bid. The system shall not allow any withdrawal after expiry of the closure of the bid.

27. The e-procurement portal system shall reject submission of any bid through portal after closure of the receipt time. For all purpose the portal time displayed in the system shall be the time to be followed by the bidder.

28. All tenders received will remain valid for 90 (Ninety) days from the date of opening of tenders and validity of tenders can also be extended if required without any monetary compensation.

29. No Relation Certificate

The contractor shall have to furnish certificate along with the tender to the effect that he is not related to any officer in the rank of an Assistant Engineer and above in the State PWD or Under Secretary and above in the Water Resources Department. If the fact subsequently proved to be false the contract will be rescinded. The earnest money and the total security will be forfeited & shall be liable to make good to the loss & damage resulting from such cancellation. **(Required Form ‘A)**

30. While determining the validity of tenders the following points shall be taken in to consideration by the authority empowered to accept tenders and his decision in the matter shall be final.

    (a) Any special condition which does not find place in the tender notice and which are not acceptable.

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(b) Indefinite conditions which will make it difficult for access to the financial implications.
(c) Tenders being incomplete in some important respects.
(d) Incomplete schedule of time for completion of the work.
(e) Failure to furnish the specified bid security.
(f) Tendered rates being unduly low and unworkable.
(g) Rates in different items of the tender being irrational.

31. The Department reserves the right of authority to reject any or all tenders received without assigning any reason whatsoever.

32. The tender may not (at the discretion of the competent authority) be considered unless accompanied by attested true copies of Registration of Firms/S.S.I. unit/ EPM rate contract holder certificate, PAN Card, Valid VAT clearance & GSTIN as the case may be and the original certificates are to be produced if required in any subsequent date during processing of tender. Attested true copy of work done certificate is to be furnished along with the tender obtaining from the Superintending Engineer concerned.

33. The earnest money will be retained in the case of successful bidder and will be dealt with as per the terms and condition of O.P.W.D. code. The earnest money of the unsuccessful bidder except the three lowest bidder shall be refunded on application. The EMD given by the other two parties shall also be refunded within 15 days of acceptance of tender and drawl of agreement.

34. The EMD will be forfeited in any of the following cases.

a) If the bidder withdraws the bid after bid opening during the period of bid validity.
b) If the bidder does not accept the correction of the bid price.
c) In the case of a successful bidder if the bidder fails within the specified time limit to
(i) Sign the agreement or
(ii) Furnish the required performance security.

d) If any of the statements, documents, certificate uploaded by the bidder through e-procurement portal, is found to be false / fabricated / bogus the bidder will be black listed and his EMD / Bid Security shall be forfeited.

35. If more than one bid is quoted (decimal up to two numbers will be taken for all practical purposes) either at the estimated cost put to tender or less than the estimated cost put to tender, the tender accepting authority will finalize the tender through a transparent lottery system, where all bidders / their authorized representatives, the concerned SE/Executive Engineer of concerned Division and DAO will remain present.

The time and venue of the lottery shall be intimated to the respective bidders through their e-mail only. No other communication in this regard will be made

36. The bidder whose tender is selected for acceptance shall within a period of seven days upon intimation being given to him of acceptance of his tender make an **initial security deposit** in the form of NSC, postal time deposit, Post Office Bank Account / Term Deposit Receipt of Schedule Bank payable at **SBI, (Code No-0113), Keonjhar, Odisha** / Kisan Vikas Patra duly pledged in favour of the **Executive Engineer, Keonjhar Irrigation Division, Keonjhar** and in no other form including the amount already deposited as **initial security deposit** shall be 2% of the value of the accepted tendered amount and sign agreement in the P.W.D. form No. P1 (Schedule XLV No.61) for the fulfillment of the contract in the office of the **Executive Engineer, Keonjhar Irrigation Division, Keonjhar.**

The security deposit together with the earnest money, Initial Security money and the amount withheld according to the provision of the P1 agreement shall be retained as Security for the due fulfillment of this contract. Failure to enter into the required agreement and to make the security deposit as above shall entail forfeiture of the earnest money. The written agreement to be entered into between the contractor and the Govt. shall be the foundation of the rights of both the contractor and the Govt. and the contract shall be deemed to be incomplete until the agreement has first been signed by the contractor and then by the proper officer authorized to enter into the contract on behalf of the Govt.

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37. **Additional Performance Security (**As per Works Department **OM No.17941/W dt.08.10.2026)** shall be obtained from the bidder when the bid amount is less than estimated cost put to the tender. In such an event, only the successful bidder who has quoted less bid price / rates than the estimated cost put to tender shall have to furnish the Additional Performance Security as per the following rate.

I. The Additional Performance Security (APS) shall be calculated as a percentage of the accepted Bid Price of the selected bidder.

II. For the purpose of determining the APS, the percentage by which the accepted Bid Price is lower than the Cost Put to Tender shall be calculated and rounded off.

III. The rounded-off percentage so determined shall be referred to as the Rounding Off of Percentage Less (ROPL) of accepted Bid Price and shall form the basis for calculation of the APS in accordance with the applicable incremental rate prescribed under this Office Memorandum.

IV. Rounding Off of Percentage Less (ROPL) of accepted Bid Price, i.e. the percentage by which the accepted Bid Price is less than the Cost Put to Tender, shall be as follows:

- Where the decimal fraction is less than 0.50, the percentage shall be rounded off to the next lower whole percentage.
- Where the decimal fraction is 0.50 or above, the percentage shall be rounded off to the next higher whole percentage.
- For avoidance of doubt, 13.25% less shall be reckoned as 13% less, whereas 13.50% less shall be reckoned as 14% less, for the purpose of determining the applicable APS under this Office Memorandum.

V. Calculation of Additional Performance Security:

- Where the accepted bid price is such that the ROPL is up to (-)10%, no additional performance security is required.
- where the accepted bid price is such that the ROPL is below (-)10% but not below (-)20%, the additional performance security percentage shall be incremented by 0.2% for every percentage of ROPL below (-)10%; for avoidance of doubt, if ROPL is (-)13%, then APS shall be @ 0.2% x (13-10) = 0.6% of accepted bid price.
- where the accepted bid price is such that the ROPL is below (-)20% but not below (-)30%, the additional performance security percentage shall be incremented by 0.3% for every percentage of ROPL below (-)20% in addition to 2% of the accepted bid price; for avoidance of doubt, if ROPL is (-)24%, then APS shall be @ 0.3% x (24-20) +2% = 1.2% + 2% = 3.2% of accepted bid price.
- Where the accepted bid price is such that the ROPL is below (-)30% or more, the additional performance security percentage shall be incremented by 0.5% for every percentage of ROPL below (-)30% in addition to 5% of the accepted bid price; for avoidance of doubt, if ROPL is (-)37%, then APS shall be @ 0.5% x (37-30) + 5% = 3.5% + 5% = 8.5% of accepted bid price.

VI. The additional performance security shall be treated as part of the performance security.

VII. The provision of additional performance security shall be applicable to all forms of tender except Turnkey Tender.

VIII. This shall take effect from the date of issue of this Office Memorandum.

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The codal provision exists in Works Department Office Memorandum No. 14459/W dated 20.09.2018 stands modified to the above extent with effect from the date of Issue of this Office Memorandum.

The security will be refunded after one year on completion of the work in all respect provided the final bill is passed and will not carry any interest. Any defect noticed during the period of one year after the actual date of completion shall be rectified by the contractor at his own cost. Failure to comply such rectification the cost involved to carry out the defective work shall be met from his dues available with Department. (Ref. works Dept. order No. 17823 /US dt. 11.10.2006.

The e-procurement portal system shall generate the award of the contract letter and intimate the bidder in his e-mail after acceptance of the agreement.

Justification for abnormally low bids shall be scrutinized by the Technical Committee and recommended to the Competent Authority for Acceptance of Tender as per Para 6.3.15 of OPWD Code, Vol-I for the approval of the Additional Performance Security (APS). An abnormally low bid is one in which the Bid price, in combination with other elements of the Bid, appears so low that it raises material concerns as to the capability of the Bidder to perform the contract at the offered price. Procuring Entity may, in such cases, seek written clarifications from the Bidder, including detailed price analysis of its Bid price in relation to scope, schedule, resource mobilization, allocation of risks and responsibilities, and any other requirements of the bid document. If, after evaluating the price analysis, the procuring entity determines that the Bidder has substantially failed to demonstrate its capability to deliver the contract at the offered price, the Procuring Entity may reject the Bid/ Proposal. However, it would not be advisable to fix a normative percentage below the estimated cost, which would automatically be considered as an abnormally low bid.

- If more than one bid is quoted (decimal up to two numbers will be taken for all practical purposes, in percentage rate tenders) as lowest, either at the estimated cost put to tender or less than the estimated cost put to tender, the Tender Accepting Authority will finalize the tender through a transparent lottery system, where all the concerned bidders/their authorized representatives, the concerned SE/EE of the concerned Division and DAO will remain present.
- If the rate quoted by the SC and ST Category Contractors comes to the rate quoted by the lowest bidder (decimal up to two numbers will be taken for all practical purposes, in percentage rate tenders) after availing 10% price preference as per Para 2 of Works Department Resolution No. 16262 dated 30.10.2018, the tender shall be finalized by the Tender Accepting Authority through a transparent lottery system along with other categories of contractors.
- Accordingly, the relevant existing codal/contractual provision stands modified with effect from the date of issue of this O.M.
- However, as regards the bidding process in which the tender has been floated before the issue of this Office Memorandum, the APS shall be calculated as per Works Department O.M.No.173 dt 03.01.2026 r/w O.M. No.632/W., dated 09.01.2026 and Corrigendum No.14560/W., dated 11.08.2026.
- In pursuance to, Works Deptt. OM No.2375/W, dt.03/03/2022, Additional Performance Security(APS) shall be refunded immediately on successful completion of the work within seven(07) days of issuance of Completion Certificate/ Provisional Completion Certificate.
- This has been concurred in by the Finance Department vide OSWAS file No.FIN-WFI-MISC-0102-2025.

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38. Before acceptance of tender, the successful bidder will be required to submit a work programme and mile stone basing on the financial achievement so as to complete the work within the stipulated time and in case of failure on the part of the agency to achieve the mile stone liquidated damaged will be imposed.

39. The contractor shall sign as a token of final acceptance of the plans, sections and agreements for the work prior to take up the work for execution.

40. The date of commencement of work shall be as notified in work order.

41. On signing the agreement the site will be handed over to the contractor for execution and completion of works in all respect.

42. On no account, the contract work should sublet to any body without prior approval of tender accepting authority of the Department. In such an event the contract may be rescinded.

43. The authority reserves the right to make such increase or decrease in quantity of items of works mentioned in the scheduled attached to the tender notice as may be considered necessary for the satisfactory completion of the contract work. All such increase or decrease shall in no way invalidate/ vitiate the contract rates. The contractor shall not be entitled for any compensation on this account, except grant of extension of time where considered necessary.

44. The work may be splited up and distributed among several contractors if considered necessary on the exigency of the circumstances of the work and the contractor is not entitled to any compensation on this account.

45. That for the purpose of jurisdiction in the event of any dispute if any, the contract would be deemed to have been entered into within the State of Odisha and it is agreed that neither party to the contract will be competent to bring a suit in regard to the matter by this contract at any place outside the State of Odisha.

46. Under section12 of contract labor (Regulation and Abolition Act 1970) the contractor who undertakes execution of work through labour, should produce valid license from licensing authority of labour department (labour license) to start the work.

47. The contractor shall be liable to fully indemnify the Department of any compensation under workmen compensation Act VII of 1993 on account of the workmen employed by the contractor and full amount of compensation paid will be recovered from the contractor. In the event of any claim sub-judice before any court of law, the claim amount shall be kept withheld till final disposal.

48. Contractor is required to abide by the fair wages clauses as introduced by Govt. of Odisha and will not pay less than the Fair wages fixed by Govt. to the laborers engaged by him for the work

49. In case of any complaint by the laborers about the nonpayment of his wages as per latest minimum wages Act., the Executive Engineer will have the right to investigate and if the contractor is found to be in at fault, Executive Engineer may recover such amount due in any form from the contractor and pay such amount to the labourer directly under intimation to the local labour office of the Govt. The decision of the Executive Engineer is final and binding on the contractor.

50. The contractor will have to submit the **Executive Engineer, Keonjhar Irrigation Division, Kendujhar** monthly return of labour both skilled and unskilled employed by him on the work.

51. The contractor should keep himself in touch with the Engineer-in-charge for smooth execution of the work and arrange adequate labour depending on the workload and working space available. No claim for detention for labour on any account will be entertained. The contractor shall make his own arrangement to shift men and machineries at his own cost before, during and after natural calamities.

52. No compensation will be paid by the Department for any damage done by rain, flood, cyclone & earthquake tide or by any other natural calamities during the execution of the work. The contractor shall make his own arrangement to shift men and machineries at his own cost before, during and after natural calamities.

53. It should be understood clearly that no claim whatsoever will be entertained in regard to extra items of work or extra quantity of any item besides estimated amount, unless written order is obtained from the Engineer-in-charge and rates settled before the extra items of work or extra quantity of any item of work is taken up.

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54. The bidder shall have to abide by the C.P.W.D. safety code rules introduced by the Govt. of India, Ministry of Works, Housing and Supply in their standing order No.44150 dated 25.1.1957.

55. The bidder shall bear cost of various incidentals, sundries and contingencies necessitated by the work in full within the following or similar category.

    (a) Rent, royalties and other charges of materials & all other taxes including ferry, tolls, conveyance charges and other cost on account of land and buildings including temporary building and temporary electric connection to work site as well as construction of coffer dam, construction of service road and its maintenance till completion of work required by the bidder for collection of materials, storage, housing of staff, other purpose of the work. No bidder will however be liable to pay for temporary occupation of land owned by Govt. at the site of the work.

    (b) Labour camps or hutments including conservancy and sanitation arrangements up to the satisfaction of the local health authorities should be arranged by the contractor.

    (c) Suitable water supply including pipe water supply wherever available for the staff and labour as well as for the work.

    (d) Fees and duties levied by the municipality or water supply authorities.

    (e) Suitable equipment and wearing apparatus for the labour engaged in risky operations and medical aid to the labourer engaged for the work.

    (f) Suitable fencing, barriers, signals including paraffin and electric signals where necessary at work and approaches in order to protect public and employees from accident.

    (g) Compensation including cost of any suit for injury to persons or property due to neglect of any major precautions also becomes payable due to operation of the workmen compensation Act.

    (h) The contractor has to arrange adequate lighting arrangement for the work wherever necessary at his own cost.

56. In case of delay in acquisition of land, handing over possession of work site, no compensation will be admissible but extension of time will be allowed if applied in prescribed format within due time to keep the contract in force.

57. The department will have the right to supply at any time in the interest of the work and departmental material to be used in the work and the contractor shall use such materials at the stock issue rate fixed by the Department by adding + 10 percentage in a particular item of work or market rate whichever is higher.

58. If a contractor removes any Govt. material or stores supplied to him from the site of the work in contradiction of the provision of this clause with a view to dispose of the same dishonestly, he shall be in addition to any other liability civil or criminal arising out of this contract be liable to pay penalty equivalent to (5) five times of the price of the materials cost. The penalty so imposed shall be recoverable at any time from the sum that may be due then or at any time thereafter become due to the contractor or from his security deposit or from his other available dues with the Department.

59. Over and above these conditions including the Technical specifications the terms, conditions, rules and regulations and specifications laid down in I.S.I / B.I.S. code are also binding on the part of the contractor.

60. Deduction of income tax at source and surcharge on income tax will be made from each running account bill for the work at the rate as per Income Tax Act and as amended from time to time. (Present rate **1 % in case of Individual Contractor & 2 % in case of company, corporation & firm** etc.)

61. (a) The rates quoted by the contractor shall be deemed to be inclusive of CESS on all the materials that he will have to purchase for performance of this contract.

    (b) GST on works contract as applicable at the time of payment shall be paid extra over the Gross amount of the running bill amount (vide section 15 and section 142 (11) (C) of Odisha GST Act 2017)

    (c) Prevailing rate of GST (Presently TDS-2%) on the gross amount of the bill will be deducted from the contractor's bill as applicable on the date of payment where

agreement value exceeds rupees two lakhs fifty thousand. (to be applicable as per Govt. Notification & amended from time to time)

(d) 1% (one percent) of the gross amount of the bill will be deducted from the contractor bill towards labour cess as per Odisha building and other construction workers (RE & CS) rule 2002 and amendment during 2008 and as amended by Govt. from time to time.

62. The amount on royalties of different materials as utilized by the contractor in the work will be recovered from his bill basing on the rate fixed by the Govt. or as amended from time to time during the period of execution. **(Stone & Stone product- Rs. 130.00 per Cum, Sand, Moorum, Earth – Rs. 35.00 per Cum)**

63. Schedule of quantity accompanies the tender notice**:** It shall be definitely understood that the Government do not accept any responsibility for the correctness and completeness of this schedule and this schedule is liable for alternations or omissions, deductions or additions as set forth in the condition of contract and such omissions, deductions, additions or alternations shall in no way invalidate/ vitiate the contract and no extra monetary compensation will be entertained.

64. Sample of stone, metal, chips, sand, cement, moorum etc to be used are to be deposited noting the quarry under dated initial of the bidder in the Office of the Concerned ***Assistant Engineer / Assistant Executive Engineer/Deputy Executive Engineer*** before the procurement for testing and acceptance. The transportation to Dept. Laboratory & testing charges of construction materials will be borne by the contractor.

65. Items of works not covered by the tender notice shall be paid at the current schedule of rates of the State and those not covered by the said schedule of rate will be paid on actual analysis approved by the competent authorities prevailing during the period of execution of work.

66. All preliminary works such as temporary constructions, mixing platforms etc are to be done by the contractor at his own cost. No payment will be made for benchmarks, level pillars, profiles, benching and leveling the ground where required. The rates to be quoted should be for finished items of works inclusive of such incidental items of works.

67. After the work is finished all surplus materials and debris's should be removed from 100 mtr. clear away from the site of the work. Preliminary work such as temporary constructions, mixing platforms etc. should be dismantled and all materials removed from the site and premises shall be made neat and clean and this is inclusive of the rates quoted by him.

68. The contractor is to supply necessary labour and materials for the purpose of alignment, recording of levels whenever required at his own cost.

69. The contractor should arrange necessary tools and plants such as Pumps, Excavators, Trucks, Compressors, Tippers, Batching plants, Concrete Mixers, steel shutter plates etc. required for the efficient execution work at his own cost. The running charges of such plant and cost of consumables and conveyance are to be borne by the contractor. Any deviation from this may lead recession of contract.

70. In the event of delay in supply of design, reasonable extension of time shall be granted on the application of the contractor. But no claim for monetary compensation will be entertained under any circumstances.

71. Under no circumstances, interest is chargeable for the dues or any additional dues, if any payable for the work.

72. An affidavit shall be furnished by the contractor at the time of submission of tender paper about the authentication of tender documents including bid security. The scanned copy of the affidavit is to be uploaded through the e-procurement portal along with the technical bid. The affidavit in original is to be produced before the officer inviting tender prior to opening of the technical bid.

73. Prediction of flood / monsoon Damage

The contractor shall make his own arrangement at his cost to shift the machineries, equipments, materials, labourer and departmental machineries if hired by the contractor to a safe place prior to flood. The work shall have to be resumed after the flood come to normal. No extension of time for the completion of the work may be considered by the Department if the discontinuance of the work is beyond the reasonable attempts of the contractor to such eventualities.

74. The debris, sand and other materials, accumulated in the work area during flood shall be removed

by the contractor as required for continuing the work at his own cost. By any chance, if any excavation portion that could not be filled up with concrete by the contractor gets filled up during the monsoon period with earths such removal will not be paid again. The contractor will have to re-excavate the same at his own cost.

75. It shall be distinctly understood that it is entirely the responsibility of the contractor to make such arrangements may be required from time to time to protect the men, machinery, materials and the work under progress and work for which the measurements were recorded and payment made, against any damages either during working season or during the flood. The department accepts no liability, what so ever for any damage or loss of men, materials, machinery and type of hindrance caused to the progress of work.

76. The contractor should provide at his own cost adequate protection measures to the completed works at the end of working season or work in progress against such eventuality till completion and handing over the entire work to the Department.

77. Dewatering from the foundation of structures when and where necessary during execution will have to be done by the contractor and no extra payment will be made on that account. The rate of respective items of work is inclusive of the dewatering. The term dewatering shall mean the execution or operation of the items due to standing water as well as due to percolation water.

78. The quantity in respect of items for which quoted rates are more than 25% of the estimated rates are not allowed to be varied by more than five percent. In case, if it exceeds the limit approval of the competent authority should be obtained prior to execution.

79. Incase of discrepancy revealed between P1 form and Detailed Tender Call Notice, condition in P1 form shall prevail over the Detailed Tender Call Notice.

80. No claim for idle labour etc. on any account will be entertained by the Department.

81. The clause of printed form of P1 contract with latest addition/ deletion/ corrections/ substitution etc. will also be binding.

82. All the measurement of earthwork is to be done by level section measurement, which will be accepted by contractor from time to time. Prior written approval of the **Executive Engineer** will be taken in case of pit measurement with size of pits etc. where level section measurements cannot be made.

83. For section measurement, levels will be taken in presence of the contractor at 15m & 30m interval in cutting & filling of earthwork respectively and will be recorded in the level book before commencement of the work. The level should be accepted by the contractor and initial section be signed by him in token of acceptance. The final levels will be taken after completion of the work in presence of the contractor on the same position, as in the case of initial level. The measurement of earth work for filling sections will be recorded on finished compact section and payment will be made on level sections only as mentioned in the BOQ.

84. The measurement of fine dressing & turfing will be taken after satisfactory full growth of the turf.

85. Borrowing earth is the entire responsibility of the contractor. No extra cost will be considered for whatsoever reason.

86. Definitions

In the contract (as hereinafter defined) the following words and expressions will have the Meanings here by assigned to them.

a. Approved / Approval - Means approved in writing.
b. Construction Plant - Means all equipments, appliances or things of whatsoever nature required for the execution, or completion, maintenance of the works or temporary works but do not include materials or other things intended to form or forming part of the permanent work.
c. Contract - means the instruction and information for tenderers General and Special conditions of the contract, Technical Specification, drawings, tender (including the schedule of quantities and tender prices) the formal agreement and all agenda and attachment related to the above.
d. Contractor - means the particular person, firm or corporation with whom the contract has been made for executing the work.
e. Drawing - Means the drawings referred to in the specifications, any modifications of such drawings approved in writing by the **Executive Engineer, Keonjhar Irrigation**

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Division, Kendujhar and such other drawings as may from time to time be furnished or approved in writing by the Engineer-in-Charge.

f. Engineer-in-Charge means the Superintending Engineer, in-charge of the work specified or parts of the works under the contract, or such other departmental assistants or sub-ordinates to whom the **Executive Engineer**, in-charge may have delegated certain duties, acting separately within the scope of particular duties entrusted to them.
g. Government - Means Government of Odisha, Department of Water Resources.
h. I.S.S. / B.I.S. - Means Indian Standard Specifications / Bureau of Indian Standard.
i. Temporary Works - Means all temporary works of every kind required for the performance of the contract.
j. Specification - Whenever the terms “Specification” are used, apart from a specified standard specification, it shall mean the specification or plan prepared for a particular site as instructed to the contractor in executing that item of work.
k. Year – means financial year.

87. Commercial/ GST invoice should be submitted by the contractor at the time of preparation of the work bill for enabling the Division office to make necessary payment.

88. Agreement shall be drawn only after due verification of EMD & APSD of the successful bidder and if any illegitimate instruments are found, criminal proceedings will be initiated against the defaulting bidder and action will be initiated for blacklisting through the license issuing Authority.

89. The incentive for timely completion should be on a graduated scale of 1(One) percent to 5(Five) percent of the contract value. Assessment of incentives may be worked out for earlier completion in all respect in the following scale.

Before 30% of the contract period = 5% Contract value
Before 20 to 30% of the contract period = 4% Contract value
Before 10 to 20% of the contract period = 3% Contract value
Before 5 to 10% of the contract period = 2% Contract value
Before 5% of the contract period = 1% Contract value

90 Cost of Empty cement bagsas utilized by the contractor in the work will be recovered from his bill basing on the rate fixed by the Govt. or as amended from time to time during the period of execution.

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SECTION – 2
INFORMATION AND
INSTRUCTION TO BIDDERS

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SECTION-2

1. Preparation of Tender Documents

The intending bidder shall log in to the e-procurement portal identified as http://tendersorissa.gov.in and download the technical bid (cover-I) and price bid (Cover-II). As per the requirement of the bid document, the bidder will fill up the required information and fill up the rate in figures and words on the intelligent MS Excel sheet. Any discrepancy in figures and words then words will be the final and binding. The bidder is to scan his registration certificate, Valid VAT clearance, GSTIN, PAN Card, Affidavit, labour license, No relation certificate and certificate issued by competent authorities required for full filling the minimum qualification criteria specified in the bid document for the work. The bidder is also required to scan the RC books and other papers relating to the machineries and other documents as specified in the bid document.

2. Method of submission of Tender Documents

2.1 The bidder shall upload the scanned copy / copies of the documents and information as per requirement of the bid documents through the e-procurement portal. All documents and scanned copies are to be uploaded in the designated location technical bid (Cover-I) except the filled up intelligent excel sheet. The filled up intelligent bill of quantities in Excel format will be uploaded in the designated location of price bid (Cover-II). The bidder is required to upload the required documents in appropriate location of Technical and Financial bid failing which the bid will be rejected. All the uploaded documents should be clear and legible. Before activating the submit button, the clarity of the document may be ensured by taking out a sample copy. In the e-procurement tendering system, the bidder is required only to submit the required information as per bid document instead of submitting the entire bid document. The "online" bidder shall digitally sign on all statements, documents, clarifications uploaded by him owning responsibility for their corrections / authenticity. If any of the information furnished by the bidder is found to be false / fabricated / bogus, the bidder will be black listed and his EMD / Bid Security will be forfeited.

2.2 The information required as per bid documents may be provided in the specified format annexed to the bid document. .

2.3 If the intending bidder is an individual, the documents shall be digitally signed by the individual while uploading the tender through e-procurement portal.

2.4 If the intending bidder is a proprietary firm, it shall be digitally signed by the proprietor while uploading the tender through e-procurement portal.

2.5 If the intending bidder is a firm in partnership, it shall be digitally signed by a partner holding the power of attorney for the firm in partnership in which case a certified copy of power of attorney shall accompany in the technical bid documents.

2.6 If the intending bidder is a limited company or Corporation, it shall be digitally signed by a duly authorized person holding the power of attorney in which case certified copy of power of attorney shall accompany.

2.7 All witness and sureties shall be of person of status and probity and their full names, occupation and address shall be stated below in the appropriate place.

2.8 The agency will install display board mentioning information about the work at worksite after drawl of the agreement at his own cost.

2.9 As the period of execution is **below 18 (eighteen) calendar months**, provision of payment of escalation as per details reveal in Clause-31 (a) of condition of contract is **not applicable**.

2.10 Bids from **joint venture** are **not acceptable.**

3. Opening of Tender Documents.

The bids will be opened on 06.11.2026 at 11.30 AM *by the openers in the* **Executive Engineer, Keonjhar Irrigation Division, Kendujhar"** in the presence of bidders or their authorized representative, who wish to be present.

4. Eligibility Criteria for Bidders:

(I) Tender for works value above Rs. 50.00 lakh up to Rs. 7.00 cr.

Irrespective of the nature of work either Ctegory-1 or Category-2 as below, shall have **no qualifying criteria**.

(II) Tender for the work value above Rs. 7.00 cr. Up to Rs. 20.00 cr.

Work value costing above Rs. 7.00 cr. and up to Rs. 20.00 cr., both Category-1 and Category-2 shall have 3 (three) qualifying criteria i.e. Bid Capacity, Satisfactory completion of similar major items of works (quantity turnover) and Combined evaluation, if applicable.

(III) Tender For work value above Rs. 20.00 cr.

For Works in **category -1:** Satisfactory completion of similar work, Annual Turn-over, Satisfactory completion of similar major items of work (quantity turnover), Availability of plant & Machineries, Credit facility, Bid capacity, Combined evaluation, if applicable.

For works in **Category -2:** Annual Turnover, Satisfactory completion of similar major items of work, Availability of Plant & Machineries, Credit facility, Bid capacity, Combined evaluation, if applicable.

Notes Below

Category-1 For specialized nature of work like Dam/Barrage/Spillway/Tunnel/Head Regulator of Dam and Barrage.

Category-2 All other works excluding category-1, such as Excavation of Canals, Canal lining Syphon, Aqueduct, and Modernization / Renovation of Canals including all structures etc.

(A) Annual turnover

To qualify for award of the contract, each bidder in its name should have in the last five years and including current financial year (**from FY 2022-23 to FY 2025-26)** achieved minimum Annual turnover (in all classes of Civil Engineering Construction works only) of **Rs. NIL lakhs at 2022-23** price level in any one financial year (attested copy of certificate of authenticity is to be enclosed by the bidder from the appropriate authority). Weightage of 10% per year shall be given on financial turnover of previous years to bring them to **FY 2022-23 Price level**.

(B) Satisfactory completion of similar work

Satisfactorily completed (Not less than 80 % of the original contract value) as a prime contractor of at least one similar work of value not less than **Rs.___**at **2017-18 Price Level** in any one year **of the last five years and including current financial year (from FY 2018-19 to FY 2022-23).** Attested copy of certificate of authenticity is to be enclosed from the concerned Superintending Engineer / competent officer in charge of execution. The detailed correspondence address / Fax number of the authority issuing certificate shall be furnished). Weightage of 10% per year shall be given on cost of satisfactory completed works of previous years to bring them to **FY 2022-23 Price level**. Failure to submit proof in support will result in non-consideration of tender.

Notes- The agreement should have been executed and work completed from FY 2022-23 to FY 2025-26.

Similar work means:

i) Earth work-
ii) Concrete work- .
iii) Stone Work-

(C) **Satisfactory completion of similar major items of work**

The bidder should have satisfactorily completed (Not less than 80 % of the original contract value) as a prime contractor **during the last five years and including current financial year** (**from FY2022-23 to FY 2025-26)**

The value of minimum quantities of important and critical items of works:

1. **Earth work -**
2. **Concrete Work -**

.The bidder should submit attested copy of certificate of authenticity in the enclosed bidding document from the concerned Superintending Engineer/Competent Officer under State Govt. or Central Govt. in-Charge of execution regarding satisfactory completion of similar major items of work **during the last five years and including current financial year**(**from FY 2022-23 to FY 2025-26**. The bidder should have executed the agreement and completed the work within **the last five years and including current financial year** (**from FY 2022-23 to FY 2025-26)**. The detailed correspondence address / Fax number of the authority issuing certificate shall have to be furnished.

NOT APPLICABLE

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Note: (i) This is sum total of similar items in all items in all the works executed in one financial year.

(ii) These items might have been executed in different years in last 5 years including FY of invitation of tender.

(D) Availability of Plant & Machineries

The bidder should produce documentary evidence regarding availability of the following machineries and equipments **in working condition** required for execution of the work (either owned in his name or obtained on hire purchase scheme or by hiring from the reputed firms/contractors firms). If the machineries are to be procured for specific period for completion of the work on lease / rental basis, then a copy of registered MOU must be attached. **The bidder should attach an affidavit that the plant and machinery / equipment are free and will be available during execution of work**.

Sl. No.	Name of the equipments	Number required
1	Excavator	.
2	Tipper /Truck/Tractor	.
3	Concrete Vibrator (Needle/Plate)	.
4	Water Tanker	.
5	Generator 33 kva	
6	Pump (5HP/10HP) Diesel/Electrical	.
7	Air compressor (170/210 Cfm)	.
8	Concrete mixture	.
9	Front Loader	
10	Dozer	
11	Rotovator	
12	Sheep foot Roller/ Vibratory Roller	
13	PRR	

(E) Credit Facility:

The bidder/Firm must possess Credit facilities of not less than **Rs 0 Lakhs** and furnish the credentials from any scheduled Commercial Bank along with the bid against the specific work by mentioning the name of work and tender identification number in prescribed Form **(Reqd Form-O).**

(F) Bid Capacity:

The Bidders will be qualified only if their available bid capacity at the time of bidding is more than the total estimated cost put to tender. The available bid capacity will be calculated as under.

Assessed Available Bid Capacity = (2xAxN-B)

Where A = Maximum value of works executed in one financial year during the last five years (updated to **2017-18** price level) rate of inflation may be taken as 10% per year (Escalation factor) which will take into account the completed as well as work in progress.

N = No. of years prescribed for completion of the work for which bids are invited.

B=Value at **2017-18** price level of existing commitments and ongoing works to be completed during the next one year (period of completion of works for which bids are invited).

Note: In case of joint venture, **if permissible as per DTCN,** the available bid capacity will be applied for each partner to the extent of his proposed participation in the execution of the works. In case the extent of participation is not mentioned, the proposed participation in the execution of the work shall be considered as equal for all the partners.

The statement showing the value of existing commitments and ongoing works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer-in-Charge not below the rank of an Superintending Engineer.

Escalation Factor

Following enhancement factors will be used for the cost of works executed and the financial figures to a common base value for works completed in India.

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Year Before	M . F
One	1.10
Two	1.21
Three	1.33
Four	1.46
Five	1.61

(Bidders should indicate actual figures of costs and amounts for the work executed by them without accounting for the above mentioned factors)

In case the financial figures and value of completed works are in foreign currency, the above enhanced multiplying factors will not be applied. Instead, current market exchange rate (State Bank of India BC selling rate as on the last date of submission of the bid) will be applied for the purpose of conversion of amount in foreign currency into Indian rupees.

(G) Combined Evaluation:

If the bid has been invited in a common tender call notice for a number of works, the order of opening of the bids shall be that in which they appear in the 'Invitation for Bids'. Further, the bidder(s) must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

(H) Sub-Contractor's experience:

Experience Certificate issued by Superintending Engineer to State PSUs and their Sub-Contractor jointly, shall be taken into consideration while examining qualifying criteria. In that case, both the original State PSU and the authorised sub-contractor will be treated at par as prime contractor.

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5. Final Decision making authority

The competent authority reserves the right to accept or reject or disqualify any of the tender without assigning any reasons and its decision shall be final.

6. Further clarification

The **Executive Engineer, Keonjhar Irrigation Division, Kendujhar, Odisha** may be contacted during office hours on any working days for any further clarification. The bidder can also seek clarification through the portal within seven days from the start of sale of bid documents. The officer inviting the tender will respond for the quarries raised by the bidder through the same portal.

7. Odisha Bridge and Construction Corporation Ltd. will be allowed price preference up to 3% over the lowest quotation or tender laid down in Works and Transportation Department, Resolution No. 285 dated 17.04.1974. The Odisha Construction Corporation will be allowed a price preference to the extent up to 3% over the lowest tender amount (where their tender is not the lowest) provided they express willingness to execute the work after reduction of rates by negotiation.

8. Sample of Material

The contractor shall supply sample of all materials before procurement for the work for testing by ***Superintending Engineer, Quality Assured Division,Keonjhar, Odisha*** at his own cost. If found unsuitable, the same may be rejected.

9. Trial boring – The foundation level as indicated in the body of departmental drawing is purely tentative and further general guidance only. The Department has no responsibility for the suitability of actual strata at the foundation level. The contractor has to conduct his own boring before starting the work and get the sample tested at his own cost to ascertain the SBC and credibility of strata at foundation level while quoting his rates for tender the contractor shall take in to account for the above projects.

10. The site from the commencement of works to the completion of the same, there to be under the contractors. The contractor is to be held responsible to make good to all injuries, damages and repairs occasioned or re-tendered. Necessary to the same by fire or other causes and they hold the Govt. of Odisha harmless for any claims for injuries to person or structural damage to property happening from any neglect, default want of proper care or misconduct on the part of the contractor or anyone in his employment during the execution of the work. Also no claim shall be entertained for loss due to earth quake, flood, cyclone, epidemic, riot or any other calamity whether natural or incidental damaged so caused will have to be made good by the contractor at his own cost.

11. Where it will be found necessary by the Department, the Officer-in-Charge of the work shall issue an order book to the contractor to be kept at the site of the work with pages serially numbered. Orders regarding the work whenever necessary are to be entered in his book by the Engineer-in-Charge with their dated signatures and duly noted by the contractor or his authorized agents with their dated signature. Orders entered in his book and noted by the contractor's agent shall be considered to have been duly given to the contractor for following the instructions of the Department. The order book shall be the property of the Department and shall not be removed from the site of work without written permission of the Engineer-in-charge and to be submitted to the Engineer-in-Charge every month.

12. The bidder should conduct three bores at pier and SBC of soil at foundation level and abutments location and furnish the test result in conformity with IRC code at his own cost before execution of the work and rates quoted by the contractor should be inclusive of such bores and SBC tests etc. without any extra cost to the Department.

EXECUTIVE INSTRUCTION REGARDING CALLING FOR AND ACCEPTANCE OF TENDER IN e-PROCUREMENT.

1. This office memorandum consists of the procedural requirement of e-procurement and shall be made part of the Detailed Tender Call Notice or Instruction to Bidder for all "Works" tenders hoisted in the portal.
2. The e-procurement portal of Government of Odisha is https://tendersorissa.gov.in.
3. Use of valid Digital Signature Certificate of appropriate class (Class II or class III) issued from registered certifying authorities (CA) as stipulated by Controller of Certifying Authorities (CCA), Government of India such as n-Code, Sify, TCS, MTNL, e-Mudhra is mandatory for all users.
4. The DSC issued to the Department users is valid for the period of two years only. All the Department users are responsible to revalidate their DSC prior to expiry.
5. For all purpose, the server time displayed in the e-Procurement portal shall be the time to be followed by all the users.
6. Government after careful consideration have decided to hoist all tenders costing 10 lakhs or above in the e-procurement portal. This will be applicable across all Engineering Departments such as Works Department, Department of Water Resources, Rural Development and Housing & Urban Development Department. Government of Odisha also welcomes hoisting of tenders by any other departments, authority, corporations, and local bodies etc. of the State with prior approval from Works Department. Works Department is the Nodal Department for the implementation of e-Procurement in the State.
7. The e-procurement shall be operated compliant to relevant provisions of OGFR/OPWD code / Accounts code / Government statues including any amendments brought from time to time to suit to the requirement of the best national practice.
8. Registration in the e-procurement portal is without levy of any charges but Government reserves the right to levy any charges for such value added services in future.
9. Contractor not registered with government of Odisha can participate in the e-procurement after necessary enrolment in the portal but have to subsequently register themselves with the appropriate registering authority of the State Government before award of the work as per prevalent registration norms of the State.
10. For the role management "Department" is the Administrative Department, Organization or wing is the Chief Engineer or highest tender accepting authority or equivalent officer, Division is the **Executive Engineer** or equivalent officer and Sub-Division is the Assistant Executive Engineer or equivalent officer.
11. The e-procurement software assigns roles for operation of the module for specific function. The terminologies used in the portal and their respective functions in the software are as follows.

11.1 Application Administrator (NIC & State Procurement Cell)

i. Master Management
ii. Nodal Officer Creation
iii. Report Generation
iv. Transfer of Officer's login ID
v. Blocking & unblocking of officer's and bidder's login ID.

11.2 Nodal Officer (At organization level not below the **Executive Engineer** or equivalent rank)

i. Creation of users
ii. Role Assignment
iii. Report Generation
iv. Transfer of Officer's login ID

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v. Blocking & unblocking of officer's login ID.

11.3 Procurement Officer – Publisher (Officer having tender inviting power at any level)
- i. Publishing of Tender
- ii. Publishing of Corrigendum / addendum / cancellation of Tender
- iii. Bid Clarification
- iv. Uploading of Pre-Bid minutes
- v. Report generation

11.4 Procurement Officer – Administrator (Generally sub-ordinate officer to Officer Inviting Tender)
- i. Creation of Tender
- ii. Creation of Corrigendum / addendum / cancellation of Tender
- iii. Report generation

11.5 Procurement Officer Opener (Generally sub-ordinate officer to Officer Inviting Tender)
- i. Opening of Bid

11.6 Procurement Officer Evaluator (Generally sub-ordinate officer to Officer Inviting Tender)
- I .Evaluating Bid

11.7 Procurement Officer -Auditor (Procurement Officer Publisher and / or Accounts Officer / Finance Officer)
- i.To take up auditing

12. NOTICE INVITING BID (NIB) or INVITATION FOR BID (IFB)

12.1 The Notice Inviting Bids (NIB) and Bid documents etc. shall be in the standard formats as applicable to conventional Bids and will be finalized / approved by the officers competent as in the case of conventional Bids.

12.2 The officers competent to publish NIB in case of conventional Bids will host the NIB in portal. Simultaneously, a notification should also be published in the newspapers, as per existing rules preferably, in the following format, to effect economy :-

Government of Odisha "e" procurement Notice

Bid Identification No. ……

1. Name of the work: …….
2. Estimated cost: Rs…
3. Period of completion ……
4. Date & Time of availability of bid document in the portal _____
5. Last Date / Time of receipt of bids in the portal _____
6. Name and address of the O.I.T ……
7. Further details can be seen from the e-procurement portal "https://tendersorissa.gov.in"

12.3 The tender documents published by the Tender Inviting Officer (Procurement Officer Publisher) in the website https://tendersorissa.gov.in will appear in the "Latest Active Tender." The Bidders / Guest Users can download the Bid documents only after the due date and time of sale. The publication of the tender will be for specific period of time till the last date of submission of bids as mentioned in the 'Notice Inviting Bid' after which the same will be removed from the list of "Latest Active tenders"

13. ISSUE OF ADDENDUM / CORRIGENDUM / CANCELLATION NOTICE

13.1 The Procurement Officer Publisher (Officer Inviting Tender) shall publish any addendum/corrigendum/cancellation of tender in the website https://tendersorissa.gov.in, notice board and through paper publication and such notice shall form part of the biding documents.

13.2 The system generates a mail to those bidders who have already uploaded their tenders and those bidders if they wish can modify their tenders. The bidders are required to watch the website till last date and time of bid submission for any addendum/corrigendum/cancellation thereof. Tender Inviting Authority is not responsible for communication failure of system generated mail.

14. CREATION AND PUBLISHING OF BID :

14.1 All the volumes / documents shall be uploaded in the portal by the tender creating officer (Procurement Officer Administrator) and published by the Officer Inviting Tender (Procurement Officer Publisher) using their DSCs in appropriate format so that the document is not tampered with.

14.2 The tender document comprises the notice inviting tender, bid document / SBD, drawings in .pdf format and the schedule of quantities / BOQ in .xls format to be uploaded by the Officer Inviting Tender.

14.3 Procurement Officer Administrator creates tender by filling up the following forms:
- I. BASIC DETAILS
- II. COVER CONTENT : The Procurement Officer Administrator should briefly describe the name and type of documents to be uploaded by the bidder in the following format

a. For Double Cover/Packet.

Sl. No	Cover Type	Document Description	Type
1	Technical	Tender Cost, EMD, GSTIN, PAN, Contractor Registration Certificate, VAT clearance certificate	.pdf
		Affidavits, undertakings and any other document as per SBD / DTCN/ Scanned copy	.pdf
2	Financial	BOQ	.xls

b. For Single Cover/Packet.

Sl. No	Cover Type	Document Description	Type
1	Free/Prequal/ Technical/ Finance	Tender Cost, EMD, GSTIN, PAN, Contractor RC, VAT clearance certificate	.pdf
		Affidavits, undertakings and any other document as per SBD / DTCN/ Scanned copy	.pdf
		BOQ	.xls

iii. TENDER DOCUMENT: The Procurement Officer Administrator should upload the NIT in pdf format.

iv. WORK ITEM DETAILS

v.FEE DETAILS: The Procurement Officer Administrator should mention the cost of tender paper and EMD amount as laid down in DTCN/SBD.

vi. CRITICAL DATES: The Procurement Officer Administrator should mention the critical dates of tender such as publishing date, document download start date and end date, seek clarification start date & end date (optional), bid submission start date & closing date, bid opening date as per DTCN/SBD.

Vii. BID OPENER SELECTION: The Procurement Officer creator can select two / three / four bid openers for a particular bid. If required the bid openers can also be selected within an organization from other procurement units (Circles / Divisions).

viii. WORK ITEM DOCUMENTS: The Procurement Officer Administrator should upload the digitally signed tender document (SBD / DTCN) or any other addition document/drawings in pdf format and Bill of Quantities in xls format.

ix. PUBLISHING OF TENDER: The Procurement Officer Publisher shall publish the tender using his/her DSC after detail scrutiny of the fields created and documents uploaded by the Procurement Officer Administrator. The Procurement Officer Publisher can publish tenders for multiple procurement units using multiple DSCs procured for each post separately. After being relieved from the additional charges he has to surrender the additional DSCs to the Nodal Officer of the concerned organization.

15. PARTICIPATION IN BID :

15.1 **PORTAL REGISTRATION** : The contractor / Bidder intending to participate in the bid is required to register in the portal using his/her active personal / official e-mail ID as his/her login ID and attach his/her valid Digital signature certificate (DSC) to his/her unique Login ID. He / She have to submit the relevant information as asked for about the firm/contractor. The portal registration of the bidder/firm is to be authenticated by the State Procurement Cell after verification of original valid certificate / documents such as (i) PAN and (ii) Registration Certificate (RC) / VAT Clearance Certificate (for procurement of goods) of the concerned bidder. The time period of validity in the portal is at par with validity of RC / GSTIN. Any change of information by the bidder is to be re-authenticated by the State Procurement Cell. After successful authentication bidder can participate in the online bidding process.

15.1.1 Bidders participating through joint Venture shall declare the authorized signatory through memorandum of understanding duly registered and enroll in the portal in the name and style of the Joint Venture Company. It is mandatory that the DSC issued in the name of the authorized signatory is used in the portal.

15.1.2 Any third party / company / person under a service contract for operation of e-procurement system in the State or his / their subsidiaries or their parent companies shall be ineligible to

participate in the procurement process that are undertaken through the e-procurement system irrespective of who operates the system.

15.2 **LOGGING TO THE PORTAL**: The Contractor / Bidder is required to type his/her Login ID and password. The system will again ask to select the DSC and confirm it with the pass word of DSC as a second stage authentication. For each login, a user's DSC will be validated against its date of validity and also against the Certificate Revocation List (CRL) of respective CAs stored in system database. The system checks the unique Login ID, Password and DSC combination and authenticates the login process for use of portal.

15.3 **DOWNLOADING OF BID**: The bidder can download the tender of his choice and save it in his system and undertake the necessary preparatory work off-line and upload the completed tender at his convenience before the closing date and time of submission.

15.4 **CLARIFICATION ON BID** : The bidder may ask question related to tender online in the e-procurement portal using his/her DSC, provided the questions are raised within the period of seeking clarification as mentioned in tender call notice / Bid. The Officer Inviting the Bid / Procurement Officer-Publisher will clarify queries related to the tender.

15.5 **PREPARATION OF BID**

15.5.1 The bids may consist of general arrangements drawings or typical or any other drawings relevant to the work for which bid has been invited. Bidder may download these drawings and takeout print for detail study and preparation of his bid. Any other drawings and documents pertaining to the works available with the Officer Inviting the bid will be open for inspection by the bidders.

15.5.2 The bidder shall go through the bid carefully and list the documents those are asked for submission. He shall prepare all documents including cost of bid document, EMD, price bid etc. and store in the system.

15.6 **PAYMENT OF EMD/BID SECURITY AND COST OF BID DOCUMENTS :**

15.6.1 The bidder shall furnish, as part of his Bid, a Bid security for the amount mentioned under NIT/Contract Data. The bidder shall scan all the written/printed pages of the bid security and up load the same in portable document format (PDF) to the system in designated place of the technical BID. Furnishing scanned copy of such documents is mandatory otherwise his/her bid shall be declared as non-responsive and liable for rejection.

15.6.2 The EMD or Bid Security payable along with the bid is 1% of the estimated contract value (ECV) or as mentioned in the bid documents. The validity period of the EMD or Bid Security shall be as mentioned in the bid document. Any bid not accompanied by an acceptable Bid Security and not secured as indicated in the bid document shall be rejected as non-responsive. The bid security shall be retained till such time the successful bidder furnishes Initial Security Deposit (ISD) or Performance Security acceptable to the Officer Inviting the Bid. Failure of the successful Bidder to comply with the requirements shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security. The Bid security in the form of FD shall be from a Nationalized Bank valid for a period of 45 days beyond the validity of the bid. Bid security in other form is acceptable if the bid document provides for it.

15.6.3 The Fixed Deposit / or any other form as mentioned in detailed tender call notice in respect of Earnest Money Deposit / Bid Security and the Bank Draft in respect of cost of Bid are to be scanned and up loaded in portable document format (PDF) along with the bid.

15.6.4 The tender accepting authority will verify the originals of all the scanned documents of the successful lowest bidder only within 5 days of opening of the tender. In the eventuality of failure on the part of the lowest successful bidder to produce the original documents, he will be debarred in future from participating in tender for 3 years and will be black listed by the competent authority. In such a situation, successful L-2 bidder will be required to produce his original documents for consideration of his tender at the negotiated rate equal to L1 bidder.

15.6.5 Contractor exempted from payment of EMD will be able to participate in the tender directly by uploading documentary evidences towards his eligibility for such exemption.

15.6.6 Government of Odisha have been actively considering integrating e-payment gateway in to the portal for payment of cost of bid and Bid Security / Earnest Money Deposit. The process of using e-payment gateway shall be issued separately after it is established.

16. SUBMISSION OF BID:

16.1 The bidder shall carefully go through the tender and prepare the required documents. The bid shall have a technical Bid & a Financial Bid. The Technical bid generally consist of cost of Bid documents, EMD / Bid Security, VAT clearance certificate, GSTIN, PAN / TIN, Registration Certificate, Affidavits, Profit Loss Statement, Joint Venture Agreement, List of similar nature of works, work in hand, list of machineries and any other information required by OIT. The Financial Bid shall consist of the Bill of Quantities (BOQ) and any other price related information / undertaking including rebates.

16.2 Bidders are to submit only the original BOQ (in xls format) uploaded by Procurement Officer Publisher (Officer Inviting Tender) after entering the relevant fields without any alteration /

deletion / modification. Multiple BOQ submission by bidder shall lead to cancellation of bid. In case of item rate tender, bidders shall fill in their rates other than zero value in the specified cells without keeping it blank. In the percentage rate tender, the bidder quoting zero percentage is valid and will be taken at par with the estimated rate of the work put to tender.

16.3 The bidder shall upload the scanned copy/copies of document in support of eligibility criteria and qualification information in prescribed format in Portable Document Format (PDF) to the portal in the designated locations of Technical Bid.

16.4 The bidder shall write his name in the space provided in the specified location in the Protected Bill of Quantities (BOQ) published by the Officer Inviting tender. The bidder shall type rates in figure only in the rate column of respective item (s) without any blank cell in the rate column in case of item rate tender and type percentage excess or less up to two decimal place only in case of percentage rate tender.

16.5 The bidder shall log on to the portal with his/her DSC and move to the desired tender for up loading the documents in appropriate place one by one simultaneously checking the documents.

16.5.1 Bids cannot be submitted after due date and time. The bids once submitted cannot be viewed, retrieved or corrected. The bidder should ensure correctness of the bid prior to uploading and take print out of the system generated summary of submission to confirm successful uploading of bid. The bids cannot be opened even by the OIT or the Procurement Officer Publisher/opener before the due date and time of opening.

16.5.2 Each process in the e-procurement is time stamped and the system can detect the time of log in of each user including the Bidder.

16.5.3 The Bidder should ensure clarity/legibility of the document uploaded by him to the portal.

16.5.4 The system shall require all the mandatory forms and fields filled up by the contractor during the process of submission of the bid / tender.

16.5.5 The bidder should check the system generated confirmation statement on the status of the submission.

16.5.6 The Bidder should upload sufficiently ahead of the bid closure time to avoid traffic rush and failure in the network.

16.5.7 The Tender Inviting Officer is not responsible for any failure, malfunction or breakdown of the electronic system used during the e-procurement process.

16.5.8 The Bidder is required to upload documents related to his eligibility criteria and qualification information and Bill of Quantity duly filled in. It is not necessary for the part of the Bidder to up-load the drawings and the other Bid documents (after signing) while uploading his bid. It is assumed that the bidder has referred all the drawings and documents uploaded by the Officer Inviting the Bid.

16.5.9 The bidder will not be able to submit his bid after expiry of the date and time of submission of bid (server time). The date and time of bid submission shall remain unaltered even if the specified date of the submission of bids declared as a holiday for the Officer Inviting the Bid.

16.6 **SIGNING OF BID**: The 'online bidder' shall digitally sign on all statements, documents, certificates uploaded by him, owning responsibility for their correctness / authenticity as per IT ACT 2000. If any of the information furnished by the bidder is found to be false / fabricated / bogus, his EMD / Bid Security shall stand forfeited and his registration in the portal shall be blocked and the bidder is liable to be blacklisted.

17. **SECURITY OF BID SUBMISSION:**

17.1 All bid uploaded by the Bidder to the portal will be encrypted.

17.2 The encrypted Bid can only be decrypted / opened by the authorized openers on or after the due date and time.

18. **RESUBMISSION AND WITHDRAWAL OF BIDS:**

18.1 Resubmission of bid by the bidders for any number of times before the final date and time of submission is allowed.

18.2 Resubmission of bid shall require uploading of all documents including price bid afresh.

18.3 If the bidder fails to submit his modified bids within the pre-defined time of receipt, the system shall consider only the last bid submitted.

18.4 The bidder should avoid submission of bid at the last moment to avoid system failure or malfunction of internet or traffic jam or power failure etc.

18.5 The Bidder can withdraw his bid before the closure date and time of receipt of the bid by uploading scanned copy of a letter addressing to the Procurement Officer Publisher (Officer Inviting Tender) citing reasons for withdrawal. The system shall not allow any withdrawal after expiry of the closure time of the bid.

19. **OPENING OF THE BID:**

19.1 Bid opening date and time is specified during tender creation or can be extended through corrigendum. Bids cannot be opened before the specified date and time.

19.2 All bid openers have to log-on to the portal to decrypt the bid submitted by the bidders.

19.3 The bidders & guest users can view the summary of opening of bids from any system. Contractors are not required to be present during the bid opening at the opening location if they so desire.

19.4 In the event of the specified date of bid opening being declared a holiday for the Officer Inviting the Bid, the bids will be opened at the appointed time on the next working day.

19.5 Combined bid security for more than one work is not acceptable.

19.6 The electronically submitted bids may be permitted to be opened by the predefined Bid opening officer from their new location if they are transferred after the issue of Notice Inviting Bid and before bid opening. Further, action on bid documents shall be taken by the new incumbent of the post.

19.7 In case of non-responsive tenders, the officer inviting tender should complete the e-Procurement process by uploading the official letter for cancelled / re-tender.

20. **EVALUATION OF BIDS:**

20.1 All the opened bids shall be downloaded and printed for taking up evaluation. The officer authorized to open the tender shall sign and number on each page of the documents downloaded and furnish a certificate that "the documents as available in the portal containing **150 nos**. of pages".

20.2 The bidder may be asked in writing / online (in their registered e-mail ids) to clarify on the uploaded documents provided in the Technical Bid, if necessary, with respect to any doubts or illegible documents. The Officer Inviting Tender may ask for any other document of historical nature during Technical Evaluation of the tender. Provided in all such cases furnishing of any document in no way alters the bidder's price bid. Non submission of legible documents may render the bid non-responsive. The authority inviting bid may reserve the right to accept any additional document.

20.3 The bidders will respond in not more than 7 days of issue of the clarification letter, failing which the bid of the bidder will be evaluated on its own merit.

20.4 The Technical evaluation of all the bids shall be carried out as per information furnished by bidders.

20.5 The Procurement Officer-evaluators will evaluate bid and finalize list of responsive bidders.

20.6 The financial bids of the technically responsive bidders shall be opened on the due date of opening. The Procurement Officer-Openers shall log on to the system in sequence and open the financial bids.

20.6.1 The Financial Bid will be opened on the notified date and time in the presence of bidders or their authorized representative who wish to be present.

20.6.2 At the time of opening of "Financial Bid", bidders whose technical bids were found responsive will be opened.

20.6.3 The responsive bidders name, bid price, item wise rates, total amount of each item in case of item rate tender and percentage above or less in case of percentage rate tenders will be announced.

20.6.4 Procurement Officer-Openers shall sign on each page of the downloaded BOQ and the Comparative Statement and furnish a certificate to that respect.

20.6.5 Bidder can witness the principal activities and view the documents / summary reports for that particular work by logging on to the portal with his DSC from anywhere.

20.6.6 System provides an option to Procurement Officer Publisher for reconsidering the rejected bid with the approval of concern Chief Engineer / Head of Department.

21. **NEGOTIATION OF BIDS:**

21.1 For examination, evaluation and comparison of bids, the officer inviting the bid may, at his discretion, ask the lowest bidder for clarification of his rates including reduction of rate on negotiation and breakdown of unit rates.

22. **NOTIFICATION OF AWARD AND SIGNING OF AGREEMNT**

22.1 The employer / Engineer-in-Charge shall notify acceptance of the work prior to expiry of the validity period by cable, telex or facsimile or e-mail confirmed by registered letter. This letter of acceptance will state the sum that the Engineer-in-Charge will pay the contractor in consideration of execution and completion of the Works by the contractor as prescribed by the contract and the amount of Performance Security and Additional Performance Security required to be furnished. The issue of the letter of Acceptance shall be treated as closure of the bid process and commencement of the contract.

22.2 The contractor after furnishing the required acceptable Performance Security & Additional Performance Security, "Letter to Proceed" or "Work Order" shall be issued by the Engineer-in-Charge with copy thereof to the Procurement Officer-Publisher. The Procurement Officer-Publisher shall upload the summary and declare the process as complete.

22.3 If the L-1 bidder does not turn up for agreement after finalization of the tender, then he shall be debarred from participation in bidding for three years and action will be taken to blacklist the contractor. Besides the consortium / JV / firm where such an agency / firm already

happens to be or is going to be partner / member / proprietor, he /they shall neither be allowed for participation in bidding for three years nor his/their application will be considered for registration and action will be initiated to blacklist him/them. In that case, the L-2 bidder, if fulfils other required criteria, would be called for drawing agreement for execution of work subject to condition that the L-2 bidder negotiates at par with the rate quoted by the L-1 bidder, otherwise the tender will be cancelled.

23. **BLOCKING OF PORTAL REGISTRATION**

23.1 If the Registration Certificate of the Contractor is cancelled / suspended by the registering authority / blacklisted by the competent authority, his portal registration shall be blocked automatically on receipt of information to that effect.

23.2 The portal registration blocked in the ground mentioned in the above Para-23.1 shall be unblocked automatically in receipt of revocation order of cancellation / suspension / blacklisting from the concerned authority.

23.3 The Officer Inviting tender shall make due inquiry and issue show cause notice to the concerned contractor who in turn shall furnish his reply, if any, within a fortnight from the date of issue of show cause notice. Thereafter, the Officer Inviting Tender is required to issue an intimation to the defaulting bidder about his unsatisfactory reply and recommend to the Chief Manager (Tech.) for blocking of portal registration within 10 days of intimation to the defaulting bidder regarding his unsatisfactory reply with intimation to the Registering Authority and concerned Chief Engineer / Heads of Office if any of the following provisions are violated.

23.3.1 Fails to furnish original Technical / Financial (Tender Paper cost, EMD / Bid Security) instruments before the designated officer within the stipulated date and time.

23.3.2 Backs out from the bid on any day after the last date of receipt of tender till expiry of the bid Validity period.

23.3.3 Fails to execute the agreement within the stipulated date.

23.3.4 If any of the information furnished by the bidder is found to be false / fabricated /bogus.

Accordingly, the Officer Inviting Tender shall recommend to the Chief Manager (Tech.), State Procurement Cell, Odisha for blocking of portal registration of bidder and simultaneously action shall also be initiated by OFFICER INVITING TENDER for blacklisting as per Appendix – XXXIV of OPWD code, Volume – II.

24. GUIDELINES FOR UNBLOCKING OF PORTAL REGISTRATION:

24.1 **UNBLOCKING OF PORTAL REGISTRATION**

Unblocking of portal registration of a contractor shall be done by a committee consisting of the following members.

EIC (Civil)-cum-CPO	-	Chairman
Engineer-in-Chief (WR)	-	Member
Concerned Chief Engineer	-	Member
Sr. Manager (Finance), SPC		Member
Office Inviting Tender	-	Member
Chief Manager (Technical), SPC	-	Convener

24.2 The Chief Manager (Tech.), State Procurement Cell will be the convener and he will maintain all records for this purpose. The Committee shall meet not less than once in a month if required and shall consider the recommendation of the officer inviting tender for unblocking of portal registration. The quorum of the meeting will be four.

24.3 The minimum period of blocking of Portal Registration shall in no case be less than 90 days. After blocking of Portal Registration, the contractor whose Portal Registration has been blocked may file application to the concerned officer inviting tender showing sufficient ground for unblocking of his portal registration along with a Treasury Challan showing deposit of Rs. 10,000/- (Rupees Ten Thousand only (non-refundable) under the head of accounts '0059-Public Works' as processing fees. The officer inviting tender shall forward the application filed by the contractor to the Chief Manager (Tech.), State Procurement Cell.

24.4 On receipt of recommendation from the concerned Chief Engineer along with the copy of challan as mentioned above, the Chief Manager (Tech.) being the member convener of the Committee shall place the case before the Committee for examination and taking a decision in this regard. After examination, the Committee may recommend for unblocking of the portal registration of said contractor if the Committee is satisfied that the fault committed by the contractor is neither unintentional nor done for the first time.

24.5 After scrutiny by the State procurement Cell if it is found that the portal registration of a contractor has been blocked for the 2nd time, the Chief Manager (Tech.), SPC may not consider his case to be placed before the Committee and may advise the concerned officer inviting tender to issue show cause notice to the contractor asking him to explain as to why his portal registration shall not remain blocked. On receipt of show cause reply from the contractor, the officer inviting tender shall examine the same and if considered proper, he may report to the Chief Manager (Tech.), SPC along with his views furnishing the copy of the

show cause reply for placement of the same before the Committee for taking a decision in respect of blocking / unblocking. If the Committee found that the contractor is in habit of committing such fault again and again intentionally, the committee may advise the concerned officer inviting tender to initiate proceeding for blacklisting as per the existing rule.

25. REVISED EXECUTIVE INSTRUCTION REGARDING ELECTRONIC RECEIPT, ACCOUNTING AND REPORTING OF COST OF TENDER PAPER AND EARNEST DEPOSIT ON SUBMISSION OF BIDS.

1. The State Government have been working on formulation of Rules and procedures for **Electronic Receipt, Accounting and Reporting of the Receipt of Cost of Tender paper and Earnest Money Deposit on submission of Bid** through the E-procurement portal of Government of odisha i.e. https://tendersodisha.gov.in for some time past.

2. Electronic receipt of cost of Tender paper has been successfully tested through SBI Payment Gateway. Now it has been decided to introduce Electronic Receipt of **Cost of Tender Paper & Earnest Money Deposit on submission of Bids** through payment gateway of designated Banks such as SBI / ICICI Bank/ HDFC Bank for all Government Departments, State PSUs, Statutory Corporations, Autonomous Bodies and Local Bodies etc. in phase (ANNEXURE –I). The process outline as well as accounting and reporting structure are indicated below.

a) It will be carried out through a single banking transaction by the bidder for multiple payments like **Cost of Tender Paper & Earnest Money Deposit on submission of Bids.**

b) Various payment modes like Internet Banking / NEFT / RTGS of designated banks and their aggregator banks as well can be accessed by the intending bidders.

c) Reporting and Accounting of the e-Receipts will be made from a single source.

d) Credit of receipts into the Government Accounts and to the designated bank accounts of the participating entities indicated in Para-2 above would be faster.

3. Only those bidders who successes fully remit their **Cost of Tender Paper & Earnest Money Deposit on submission of Bids would be eligible to** participate in the tender/ Bid process. The bidders with pending or failure payments status shall not be able to submit their Bid. Tender Inviting Authority, State Procurement Cell, NIC , the designated banks shall not be held responsible for pendency or failure.

4. Banking Arrangements.

a. Designated banks (SBI/ ICICI Bank/ HDFC Bank) payment gateway are being integrated with e-Procurement portal of Government of Odisha (https://tendersodisha.gov.in)

b. The designated bank participating in **Electronic Receipt, Accounting and Reporting of the Receipt of Cost of Tender paper and Earnest Money Deposit on submission of Bids** will nominate Focal Point Branch called e-FPB, who will authorized to collect and collate all e-Receipts. Each such branch will act as the Receiving branch and Focal Point Branch notwithstanding the fact that the bidder might have debited his account in any of the banks branches while making payments.

5. Procedure of Bid submission using electronic payment of tender paper cost and EMD by bidders.

a. The bidders have to logon to the e-Procurement portal (https://tendersodisha.gov.in) using his/her digital signature certificate and then search and then select required active tender from the "Search Active tender" option. Now, submit button can be clicked against the selected tender so that it comes to the "My Tenders" section.

b. **Uploading of Prequalification / Technical/Financial Bid:** The bidders have to upload the required Prequalification / Technical/Financial Bid, as mentioned in the bidding document and in line with the Work Department Office Memorandum No.7885/W dt.23.07.2013.

c. **Electronic payments of paper cost and EMD:** Then the bidders have to select and submit the bank name as available in the payment options.

i. A bidders shall make electronic payment using his/her internet banking enabled account with designated banks of their aggregator banks.

ii. A bidder having account in other banks can make payments using NEFT/RTGS facility of designated banks.

- Online NEFT/RTGS Payments using internet banking of the bank in which the bidders hold his account, by adding the account No. as mentioned in the challan as on Interbank Beneficiary.

d. **Bid Submission:** Only after receipt of intimation at the e-Procurement portal regarding successful transition by Bidders the system will activate the 'Freeze Bid Submission' button to conclude the bid submission process.

e. **System generated acknowledgement receipt for successful bid submission:** System will generate and acknowledgement receipt for successful bid submission. The bidders should make a note of **Bid ID** generated in the acknowledgement receipt for tacking their bid status.

6. Settlement of cost of Tender Paper

a. **Cost of Tender Paper:** In respect of Government Receipts on account of **Cost of Tender Paper** the e-Procurement portal shall generated a MIS for the State procurement Cell (SPC). The MIS will contain as abstract of the cost of tender paper collected with reference to **Bid Identification Number.** The State procurement Cell shall generate Bank wise challans under the Head of Account for **Cost of Tender Paper** and instruct the designated Banks to remit the money to the proper Had of Account of State Government. In respect of the cost of Tender Paper received through the e-Procurement Portal, the remittance to the Cyber Treasury account will be made to the Head of Account 0075-Misc. General Service-800-Other Receipts-0097-Misc Receipts-02237-Cost of Tender Paper.

b. For the time being, the State Procurement Cell (SPC) will use over the counter payment facility of the Treasury Portal. Thereafter remittance through NEFT & RTGS will be facilitated through Odisha Treasury Portal.

c. Similarly, in case of State PSUs, Statutory Corporations, Autonomous Bodies & Local Bodies etc. **Cost of Tender Paper,** the e-Procurement Portal shall generate a MIS for the State Procurement cell (SPC). The MIS will contain an abstract of cost of Tender Paper collected with reference to **Bid Identification Number.** The Cost of Tender papers will be credited to the registered Bank accounts of the concerned State PSUs, Statutory Corporations, Autonomous Bodies and Local Bodies.

d. The Bank will refund (in case the Tender Inviting Authority (TIA) issues such instructions), the tender fee and EMD to the Bidder, in case the Tender is cancelled before opening of Bid as per direction received from TIA through-procurement system.

e. Back-end Transaction Matrix of Electronic Receipt of Cost of Tender Paper and Earnest Money deposits on submission of BIDs is enclosed in the **Annexure-I.**

7. Settlement of Earnest Money Deposit on submission of Bids:

a. The Bank will remit the **Earnest Money Deposit on submission / cancellation of Bids** to respective Bidders account as per direction received from TIA through e-procurement system**.**

8. Forfeiture of EMD:

Forfeiture of **Earnest Money Deposits on submission of Bid** of defaulting bidders is occasioned for various reasons.

a. In case the **Earnest Money Deposits on submission of Bid** is forfeited, the e-Procurement Portal will directed the bank to transfer the EMD value from the pooling account of SPC to the registered account of the tender inviting authority.

b. The Tender Inviting Authorities of the Government Departments will deposited the forfeited **Earnest Money Deposits on submission of Bid,** in the State Government Treasury under the appropriate head(8782-Cash Remittances and Adjustments between the officers rendering accounts to the same Accounts Officer-102-P.W.Remittances-1683-Remittances-91028-Remittances into Treasury) after taking the amount as a revenue receipts in their cash book under the head 0075-Misc. General Service-00-101-unclaimed Deposits-0097-Misc Receipts-02080-Misc. Deposits and submit the detail account to DAG, Puri as a deposit of the Division.

c. By clicking submit button, system will initiate the forfeiture of EMD. System will not allow the evaluator to edit the initiation after clicking the submit button. Forfeiture option can be carried out in phased manner like One Bidder at a time.

9. Role of the Banks:

a. Make necessary provision/ customizations at their end to enable the provision for online payments/refunds as per this document.

b. Provide real-time message to bidders regarding successful or un-successful transaction during online payment process and re-direct them to e-Procurement website with necessary transaction reference detail enabling them to submit their bids.

c. The bank shall ensure transfer of funds from the pooling account to the Government Head / Current Account of PSUs /ULBs within the next bank working day as per the directions generated from e-Procurement Portal.

d. Bank should provide time reports and reference details to NIC enabling them to carry out their role as stated below.

e. Refund of the amount to Bidders as per the XML file provided by e-Procurement System on the next bank working day from the date of generation of the XLM-file and also provide a confirmation to NIC on the same.

10. Role of State Procurement Cell:

a. Communicate requirement of Government departments / State PSUs / Autonomous Bodies / ULBs online payment requirement to National Informatics Centre / the authorized Banks for mapping / customization.

b. In every working day, the State Procurement Cell shall generated MIS from the e-procurement portal to ascertain the tender paper cost received in the e-tendering process separately bank-wise for the Government Department and the PSUs/LUBs. The SPC shall generate bank-wise separate online challans from the Odisha Treasury portal and make the remittance through over the counter facility or NEFT/RTGS (as and when this functionality is available in treasury portal) and issue instruction to the bank for remittance of the receipt to the State Government account.

c. The State Procurement Cell shall be responsible for providing challan details and MIS in respect of the remittance towards tender paper cost to the Tender Inviting Authorities for their record.

d. State procurement Cell shall monitor the progress of e-Tendering by different Government Departments / State PSUs / Autonomous Bodies / ULBs through MIS. State Procurement Cell shall monitor and send monthly progress reports to the Government.

e. The e-Procurement System will generate a consolidated refund & settlements XML file as an end of the day activity.

f. e-Procurement system will provide a web service for Payment Gateway (PG) provider to pull the encrypted refund and settlement details in XML file against a day.

g. Similarly, Payment Gateway (PG) provider will provide a web service to pull the refund and settlement status against a day.

h. e-Procurement system will update the status accordingly for reconciliation report.

11. Role National Informatics Centre:

a. Customize e-Procurement software and web-pages of Government of Odisha (https://tendersodisha.gov.in) to enable the provision for electronic payment.

b. The NIC, Odisha will modify / rectify the errors in electronic data relating to the Cahrt of Account.

c. NIC will provide an interface to organizations to download the electronic receipt data.

d. Enable automatic generation of daily XML files from e-Procurement system and ensure delivery of the same to the authorized Banks for enabling automatic refund / settlement of funds.

e. NIC shall enable the e-Procurement portal to generate MIS as required for the State Procurement Cell in order to make remittance of the tender paper cost to the State Government account using the Odisha Treasury Portal.

12. Role of Cyber Treasury

a. The cost of the tender paper deposited by the SPC using the Odisha Treasury Poratl which will be accounted for by the Cyber Treasury and it shall submit the accounts to A.G.(O) as per the established process.

b. The Cyber Treasury will provide MIS as required to the SPC for the purpose of accounting and reconciliation of the electronic made to the State Government account.

13. Redressal of Public grievances :

a. The State Procurement Cell, Odisha, National Informatics Centre, Odisha and the e-FPB will have an effective procedure for dealing with, public complaint for e-Receipt related matters. In case, any mistake is detected any of the stakeholders in reporting of receipt of tender paper cost and EMD, either soumoto or on being brought to its notice, the State Procurement Cell, Odisha, National Informatics Centre , Odisha unit, Cyber Treasury and bank will promptly take steps for rectification. The e-Focal Point Branch of the participating Banks, National Informatics Centre, Odisha and the State Procurement Cell, Odisha will notify the contact number and address of the Help Desk for resolution of any dispute regarding e-Receipt.

14. Applicability and modification of existing rules/ orders:

The modalities prescribed in this Office Memorandum for downloading of Tender Paper, submission and rejection of bid, acceptance of bid as well as refund and forfeiture of earnest deposit will be applicable for electronic submission of bids through e-Procurement portal. Existing provision regulating cost of tender paper and earnest money deposits in OPWD code and OGFR would stand modified to the extent prescribed in this Office Memorandum.

15. These arrangements would be made effective after signing of MoU between the designated Bank and State Procurement Cell, firming up of Banking arrangements and technical integration between designated bank and e-Procurement Portal.

1. This shall take effect from the date of issue of this Office Memorandum
2. Accordingly, relevant existing codal / contractual provision exist vide Office Memorandum No.6785/W dt.09.05.2017 of Works Department stands modified to the abopve context.
3. This has been concurred in by the Finance Department vide their UOR NO.:-39-WF-I dt.09.11.2017.

ANNEXURE-I

Back-end Transaction Matrix of Electronics receipt and remittance of Cost of Tender Paper and Earnest Money Deposit on submission of bids

	Cost of Tender Paper	**Earnest Money Deposit on submission of Bid**
Government Departments	I. The *payment* towards the **Cost of Tender Paper,** in case of Government Departments, shall be collected in the separate pooling accounts opened in Focal Point Branch call e-FPB of respective designated banks (as stated in Para-2) at Bhubaneswar on T+1 day. II. With reference to the Notice Inviting Tender / Bid Identification Number, the amount so realised is to be remitted to Government Account under the Head of Account 0075-Misc. general Services-800-Other Receipts-0097-Misc Receipts -02237-Cost of tender Paper through Odisha Treasury Portal after opening of the Bid.	I. In case of tenders of Government Departments amount towards **Earnest Money Deposits** on submission of bids shall be collected in a pooling account opened for this purpose at Focal Point Branch called e-FPB of respective designated banks at Bhubaneswar and the bank will remit the amount to the respective bidder's account within two working day on receipt of instruction from TIA through refund and settlement of e-Procurement System. II. In case of forfeiture of **Earnest Money Deposit** on submission of bids, the e-procurement portal will direct the Bank to transfer the EMD value from the Pooling Account of SPC to the registered account of the tender inviting authority within two working days of receipt of instruction from TIA.
State PSUs, Statutory Corporations, Autonomous Bodies and Local Bodies	I. In case of State PSUs, Statutory Corporations, Autonomous Bodies and Local Bodies etc. the amount towards **Cost of Tender Paper** on submission of Bids shall be collected in separate pooling accounts opened in Focal Point Branch called e-FPB of respective designated banks at Bhubaneswar on T+1 day.	I. Amount towards **EMD** on submission of Bids shall be collected in a separate pooling account of Focal Point Branch called e-FPB of respective designated banks at Bhubaneswar and the banks will remit the amount to respective bidder's account on receipt of instruction from TIA through refund and settlement of e-procurement system

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		within two working days from the receipt of such instruction.
	II. The **Paper Cost** will be transferred to the respective current account of concerned State PSUs, Statutory Corporations, Autonomous Bodies and Local Bodies etc. after opeingin of Bid	II. In case of forfeiture of **Earnest Money Deposit** on submission of bids, the e-Procurement portal will direct the Bank to transfer the EMD value from the pooling account of SPC to the registered account of the tender inviting within two working days of receipts of instruction from TIA.

26. **GENERAL INSTRUCTIONS TO CONTRACTORS**

1. Any Agency or Contractor executing a work should be aware about the local festivals like Makar Sankranti, Raja Sankrati, Chaiti Parba, Danda Nata or any such festivals which may affect the work schedule. Therefore, the Contractor should engage more work forces during working period available at his disposal to complete the work as per schedule.
2. In the peak summer season, working hour is curtailed by the Labour Department to avoid exposure to personnel to the scorching sun and heat. It is the duty of the agency to increase the number of workforce and to employ the existing workforce during morning and afternoon hours as per Government orders.
3. Rainfall is a normal occurrence during monsoon in Odisha. So, unless there is unusually heavy rainfall resulting in a declared calamity, the Contractor is not eligible for any extension of time. The Contractor should plan the deployment of workforce and machinery, so as to complete the work as per schedule considering ordinary vagaries of the nature. The same applies for borrow areas ponding also. The contractor should forsee possible ponding borrow area in monsoon and likewise lift more quantity of soil/ other materials during dry period, so as to complete the work as per schedule.
4. The Contractor should foresee possible ponding of borrow area in monsoon and likewise lift more quantity of soil/other materials during dry period so as to complete the work as per schedule. The Contractor should take up the work with due diligence in the acquired land without waiting for acquisition of the entire land. This should be completed in proportionally less period depending on the quantum of available work front.
5. The Agency should plan his work programme and mobilize men and machineries considering the canal closure programme of a particular system or area. Khariff/Rabi closure can't be imposed arbitrarily on the farmers as per the convenience of the agency. Closure of canal for the interest of work will be solely at the discretion of the Engineer-in-Charge and can't be claimed as a matter of right.
6. There will always be standing crop before harvesting season as per crop schedule and this fact has to be clearly understood by the agency. Extension of time on this ground may not be considered by Divisional Officers.
7. Only the day(s) of elections to the Local Bodies/Assembly/Parliament will be treated as a non-working day(s).
8. It is mandatory to provide necessary safety arrangement by the contractor/agency at the worksite. He should also supply helmet, gun boot, safety jacket etc. to the workers at his own cost during construction activities at worksite.
9. The contractor/bidder must furnish his e-mail ID and Telephone/Mobile number for official correspondence at the time of requirement.

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SECTION – 3

GENERAL RULES & DIRECTIONS

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ODISHA PUBLIC WORKS DEPARTMENT

(FORM P-1)

PERCENTAGE RATE TENDER AND CONTRACT FOR WORKS

GENERAL RULES & DIRECTIONS FOR THE GUIDANCE OF CONTRACTORS

1. The work proposed for execution by contract will be notified in a form of invitation to tender posted through Govt. website **www.tendersorissa.gov.in**

   This notice will state the work to be carried out, the items and approximate quantities thereof as well as the date for submitting and opening tenders also the amount of earnest money to be deposited and the amount of the security deposit by the successful bidders and the percentage if any to be deducted from bills. Copies of the specifications, designs and drawings and any other documents required in connection with the submission of tender signed for the purpose of identification by the Sub-divisional Officer/Superintending Engineer shall also be open for inspection by the contractor at the office of the Sub-Divisional Officer/Superintending Engineer during office hours.

2. In the event of the tender being submitted by a firm, it must be signed separately by each member thereof, or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power of attorney authorizing him to do so.

3. Receipts for payment made on accounts of works, when executed by a firm must also be signed by the several partners, except where the contractors are described in their tender as a firm in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having authority to give effectual receipts for the firm.

4. The memorandum of work tendered for and the memorandum of materials to be supplied by the Public Works Departments and their issue rates shall be filled in and completed in the office of the Sub-Divisional Officer/Superintending Engineer before the tender form is issued if a form is issued to an intending bidder without having been so filled in and completed, he shall request the office to have this done before he completes and delivers his tender.

5. a)Earnest money Deposit@ 1%of the amount put to tender for General Contractors i.e.**Rs.12,200/-,** 0.5% of the amount put to tender for SC/ST Contractor i.e.**Rs.6100/-** , exempted for eligible Engineering Contractors and Physically Handicaped contractors. The “E.M.D.“ shall be paid online by the bidder by using internet banking enabled account with designated banks(SBI, ICICI, HDFC Bank) or their aggregator banks. A bidder having account in other banks can made payment using NEFT/RTGS facilities of designated banks such as SBI, ICICI, HDFC Banks. For submission of bids through e-procurement portal, the bidder shall scan all the required documents such as Affidavit, Contractor License ,Pan Card, GST Registration, & Financial Bid .

6. Any person who submits a tender shall fill up the usual printed form stating at what rate he is willing to undertake each item of the work. Incomplete tender and tender rate he is willing to undertake each item of the work specified in the said form of invitation to tender or which they contain any other conditions of any sort, or omit to note the time within which the work can be finished or which are not accompanied by a treasury Challan for the required earnest money will be liable to rejection. No single tender shall include more than one work, but contractors who wish to tender for two or more work shall submit a separate tender for each tender. Tender shall bear the name of the work to which they refer written outside the envelope, cash deposited for earnest money therein before mentioned shall be made in Government treasuries and the Challan thereof should be enclosed with the tender.

7. The Engineer-in-charge or his duly authorized assistant will open the tenders in the presence of any intending contractors who may be present at the time and will enter the amounts of the several tenders in a comparative statement in a suitable form. In the event of tender being rejected, the Challan for the earnest money forwarded therewith shall thereupon be returned to the bidders by a pay order for the amount of the earnest money.

8. The Engineer-in-charge shall have the right of rejecting all or any of the tenders.

9. In the event of a tender being selected for acceptance, the Engineer who opened the tenders will, if he is competent to accept the tender, inform the bidders of the selected tender who shall there upon sign copies of the specification and other documents with the agreement. The bidder of the selected tender shall also deposit the required amount of the security money within the prescribed time. If the bidders fail to deposit the required amount of the security money within the prescribed time, the Engineer-in-charge may reject the tender.

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If the Engineer is not competent to accept the tender himself, he will inform the bidders of the tender which he decides to recommend for acceptance, such bidders shall thereupon sign forthwith copies of the specification and other documents mentioned in rules 1 and 4 and shall deposit the required amount of the security money within the prescribed time. The tender with the specification and other documents signed by the bidders will then be forwarded for acceptance to the Engineer who is competent to accept the same. If the said Engineer rejects the tender, the security money deposited shall be refunded to the bidders.

10. When a tender is selected for acceptance, the bidders shall deposit the required amount of the security money in cash in any treasury and shall forward the Challan to the Superintending Engineer. Government securities may be endorsed to the Superintending Engineer in lieu of cash deposit of the required amount of the security money No tender shall be finally accepted until the required amount of the security money has been deposited.

11. The amount of security money to be deposited by the bidders whose tender is selected for acceptance shall be 2 (two) percent of the estimated value of the work and towards this amount the earnest money already deposited by him shall be credited. At least half of this security inclusive of the earnest money shall be deposited by the bidders within such time as may be notified to him in writing by the officer opening the tender, failing which tender shall be liable to rejection.

    Any balance of the security money outstanding after completion of the contract with the bidders may be made up by deduction of 5% of the amount of each payment to be made to him under clause of the condition of contract for work done under the contract.

    Taxes as per provisions of Government shall be deducted from the bills of bidders.

12. When tender has been selected for acceptance and the required amount of the security money has been deposited, the Engineer shall scrutinize all pages of the form of item, Rate Tendered and Contract for works to see that the form has been properly filled up and signed by the contractor and the signature witnessed. He shall then, if he is competent to accept the tender, sign the acceptance of the tenders or if he is not so competent to, shall send the form for signature of the acceptance to the officer competent to accept it.

13. All bidders are required to submit a list of works, which are in hand at the time of submitting their tenders. The list of works is required to be submitted in the proforma by the Superintending Engineer under whom he has executed the work in order to judge their past performance. (vide Works Department Circular No. 15443 DT. 01.08.2005)

14. The earnest money deposited is liable to be forfeited to Govt. if the bidders back out from the offer before acceptance of the tender by the competent authority.

15. GST on works contract as applicable at the time of payment shall be paid extra over the Gross amount of the running bill amount. (vide section 15 and section 142 (11) (C) of Odisha GST Act 2017)

16. Prevailing rate of GST (Presently TDS-2%) on the gross amount of the bill will be deducted from the contractor's bill as applicable on the date of payment where agreement value exceeds rupees two lakhs fifty thousand. (to be applicable as per Govt. Notification & amended from time to time)

17. Agreement shall be drawn only after due verification of EMD & APSD of the successful bidder and if any illegitimate instruments are found, criminal proceedings will be initiated against the defaulting bidder and action will be initiated for blacklisting through the license issuing Authority.

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TENDER FOR WORKS

I / We hereby tender for the execution for the Government of Odisha for the work specified in the underwritten memorandum at the rates specified therein a period of **3 Calendar Months** from the date of written order to commence and in accordance in all respects with the specifications designs and other documents referred to in rule. I here of and subject to the annexed conditions of contract and with such materials as are provided for by and in all other respects in accordance with such condition so far as applicable.

MEMORANDUM

a) If several sub-works are included they should be detailed in a separate sheet.	(a)	Name of Work	:	Improovement to Jamunaposi Minor from RD 2511m to 2611m (Construction of Troughwall) for the year 2026-27
	(b)	Amount put to Tender	:	Rs. **12,13,952.00**
	(c)	Agreement Amount		
	(d)	**E.M.D**	:	**Rs. 12200.00 (Online)**
e) This deposit will be 2 percent of the estimated cost of the work.	(e)	Initial security deposits (including earnest money) to be deposited before Signing of Agreement.	:	**2%**
	(f)	Additional Performance security deposited before Signing of Agreement.		
f) This percentage from bills will be credited to the contractor's security.	(g)	Security deposits to be deducted from bills.	:	**3%**
	(h)	Time required for the work from date of written order to commence	:	**3 Calendar Months.**
	(i)	Date of written order to commence	:	
	(j)	Actual date of commencement of work	:	
	(k)	Schedule date of completion	:	
	(l)	Total number of item of works tender for	:	**08 (Eight)**

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Nature of contractor before submission of tender

Should this tender be accepted I/We hereby agree to abide by and fulfill the terms and provision of the said condition of contract annexed here to so far as applicable, or in defaults thereof to forfeit and pay to the Government of Odisha or his successors in office, the sum of money mentioned in the said conditions.

Dated the ……..Day of.....26

Signature of witness to one tender's signature

Witness :

Address:

CONTRACTOR

Signature of Officer by whom accepted

The above tender is hereby accepted by me on behalf of the Government of Odisha.

Dated the ……..Day of.....26

.

Executive Engineer
Keonjhar Irrigation Division
Kendujhar

SECTION – 4

CONDITIONS OF CONTRACT

CONTRACTOR **EXECUTIVE ENGINEER**

CONDITION OF CONTRACT

Clause 1- All compensation or other sum of money payable by the contractor to Government under the terms of his contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising there from, or from any sums which may be due or may become due to the contractor by Government on any account what so ever and in the event of his security deposit being reduced by reason of any such deduction or sale as aforesaid, the contractor shall within ten days thereafter make good in cash or Government securities endorsed as aforesaid any sum or sums which may have been deducted from or raised by, sale of the security deposit or any part thereof.

Compensation for delay

Clause 2 (a) The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor and shall be reckoned from the date on which the written order to commence work is given to the contractor, The work shall throughout the stipulated period of the contract be carried on with all due diligence (time being deemed to be of the essence of the contract on the part of the contractor) and the contractor shall pay as compensation an amount equal to ½ % on the amount of the estimated cost if the whole work as shown by the tender for every day that the work remains un-commenced, or unfinished after the proper dates (The work should not be considered finished until such date as the **Executive Engineer** shall certify as the date on which the work is finished after necessary rectification of defects as pointed out by the **Executive Engineer**, or his authorised, agents are fully complied with by the contractor to the **Executive Engineer**'s satisfaction). And further to ensure good progress during execution of the work the contractor shall be bound, in all cases in which the time allowed for any work exceeds one month, to complete one fourth of the whole work before one fourth of the whole time allowed under contract has elapsed one half of the work, before one half of such time has elapsed and three-forth of the work before three-forth of such time has elapsed. In the events of the contractor failing to comply with the condition, he shall be liable to pay as compensation an amount equal to one third percent on the said estimated cost of the whole work for every day that the due quantity of work remains incomplete, provided always that the entire amount of compensation to be paid under the provision of this clause shall not exceed 10% on estimated cost of the work as shown in the tender.

The work should not be considered finished until such date as the E.E. shall certify as the date on which the work is finished after necessary rectification of defects as pointed out by E.E. or his authorized agents are fully complied with by the contractor to the E.Es satisfaction.

(b) If there are possibilities of exceeding this compensation amount as mentioned in clause (a) 10% of the estimated cost or in any case in which under any clause or clauses of this contract the contractor shall have tendered himself liable to pay compensation amounting to the whole of his security deposit in the hands of Govt. (whether paid in one sum or deducted by installments) the **Executive Engineer** on behalf of the Governor of Odisha, shall have power to adopt any of the following courses as he may deem best suited to the interest of Government.

Action when whole security deposit is forfeited

(i) To rescind the contract (of which rescission notice in writing to the contractor under the hand of the Superintending Engineer shall be conclusive evidence) 20% of the value of left over work will be realized from the contractor as penalty.

In the event of any of the above courses being adopted by the **Executive Engineer** the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials, or entered into any engagements or made any advances on account of or with a view to, the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereto for actually performed under this contract, unless and until the **Executive Engineer** shall have certified in writing the performance of such work and the value payable in-respect thereof and he shall only be entitled to be paid the value so certified.

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Amendment to clause 2(b) of item rate F2 Agreement vide Works Department order no.10639 dt. 27.05.2005.

(ii) Security deposit of contractor for each work will be refunded only one year after the date of completion of work provided the final bill has been paid and defects if any rectified.

Clause-3 In any case in which any of the powers, conferred upon the **Executive Engineer** by clause 3 thereof, shall become exercisable and the same shall not be exercised the non exercise thereof shall not constitute a waiver of the conditions here of and such powers shall not withstanding be exercisable in the event of any clause or clauses thereof he is declared liable to pay compensation amounting to the whole of his security deposit, and the liability of the contractor for past and future compensation shall remain unaffected in the event of the **Executive Engineer** putting in force the powers vested in him under the preceding clause he may if he so desire, take possession of all or any tools, plants, materials & stores, in or upon the works or the site thereof or belonging to the contractor or procured by him and intended to be used for the execution of the work or any part thereof paying or all wing for the same in the account at the contract, rates, or in case of these not being applicable ; at current

Contractor remain liable to pay compensation if action not taken under clause-3

market rates to be certified by the **Executing Engineer** whose certificate thereof shall be final; otherwise the **Executive Engineer** may give notice in writing to the contractor or his clerk of the works, foreman or other authorized agent required him to remove such tools, plants, materials or stores from the premises (within a time to be specified in such notice) and in the event of the contractor failing to comply with any requisition to the **Executive Engineer** may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respects and the certificate of the **Executive Engineer** as to the expense of removal and the amount of proceeds and expense of any such sale shall be final and conclusive against the contractor.

Power to take possession of or require removal of or sell contractor plants

Clause – 4 If the contractor shall desire on extension of time for completion of the work, on the ground of his having been unavoidable hindrances in its execution or any other ground he shall apply in writing to the **Executive Engineer** within 30 days of the date of the hindrance on account of which he desires such extension as aforesaid and the **Executive Engineer** shall, if in his opinion (which shall be final) reasonable be shown therefore, authorize such extension of time if any, as may in his opinion, be necessary or proper. The **Executive Engineer** shall at the same time inform the contractor whether he claims compensation for delay.

Extension of time

Clause – 5 On completion of the work, the contractor shall be furnished with a certificate by the **Executive Engineer** (here-in-after called the Engineer-in-charge) of such completion, but no such certificate be given, nor shall the work be considered to be complete until the contractor shall have removed from the area of premises (to be distinctly marked by the **Executive Enginee**r in the site plan) on which the work shall be executed, all scaffolding surplus materials and rubbish and cleaned off the dirt from all wood work doors, windows, walls, floors or other parts of any building in upon or about which the work is to be executed, or of which he may have had possession for the purpose of the execution thereof nor until the work shall have been measured by the officer of the PWD in accordance with the rules of the department whose measurements shall be binding and conclusive against the contractor the contractor shall fail to comply with the requirements of this clause as removal of scaffolding surplus materials and rubbish and cleaning of dirt on or before the date fixed for the completion of the work the Engineer-in-charge may at the expenses of the contractor, remove such scaffolding surplus materials and rubbish and dispose of the same as he thinks fit and clean off such dirt's as aforesaid and the contractor shall forth with pay the amount of all expenses incurred and shall have no claim in respect of any such scaffolding, or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

Final Certificate

Sub-clause –5 "If in the opinion of the Engineer-in-charge which shall be final and binding on the contractor occupation or utilization of a portion of the work completed in no way interferers with the progress for rest of the work, the same may be occupied or utilized

by or on behalf of the Govt. under the written order of the Engineer-in-charge to get the defects of any rectified by the contractor at his (Contractor) own cost within six months from the date of completion of the whole work provided that the contractor will not be allowed any other concession either in the shape of extensions of stipulated period or any other monetary compensation on account of such occupation or use.

Clause – 6 A bill shall be submitted by the contractor each month on or before the date fixed by the Engineer-in-charge for all works executed in the previous month, and the Engineer-in-charge or his subordinate shall take the requisite measurement for the purpose of having the same verified and the claim as far as admissible' adjusted if possible before the expiry of ten day from the presentation of the bill. If the contractor does not submit the bill within the time fixed as aforesaid, the Engineer-in-charge or his subordinate shall measure up the said work in the presence of the contractor whose countersignature to the measurement list will be sufficient warrant and the Engineer-in-charge or his subordinate shall prepare a bill from such list which shall be binding on the contractor in all respects.

Payment on intermediate certificate be regarded as advance & bill to be submitted monthly

Provided that, if any balance of the 7% security is outstanding from each such payment shall be deducted so much, not exceeding 5% as may be necessary to make up the balance of the security. All such intermediate payments shall be regarded as payment by way of advance against the final payment only and not as payments for work actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskillful work to be removed and taken away and reconstructed or re-erected, or be considered as an admission of the due performance of the contract, or any part thereof in any respect, or the actual of any claim nor shall it conclude, determine or effect in any way the powers of the Engineer-in-charge under these conditions or any of them as the final settlement or adjustment of the accounts or otherwise, or in any other way vary or affect the contract.

Clause – 7 The final bill shall be prepared by the offices of the P.W.D. in accordance with the rules of department in the presence of the contractor within one month of the date fixed for completion of the work.

Clause – 8 If the specification of estimate of the work provides for the use of any special description of materials to be supplied from the Engineer-in-charge's store, or it is required that the contractor shall use certain stores to be provided by the Engineer-in-Charge under the conditions of this contract [such materials and stores and the prices to be charged thereof as herein after mentioned being so far as practicable for the convenience of the contractor, but not so as in any way to control the meaning or effect of his contract are specified in the schedule or memorandum here to annexed] the contractor shall be supplied with such materials and store noted in the annexed schedule as are required from time to time to be used by him for the purposes of the contract only, and the value of the full quantity of materials and stores so supplied at the rates specified in the said schedule may be set off or deducted from any sums then due, or thereafter to become due to the contractor under the contract or otherwise or against or from the security deposit, or the proceed of sale thereof if the same is held in Government securities, the same or a sufficient portion thereof being in this case sold for the purpose. All materials supplied to the contractor shall remain the absolute property of Government and shall not on any account be removed from the site of the work, and shall at all time be open to inspect by the Engineer-in-charge. Any such materials unused and in perfectly good condition at the time of completion or determination of the contract shall be returned to the Engineer-in-charge's store, at the prevailing market rate or at the issue rate whichever is less if by a notice in writing under his hand he shall so require, but the contractor shall not be entitled to return any such materials unless with such consent and shall have no claim for compensation no account of any such materials so supplied to him as aforesaid being unused by him, or for any wastage in or damage to any such materials.

Store supplied by Government

NOT APPLICABLE

Clause - 8(a) "If a contractor removes any materials or stock so supplied to him from the site of the work in contravention of the provision of this clause with a view to dispose of the same dishonestly, he shall in addition to any other liability, civil or criminal, arising out of this contract be liable to pay a penalty equivalent to five times the price of the said materials

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or stock according to the stipulated rate. The penalty so imposed shall be recoverable from any sum, that may be then, or at any time there after may become due to the contractor; or from his security deposit, or the proceeds of sale thereof. ”

Clause - 8 (b) Owing to difficulty in obtaining certain materials in the open market the Government have undertaken to supply materials specified in the schedule here to annexed. There may be delay in obtaining materials by the Department and the contractor is therefore required to keep himself in touch with day position regarding the supply of materials from the Engineer-in-charge and to so adjust the progress of the work that their labour may not remain idle nor may there be any other claim due to or arising from delay in obtaining the materials. It should be clearly understood that no monetary claim whatsoever shall be entertained by the Government on account of delay in supplying materials. However extension of time for the completion of work can be granted on timely application by the contractor vide clause 4.

Clause - 9 The contractor shall execute the whole and every part of the work in the most substantial and workman like manner and both as regards materials and otherwise in every respect in strict accordance with the specification. The contractor shall also confirm exactly fully and faithful to the design, drawings & instructions in writing relating to the work signed by the Engineer-in-charge and lodged in his office and to which the contractor shall be entitled to have access at such office for the purpose of inspection during office hours and the contractor shall, if he so require be entitle at his own expense to make or cause to make copies of the specifications and of all such designs, drawings and instructions as aforesaid.

Works to be executed in accordance with specification drawing & orders etc.

Sub clause-9 The work should be done strictly in accordance with the relevant specifications of the I.S.I. Codes. If the work is not covered by the specification of I.S.I. it should be done in accordance with the provision in the Odisha Detailed Standard Specifications (O.D.S.S). In case, the work is not covered by O.D.S.S. the work should be executed as per the instruction of the Engineer-in-charge.

Clause – 10 The Engineer-in-charge shall have power to make any alterations in or additions to the original specifications, drawing, designs and instruction that may appear to him to be necessary advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instruction which may be given to him in writing signed by the Engineer-in-charge and such alteration shall not invalidate the contract and at additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respect on which he agreed to do the main work, and at the same time rates as are specified in the tender for the main work., The time for the completion of the work shall be extended in the proportion that the additional work includes bears to the original contract work and the certificate of the Engineer-in-charge shall be conclusive as to such proportions. And if the additional work includes any class of work for which no rate is specified in this contract then such class of work shall be carried out at the on rates specified on entered in the sanctioned schedule by rates of the locality during the period when the work being carried on and if such the district then the contractor shall within seven days of the date of his receipt of the order to carry out the work inform the Engineer-in-charge of the rate which is it his intention to charge for such class of work, and if the Engineer-in-charge does not agree to this rate he shall by notice in writing be at liberty to cancel his order to carry out such class or work and arrange to carry it out in such manner as he may consider advisable.

Alteration in specification and designs

Extension of time in consequence of alterations

Do not invalidate contract

No deviations from the specification stipulated in the contract or additional items of work shall ordinarily be carried out by contractor nor shall any altered. Additional or substituted work to be carried out by him unless the rates on the substituted altered of additional items have been approved and fixed in writing by the Engineer-in-charge.

Rates of works not in estimate of schedule or rate of the district.

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The contractor shall be bound to submit his claim for any additional work done during any month on or before the 5th days of the following month accompanied by copy of the order in writing of the Engineer-in-charge for the additional work and that the contractor shall not be entitled to any payment in respect of such additional work if he fails to submit his claim within the aforesaid period.

Provided always that if the contractor shall commence work incur any expenditure in regards thereof before the rates shall have been determined as lastly herein before mentioned, then and in such case he shall only be paid in respect of the work carried out or expenditure incurred by him prior to the determination of the rates as aforesaid according to such rates as shall be fixed by the Engineer-in-charge. In the event of dispute the decision of the **Executive Engineer** of the circle will be final.

Clause – 11 If at any time after the commencement of the work the Government of Odisha shall for any reason whatsoever not require the whole thereof as specified in the tender to be carried out the Engineer-in-charge shall give notice in writing of the fact to contractor. Who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage, which he might have derived from the execution of the work in full but which he did not derive in consequence of the full amount of the work not having been carried out, neither shall he have any claim for compensation by reason of any alternations having been made in the original specification, drawing, designs and instruction which shall involve any curtailment of the work as originally contemplated.

No compensation for alteration in or restriction of work to be carried out.

Clause – 12 If it shall appear to the Engineer-in-charge or his subordinate in charge of the work that any work has been executed with unsound, imperfect or unskillful workmanship or with materials of any inferior description, or that any materials or articles provided by him for or execution of the work are unsound or of a quality inferior to that contracted for or otherwise not in accordance with the contract. The contractor shall on demand in writing from the Engineer-in-charge specifying the work materials or articles complained of notwithstanding that the same may have been inadvertently passed, certified and paid forth with rectify or remove and reconstruct the work so specified in whole or part, as the case may require or as the case may be remove the materials or articles so specified and provided other proper and suitable materials or articles at his own proper charge and cost and in the event of his failing to do so within a period to be specified by the Engineer-in-charge in his demand aforesaid then the contractor shall be liable to pay compensation at the rate of one percent on the amount of the estimate for every day not exceeding 10(Ten) days his failure to do shall continue and in the case of any such failure the Engineer-in-charge may rectify or remove and re-execute the work or remove and replace with other the materials or articles complained of as the case may be at the risk and the expense in all respects of the contractor.

Action and compensations payable in case of inferior / unsound work.

Clause – 13 All work under or in course of execution or executed in pursuance of the contract shall at all times be open to the inspections and supervision of the Engineer-in-charge and his subordinates and the contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of intention of Engineer-in-charge his subordinates to visit the works shall have been given to the contractor either himself be presented to receive orders and instructions, or have a responsible agent duly accredited in writing present for that purpose, Orders given to the contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

Works to be open to inspection

Contractor or responsible agents to be present

Clause – 14 The contractor shall give not less than five day's notice in writing to the Engineer-in-charge or his subordinate in-charge of the work before covering up or otherwise placing beyond the reach of measurement of any work in order that the same may be measured and correct dimensions thereof be taken before the same is so covered up or placed beyond the reach of measurement and shall not cover up or placed beyond the reach of measurement any work without the consent in

Notice to be given before work is covered up

writing of the Engineer-in-charge or his subordinate in charge of work and if any work shall be cover up or placed beyond the reach of measurement without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, or in default thereof no payments or allowance shall be made for such work or the materials with which the same was executed.

Clause – 15 If the contractor or his work people or servants shall break, deface, injure or destroy any part of a building, in which they may be working or any building, road, enclosure or grass land, or cultivated ground continuous to the premises on the premises on which work or any part of it being executed, or if any damage shall happen to the work while in progress from any cause whatever or any imperfection become apparent in it within six Months from the date of final certificate of its completion shall have been given by the Engineer-in-charge, as aforesaid the contractor shall make the same good at his own expense, or in default the Engineer-in-charge may cause the same to be made good by other workmen, and deduct the expense(of which the certificate of the Engineer-in-charge shall be final) from any sums that may be then or at any time thereafter may become due to the contractor, or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof and the contractor shall be liable to pay any part of the expenses not so recovered by the Engineer-in-charge.

Contractor liable for damage done and for imperfections for 12 months after certificate

Clause – 16 The contractor shall supply at his own cost all materials (except such special materials if any as may in accordance with the contract be supplied from the Engineer-in-charge's stores) plant, tools, appliances, implements, ladders, cordage, tackle scaffolding and temporary works requisite or proper for the proper execution of the work whether original altered or substituted and whether included in the specification or other documents forming Part of the contract or referred to in these conditions or not or which may be necessary for the purpose of satisfying or complying with the requirement of the Engineer-in-charge as to any matter as to which under this conditions he is entitled to be satisfied which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out work and counting, weighing and assisting in the measurement of examination at any time and from time to time the work or materials, failing him so doing the same may be provided by the Engineer-in-charge at the expenses of the contractor and the expenses may be deducted from any money due to the contractor under the contract or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof. The contractor shall also provide all necessary fencing and lights required to protect the public from accident and shall be bound to bear the expenses of defence to every suit, action or other proceeding at law that may be brought by any persons for injury sustained owing to the above precautions, and to pay any damages and cost which may be awarded in any such suit action or proceeding to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.

Contractor to supply plants, ladders, scaffolding etc.

And is liable for damages arising from non provision of lights, fencing etc.

Clause – 17 No female labour shall be employed within the limits of a cantonment. The contractor shall not employ for the purpose of this contract any labour below the age of twelve year, and shall pay to each labourer; for the work done by such labour, wages not less than the wage paid for similar work in the neighbourhood.

Explanation : Fair wages means wages whether for time or piece work prescribed by State P.W.D. provided that where higher rates have been prescribed under the minimum wages Act 1948 wages at such higher rates would constitute "Fair wages" [W/D No.22059 dated 16.8.77.

The **Executive Engineer** shall have the right to enquire into and decide any complaints alleging that the wages paid by the contractor to any labourer for the work done by such labourer is less than the wages paid for similar work in the neighbourhood.

The officer in charge of the work shall have the right to decide whether labourer employed by the contractor is below the age of twelve years and to refuse to allow any labourer whom he decides to be below the age of twelve years to be employed by the contractor.

Clause – 17 (a) The contractor shall, if so required by the Engineer-in-charge employ one more Engineering Graduate or Diploma holder as apprentices at his own cost if the cost of work as shown in the tender exceeds Rs.2,50,000/- The apprentices will be selected by the Chief Engineer. The period of employment will commence within one month after the date of work order and would last till the date when 90% of work is completed. The stipend to be paid to the apprentices, should not be less than Rs.213.50/- per day in case of graduate Engineers and not less than Rs.150/- per day in case of Diploma holders. The number of apprentices to be employed should be fixed by the Chief Engineer in a manner so that total expenditure does not exceed 1% of the tender cost of the work.

Clause – 17 (b) Special class Contractor shall employ under him one Graduate Engineer and Two Diploma Holders belonging to the State of Odisha. Like wise 'A' class contractor shall employ under him one Graduate Engineer or Two Diploma holders under the contractor shall be full time & continuous and they should not be superannuated, retired, dismissed or removed personnel from any State Govt. or Central Govt. service/public Sector undertakings, private companies and firms or be ineligible for appointment to Government service. The contractor shall pay them monthly emoluments which shall not be less than the emoluments of the personnel of equivalent qualification employed under the State Government of Odisha. The Chief Engineer, Roads Odisha may however, assist the contractor with names of such unemployed Graduate Engineer and Diploma holders if such help is sought for by the contractor. The names of such Engineering personnel appointed by the contractor should be intimated to the tender receiving authority along with the tender.

Employment of Graduate Engineers & Diploma Holders

Each bill of the Special Class or 'A' class contractor shall be accompanied by an employment Roll of the Engineering personnel together with a certificate of the Graduate Engineer or Diploma holder is employed by the contractor to the effect that the work executed as per the bill has been supervised by him.

Clause – 18 The contract shall not be assigned or sublet without the written approval of the Superintending Engineer and if the contractor shall assign or sublet his contract or attempt so to do, or become insolvent or commence any insolvency proceedings or make any composition with

Work not to be sublet.

his creditor or attempt so to do, or if any bride gratuity, gift loan, perquisite reward or advantage pecuniary otherwise shall either directly or indirectly be given, promised or offered by the contractor or any of his servants to agents to any public officer or person in the employee of Government in any way relating to his office of employment or if any such officer or person shall become in any way directly or indirectly in the contract, the **Executive Engineer** may thereupon by notice in writing rescind the contract and the security deposit of the contractor shall there upon stand forfeited and be absolutely at disposal of Government and the same consequences shall ensure as if the contract had been rescinded under clause 3 hereof and in addition the contractor, shall not be entitled to recover or be paid for any work therefore actually performed under the contract.

Contractor may be rescinded and security deposit forfeited subletting bribing or if contractor become in solvent

Clause – 19 All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of Government without reference to the actual loss or damage sustained, and whether or not any damage shall have been sustained.

Sum payable by way of compensation to be considered as reasonable compensation without reference to actual loss

Clause – 20 In the case of a tender by partners any changes in the constitution of the firm shall be forthwith notified by the contractor to the Engineer-in-charge for his information.
In case of failure to notify the change in the constitution within fifteen days the Engineer-in-charge may be noticed in writing rescind the contract and the security deposit of the contractor shall there upon stand forfeited and be absolutely at the disposal of Government

Changes in constitution of firm

and the same consequences shall ensure as if the contract had been rescind under clause 3 hereof and in addition the contractor shall not be entitled to recover or be paid for any works therefore actually performed under the contract.

Clause – 21 All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects by **Executive Engineer** of the circle for the time being who shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

Clause – 22 **DELETED**

Clause – 23 When the estimate on which a tender is made includes lump sums in respect of the items of work involved or the part of the work the contractor shall be entitled to payment in respect to items of work involved or the part of the work in question at the same rates as are payable under this contract for such items, or if the part of the work in question is not, in the opinion of the Engineer-in-charge capable of measurement, the Engineer-in- charge may by his discretion pay the lump sum amounts entered in the estimate, and the certificate in writing of the Engineer-in-charge shall be final and conclusive against the contractor with regard to any sums payable to him under the provisions of this clause.

Lump sums in estimates

Clause – 24 In the case of any class of work for which there is no such specification as is mentioned in rule, such work shall be carried out in accordance with the circle specification and in the event of there being no circle specification, then in such case the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-charge.

Action where no specification

Clause – 25 The expression 'work' or 'works' where used in these conditions shall unless there be something either in the subject or context repugnant to such construction be construed & taken to mean the works by or by virtue of contract contracted to be executed whether temporary or permanent, and whether original altered, substituted, or additional.

Definition of works

Clause – 26 Government shall be entitled to recover in full from the contractor any amount that the Government may be liable to pay under workmen compensation Act. VIII of 1923, to any workmen employed in course of execution of any part of the work covered by this contract.

Clause – 27 That for the purpose of jurisdiction in the event of dispute if any, the contract should be deemed to have been entered into within the State of Odisha and it is agreed that neither party to the contract or agreement will be competent to bring a suit in regard to the matters covered by this contract at any place outside the State of Odisha.

Clause – 28 The Department will have the right to inspect the scaffolding and centering made for the work and can reject partly or fully such structure if found defective in their opinion.

Clause – 29 Sanitary arrangements will be made by the contractor at his own cost for his labour camp.

Clause – 30 The contractor shall bear all taxes including income tax, royalty, fair weather charges and tollage, where ever necessary.

Clause - 31 Contract price shall be adjusted for increase or decrease in rates and price of labour, cement, steel, bitumen, pipes, POL and other material component in accordance with the following principles and procedure as per formula given below.

31.(a) **(i) REIMBURSEMENT / RECOVERY DUE TO VARIATION IN PRICES OF MATERIALS OTHER THAN (STEEL, CEMENT, BITUMEN, PIPES AND P.O.L.)**

If during the progress of the work the price of any materials (Excluding the cost of steel, cement, bitumen and P.O.L.) incorporated in the work (not being materials supplied from the Engineer-in-Charge's store) in accordance with clause there of increases or decreases as a result of increase or decrease in the Average whole sale price index (all commodities) , and the contractor there upon necessarily and properly pays in respect of that materials incorporated in the work such increased or decreased price ,

then he shall be entitled to reimbursement or liable to refund , quarterly as the case may be , such an amount , as shall be equivalent to the plus or minus difference of 85% in between the Average Wholesale Price Index (all commodities) which is operating for the quarter under consideration and that operated for the quarter in which the bid was received (last date of receipt) as per the formula indicated below provided that the work has been carried out within the stipulated time or extension there of as are not attributable to him. If penalty is levied for delayed completion of the work, the contractor shall not be eligible to get price escalation on the above materials on the value of works executed during the extended period.

This clause will be applicable to the contracts where original stipulated period of completion is more than 18 months.

In the situation where the period of completion is initially stipulated in the agreement as less than 18 (eighteen) months but subsequently the completion period has been validly extended on the ground that the delay in completion is not attributable to the contractor and in the result the total period including the extended period stands more than 18 (eighteen) months or more, price escalation for other materials is admissible only for the remaining period excluding 18 (eighteen) months there from.

Formula to calculate the increase or decrease in the price materials:-

Price adjustment for increase or decrease in cost of materials other than cement, steel, bitumen pipes and POL procured by the contractor shall be paid in accordance with the following formula.

$V_m = 0.85 \times P_m / 100 \times R \times (M_i - M_o) / M_o$

V_m= Increase or decrease in the cost of work during the quarter under consideration due to changes in rates of materials other than cement , steel , bitumen , pipes and POL.

R= Value of work done during the quarter under consideration excluding the work executed under extra items if any at prevailing scheduled of rate / derived rates.

M_o= The all India whole sale price index (all commodities) prevailed during the quarter of last date of receipt of bids (as published by the Economic Adviser to Govt. of India , Ministry of Industry and Commerce , New Delhi)

M_i= The all India whole sale Price index (all commodities) for the quarter under consideration as published by Economic Adviser, Govt. of India, Ministry of Industry and Commerce, New Delhi. In respect of the justified period extended for completion of the work, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be considered.

P_m= Percentage of material component (other than Cement, Steel, Bitumen, Pipes and POL) of the work, as indicated in Clause – 31 (d) below-

31.(a) **(ii) REIMBURSEMENT / RECOVERY OF DIFFERENTIAL COST DUE TO VARIATION IN PRICES OF PRINCIPAL MATERIALS (STEEL , CEMENT , BITUMEN , AND PIPES NOT ISSUED BY DEPARTMENT) AFTER SUBMISSION OF TENDER.**

If after submission of the tender , the prices of Steel , Cement , Bitumen and Pipes, (not being supplied by the Department) increases / decreases beyond the price (s) prevailing at the time of the last date of submission of tenders including extension for the work , the contractor shall be eligible to get differential cost due to such hike on the value of works executed during the stipulated period and during the extended period when the reason of delay in completion of the work is not attributable to the Contractor . If penalty is levied for delayed completion of the work , the contractor shall not be eligible to get price variation on the above materials on the value of works executed during the expended period .

Reimbursement in case of differential cost due to increase in prices of Cement , Steel , Bitumen and Pipes are to be made by the Superintending Engineer with prior approval of tender accepting authority subject to following conditions:-

1) Contractors have to submit the vouchers showing procurement of different materials from authorized dealers for the said work.

2) Differential cost will be allowed only for the works which are progressed as per the approved work programme / revised work programme duly approved by the Engineer-in-Charge.

Recovery in case of decrease in prices of Cement, Steel, Bitumen and Pipes shall be made by concerned **Executive Engineer** from the Contractor immediately.

The increase/ decrease in prices of Cement, Steel, Bitumen and Pipes for reimbursement / recovery shall be determined as follow-

(a) Adjustment towards differential cost of Cement.

V_c= (C_i-C_o) / C_o x Actual quantity of cement utilized in the work during the quarter under consideration x base price of cement as prevailing on the last stipulated date of receipt of tender including extension , if any.

V_c= Differential cost of cement i.e. amount of increase or decrease in rupees to be paid or recovered.

C = All India Wholesale price index for cement for the quarter under consideration as published by Economic Adviser , Govt. of India Ministry of Industry and Commerce New-Delhi.

C_o= All India Wholesale price index (as published by Economic Adviser , Govt. of India, Ministry of Industry and Commerce, New-Delhi) for cement as prevailing on the last stipulated date of receipt of tender.

b) Adjustment towards differential cost of Steel-

V_s= (S_i – S_o) x Actual quantity of steel utilized in the work during the quarter under consideration.

V_s= Differential cost of steel i.e. amount of increase or decrease in rupees to be paid or recovered.

S_i = Cost of the Steel as prevailed during the period under consideration as fixed by Steel Authority of India.

S_o = Base price of steel prevailing as on the last date of submission of tender including extension, if any.

c) Adjustment towards differential cost of Bitumen.

V_b = (B_i –B_o) x Actual quantity of bitumen utilized in the work during the quarter under consideration.

V_b = Different cost of bitumen i.e. amount of increase or decrease in rupees to be paid or recovered.

B_i = Average cost of bitumen prevailed during the period under consideration as fixed by IOCL / BPCL / HPCL

B_o = Base price of bitumen as prevailing on the last stipulated date of receipt of tender including extension, if any.

d) Adjustment towards differential cost of Pipes.

V = 0.85 x P_p /100 x R (P_i – P_o) / P_o

V_p = Differential cost of pipe i.e. amount of increase or decrease in rupees to be paid or recovered during the quarter under consideration.

P_p = Percentage of pipe component of the work as indicated in the clause 31 (d).

R = Value of work done during the quarter under consideration excluding the value of work executed under extra items , if any , at prevailing schedule of rates or derived rate.

P_i = All India whole sale index for the period under consideration as published by Economic Adviser , Govt. of India, Ministry of Industry and Commerce , New-Delhi for the type of pipe under consideration.

P_o = All India wholesale price index (as published by Economic Adviser, Govt. of India, Ministry of Industry and Commerce , New-Delhi) as on the last stipulated date of receipt of tender including extension , if any , for the type of pipe under consideration.

31.(b) REIMBURSEMENT / REFUND DUE TO STATUTORY RISE IN COST OF MINIMUM WAGES BY GOVERNMENT.

If after submission of the tender , the wages of labour increases or decreases as a direct result of the coming into force of any fresh law , or statutory rule or order beyond the wages prevailing at the time of the last date of submission of tenders including extensions , the contractor shall be eligible to get escalation due to such hike on the value of works executed during the stipulated period and during the validly extended period when the delay in completion is not attributable to the Contractor . If penalty is levied for delayed completion of the work, the contractor shall not be eligible to get escalation on labour on the value of works executed during the extended period.

The contractor shall within a reasonable time of his becoming aware of any alteration in the price of any such wages of labour , give notice there of to the Engineer-in-Charge stating that the same is given pursuant to this condition together with all information

relating there to which he may be in a position to supply. Engineer-in-Charge may call books of account and other relevant documents from the contractor to satisfy himself about reasonability of increase in prices of wages and actual payment thereof. For this purpose , the labour component of the work executed during period under consideration shall be the percentage (as specified in table below) of the value of work done during that period and the increase / decrease in labour shall be considered on the cost of minimum daily wages of any unskilled labour, fixed by the Government of Odisha under Minimum wages act.

The compensation for escalation for labour shall be worked out as per the formula given below:-

$V_i = 0.85 \times P_i /100 \times R (L_i - L_o) / L_o$

V_i = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates of minimum wages.

R = Value of work done during the quarter under consideration excluding the work executed under extra items , if any , at prevailing schedule of rates / derived rates.

L_o = The minimum wages for labour as noted by State Govt. as prevailing on the last stipulated date of receipt of tender including extension if any.

L_i = The minimum wages for labour as notified by State Government and as prevailed on the last date of the quarter previous to the one under consideration . In respect of the justified period extended , the minimum wage prevailing on the last date of quarter previous to the quarter pertaining to stipulated date of Completion or the minimum wage prevailing on the last date of the quarter previous to the one under consideration , whichever is less , shall be considered.

P_i = Percentage of labour component of the work, as indicated in the clause 31 (d)

31.(c) REIMBURSEMENT / REFUND DUE TO VARIATION IN PRICES OF POL.

Similarly, if during the progress of work, the prices of Diesel, Petrol, Oil and Lubricants increases or decreases as a result of the price fixed thereof by the Government of India and the Contractor there upon necessarily and properly pays such increased or decreased price towards Diesel, Petrol, Oil and Lubricants use in the execution of the work, then he shall be entitled to reimbursement or liable to refund, quarterly as the case may be such an amount as shall be equivalent to the plus or minus difference of 85% in between the price of POL which is operating for the quarter under consideration and that operated for the quarter of last date of receipt of bids as per the formula indicated below provided that the work has been carried out within the stipulated time or extension thereof as are not attributable to him. If penalty is levied for delayed completion of the work, the contractor shall not be eligible to get price escalation on POL on the value of works executed during the extended period.

Formula calculate the increase or decrease in the price of P.O.L.

$V_i = 0.85 \times P_i /100 \times R (F_i - F_o) / Fo$

V_i = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for P.O.L.

P_i= Percentage of P.O.L component of the work, as indicated in clause 31 (d) below-

R = Value of work done during the quarter under consideration excluding the work executed under extra items , if any , at prevailing schedule of rates / derived rate.

F_i = All India Wholesale price index for Fuel , Oil and Lubricant (High speed Diesel) for the quarter under consideration as published by Economic Adviser , Govt. of India , Ministry of Industry and Commerce , New- Delhi. In respect of the justified period extended, the rates prevailing at the time of stipulated date of completion or the prevailing rates of the period under consideration, whichever is less, shall be considered.

F_o = All India Wholesale price index for Fuel, Oil and Lubricant (High speed Diesel) as prevailing on the last stipulated date of receipt of tender including extension, if any.

31.(d) THE FOLLOWING PERCENTAGE WILL GOVERN THE PRICE ADJUSTMENT FOR THE ENTIRE CONTRACT FOR DIFFERENT TYPES OF WORKS AS APPLICABLE GIVEN INTHE FOLLOWING TABLE.

PERCENTAGE TABLE

Sl. No.	Category of works	% Component(Cost wise)		
		Labour	POL	Steel+Cement+

CONTRACTOR **EXECUTIVE ENGINEER**

			(P_i)	(P_i)	Bitumen+Other Materials*
1	R & B works (% of component)	Road works	5	5	90
		Bridge works	25	5	70
		Building works	25	-	75
2	Irrigation works (% of component)	Structural work	20	5	75
		Earth, Canal & Embankment work	25	10	65
3	P.H.Work	Structural work	25	5	70
		Pipeline work	5	-	Pipe -70% *Other material-25%
		Sewer Line	10	-	Pipe -70% *Other material-20%

***Note- Further break up may be worked out considering the consumption of Cement, Steel, Bitumen and Pipe in the concerned works for the period under consideration.**

31.(e) APPLICATION OF ESCALATION CLAUSE

i) The contractor shall for the purpose of availing reimbursement / refund of differential cost of Steel ,Bitumen , Cement , Pipe , POL and wages , keep such books of account and other documents as are necessary to show that the amount of increase claimed or reduction available and shall allow inspection of the same by a duly authorized representative of Government and further , shall at the request of the Engineer-in-Charge , furnish documents to be verified in such a manner as the Engineer-in-Charge may require any documents and information kept. The Contractor shall within a reasonable time of 15 days of his becoming aware of any alteration in the price of such material, wages of labour and / or price of POL give notice thereof to the Engineer-in-Charge stating that the same is given pursuant to this condition along with information relating thereto which he may be in a position to supply.

ii) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The first such payment shall be made at the end of three months after the month (excluding the months in which tender was accepted) and thereafter at three months intervals. At the time of completion of the work, the last period for payment might become less than 3 three months, depending on the actual date of completion.

Clause – 32 After the work is finished all surplus material and debris are to be removed by the contractor and preliminary works such as vats, mixing platforms etc. are to be dismantled and all materials removed from site. The ground up to 100'-0" wide from the building should be cleared and dressed.

FAIR WAGE CLAUSE

Clause – 33(a) The contractor shall pay not less than fair wage to labourers engaged by him on the work.

Explanation: "Fair wages" means wages, whether for time or price work prescribed by the State Public works Department provided that where higher rates have been prescribed under the Minimum Wages Act. 1948 wages at such higher rates would constitute "Fair wages" (W.D. No.22059 dt.16.8.77)

(b) The contractor shall, notwithstanding the provisions of any contract to contrary cause to be paid a fair wage to labourers indirectly engaged on the work including any labour engaged by his sub contractors in connection with the said work, as if the labours had been immediately employed by him.

(c) In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all regulation made by Government in regard to payment of wages, wage period deductions from wages, recovery of wages not paid and deductions unauthorisedly made, maintenance of wages register, wage cards, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of a like nature.

(d) The **Executive Engineer** or Sub-Divisional Officer concerned shall have the right to deduct, from the money due to contractor, any sum required or estimated to be required

for making good the loss suffered by a worker or workers by reason of non fulfillment of the conditions of the contract for the benefit of workers non payment of wages or of deductions made from his or their wages, which are not justified by their terms of the contract'" or non-observance of the regulations, money so deducted should be transferred to the workers concerned.

(e) Vis-à-vis the Government of Odisha, the contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity from his sub contractor.

(f) The regulations aforesaid shall be deemed to be part of this contract and any breach there of shall be breach of this contract.

(g) Under the provision of the Minimum Wages Act, 1948 & minimum wages (Central Rules, 1950) the contractor is bound to allow or cause, to allow to the labourers directly or indirectly employed in the works one day rest for six days continuous work and pay wages at the same rate as for duty, in the event of default. The Superintending Engineer or Sub-Divisional Officer concerned shall have the right to deduct the sum not paid on account of wages for weekly holiday to labourers and pay the same to the persons entitled there to from any money due to the contractor.

(h) The contractor shall at his own expense provide or arrange for the provision of foot wear for any labour doing cement mixing work and black topping of roads (The contractor has undertaken to execute under this contract) to the satisfaction of the Engineer-in-charge and on his failure to do so Government shall be entitled to provide the same and recover the cost from the contractor.

(i) The contractor shall submit by the 4th & 19th of every month, to the Engineer-in-charge a true statement showing in respect of the second half of the preceding month and the first half to the current month respectively (1) the number of labours employed by him on the work (2) their working hours (3) the wages paid to them (4) the accident that occurred during the said fortnight showing the circumstances under which they happened and the contend of damage and injure caused by them and (5) the number of female workers who have been allowed maternity benefit according the clause [K] and the amount paid to the Government a sum not exceeding **Rs.213.50** for each default of materially incorrect statement. The amount levied as fine as per decision of the **Executive Engineer** shall be final in deducting from any bill due to contractor.

(j) In respect of all labour directly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with a cause to be complied with all the rules framed by Government from time to time for the protection of health and sanitary arrangement for workers employed by the Odisha Public Works Department and its contractor. This will apply to work places having 50 or more workers.

(k) Maternity benefit rules for female worker employed by contractor, Leave and pay during leave shall be regulated as follows.

1- Leave:(i) **In case of Delivery:-** Maternity leave not exceeding 8 weeks, 4 weeks up to including the day of delivery or 4 weeks following that day.

(ii) **In case of Miscarriage: -** Up to 3 weeks from the date of miscarriage.

2. Pay (i) **In case of Delivery: -** Leave pay during maternity leave will be at the rate of women's average daily earnings calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date of which she gives notice that she expects to be confined or at the rate of Rs.213.50 a day whichever is greater.

(ii) **In case of Miscarriage :** Leave pay at the rate of average daily earnings calculated on the total wages earned on the days when full time work was done during a period 3 months immediately preceding the date of such miscarriage,

Conditions of grant of Maternity Leave: No maternity leave benefit shall be admissible to a women unless she has been employed for a total period not less than 6 months immediately preceeding the date on which she proceeds on leave.

MODEL RULES FOR HEALTH & SANITARY ARRANGEMENTS FOR WORKERS EMPLOYED BY ODISHA P.W.D. OR ITS CONTRACTORS

1. **Application:**

These rules shall apply to all construction work in charge of Odisha Public Works Department which are expected to continue for a year or more.

2. **Definitions**:

(i) "Work Place" means a place at which an average of fifty or more workers are employed in connection with construction work

(ii) Large work place means a place at which an average of 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 accessitle place first aid appliances including an adequate supply or sterilizer dressing and sterilized cotton wool. The appliances shall be kept in good order and in large work places they shall be readily available during working hours.

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

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

(d) Where large work places are situated in cities towns or in their suburbs and no beds are considered necessary owing to the proximity of city, town hospitals, an ambulance shall be provided to facilitate removal of urgent cases to these hospitals. At the work place some conveyance facilities such as a car shall be kept readily available to take injured persons or person to the nearest hospitals.

4. **Drinking Water:**

(a) In every work places, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of 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 shall be stored.

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

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

(e) The temperature of drinking water supplied to workers shall not exceed 90^0 F.

5. **Washing and Bathing Place:**

(i) Adequate washing and 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 in Latrines and Urinals:**

There shall be provided within the premises of every work place latrines and urinals in an accessible place; and the accommodation, separately for each of them shall not be less than the following.

(a)	Where the number of persons employed does not exceed 50.	No. of seats 1
(b)	Where the number of persons employed exceeds 50 but does not exceed 100	No. of Seats 3
(c)	For every additional 100 (in particulars cases the Superintending Engineer shall have the power to vary the scale where necessary)	No. of seats 3 per 100

7. **Latrine and Urinals for Women:** If women are employees, separate latrines and urinals separate from that for women and marked in the vernacular in conspicuous letter "for women only" shall be provided on the scale laid in rule.

Those for men shall be similarly marked " for men only" A poster showing the figure of a men and women and shall also be exhibited at the entrance of Latrines for each sex. There shall be adequate supply of water close to the urinals and latrines.

8. **Latrines and Urinals** : Except in work places provided with water flushed latrines connected with a water borne sewerage system, all latrines shall be provided with receiptable on dry-earthen system which shall be cleaned at least four times daily and at least twice during working hours and kept in a strictly sanitary condition. The receiptables shall be tarred inside and out side at least once a year.

9. **Construction of Latrines:** The inside wall shall be constructed of masonry or stone materials and shall be cement washed inside and outside at least once a year. The dates of cement washing shall be noted in register maintained for this purpose, and kept available for inspection.

10. **Disposal of excreta :** Unless otherwise arranged for by the local sanitary authorities arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator approved by as, Director of Public Health of Municipal Medical Officer or Health at the case may be, whose jurisdiction the work place is situated. Alternatively excreta may be disposed of by putting a laver of night soil at the bottom of pucca tank prepared for the purpose and covering it with 6' layer of waste or refuse and then covering it up with a layer of earth for a fortnight (when it will turn in to manure).

11. **Provision of shelters during rest:** At every work place, there shall be provided free of cost two suitable sheds one for females and the other for rest for the use of labourers. The height of the shelter shall be less than 11 feet from the floor level the lowest part of the roof.

12. **Creche :** At every work place at which more than 50 women workers are employed, there shall be provided only one hut for the use of children under the age of 6 year, belonging to such women and shall be used for infant's games and play and their bed room. The huts shall not be constructed on a lower standard than the following.

i) Thatched huts

ii) Mud floors and walls.

iii) Planks spared over the mud floor and covered with matting.

a) The hut shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision for sweepers to keep the place clean. There shall be two dhai in attendance. Sanitary utensil shall be provided to the satisfaction of the Health Officer of the area concerned. The use of the hut shall be restricted to Children, their attendants and mothers of the children.

b) Where the number of women workers is more than 50 the contractor shall provide one hut and Dhai to look after the Children of women workers.

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

d) The crèche shall be properly maintained and necessary equipments like toys etc. shall be provided.

13. **Canteen:** A cooked food canteen :- on a moderate scale shall be provided for the benefit of workers whenever it is considered expedient.

CONTRACTOR'S LABOUR REGULATIONS

1. **Short title**: - These regulations may be called "The Odisha Public Works Department / Electricity Department Contractor's Regulations".

2. **Definition:** In these Regulations, unless otherwise expressed or indicated the following words and expressing shall have the meaning hereby assigned to them respectively, that is say:

(a) "Labour" means a worker employed by a contractor for the work **d**irectly or indirectly through a sub-contractor or other person, by an agent on his behalf.

(b) Fair wages means wages whether for time or piece work prescribed by the **Executive Engineer, Keonjhar Irrigation Division, Keonjhar, Odisha** provided that where high

rates have been prescribed under the minimum wages Act 1948 wages at such higher rates would constitute fair wages (W.D. No.22059 dt,16.8.77)

(c) "Contractor" shall include every person whether a sub-contractor or headman or agent employing labour on the work taken on contract.

(d) "Wages" shall have the same meaning as defined in the payment of wages Act. And include time and piece rate wages if any.

3. **Display of notices regarding ways, etc.:-**

The contractor shall:-

(a) Before he commences his work on contract display, and correctly maintain and continue to display and correctly maintain, in a clean and legible condition in a conspicuous places on the work, notice in English and in the local Indian language spoken by the majority of the workers giving the rate of wage prescribed by State Public Works Department/ **Executive Engineer, Keonjhar Irrigation Division, Keonjhar, Odisha** for the district in which the work is done.

(b) Send a copy of such notices to Engineer-in-charge of the work.

4. Payment of Wages :-

(a) All wage shall have to be paid in cash in current coin or currency or in both.

(b) Wages due to every worker shall be paid to him direct.

5. Fixation of wages periods :-

(a) The contractor shall fix the wage period in respect of which the wages be payable.

(b) No wage period shall exceed one month.

(c) Wage of every workman employed on the contract shall be paid before the expiry of ten days, after the last day of the wage period in respect of which the wages are payable.

(d) When the employment of any worker is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the day succeeding the one on which his employment is terminated.

(e) All payment of wages shall be made on a working days

6. Wage book and wage cards etc.

1) The contractor shall maintain a wage book of each worker in such forms as may be convenient, but the same shall include the following particulars:-

   a. Rate of daily or monthly wages.
   b. Nature of work on which employed.
   c. Total number of days worked during each wage period.
   d. Total amount payable for the work during each wage period.
   e. All deductions made from the wages with an indication in each of the ground for which the deduction is made.
   f. Wage actually paid for each wage period.

2) The contractor shall also maintain a wage card for each worker employed on the work.

3) The **Executive Engineer** may grant an exemption from the maintenance of wage bond, wages cards to a contractor who, in his opinion may not directly or indirectly employ more than 100 persons on the work

7. Fines and deduction, which may be made from wages.

1) The wages of a worker shall be paid to him without any deductions of any kind except the following.

   a) Fines.

b) Deduction for absence from duty, i.e. from the place or places where by terms of his employment he is required to work. The amount of deductions shall be in proportion to the period for which he was absent.

c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody' or for loss on money for which he is required to account where such damage or loss is directly attributable to his neglect or default.

d) Any other deduction which the Odisha Government may from time to time allow.

3) No fines shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity of showing abuse against such fines or deduction.

4) The total amount of fines which may be imposed in any one wage period on a works shall not exceed a amount equal to Five paise in a rupee of the wages payable to him in respect of that wage period.

5) No fine imposed on any worker shall be recovered from him by installments after the expiry of 60 days from the date on which it was imposed.

8. Register of fines, etc.

1) The contractor shall maintain a register of fines and of all deduction for damage or loss. Such register shall mention the reason for which fine was imposed or deduction for damage or loss was made.

2) The contractor shall maintain a list in English and in the local Indian language clearly defining acts and omissions for which penalty of fine can be imposed. It shall display such list and maintain it in a clean and legible condition in conspicuous place on the work.

9. **Preservation of register:**

The wage register, the wage cards and the register of fines, deduction required to be maintained under these regulations shall be preserved for 12 months after date of the last entry made in them.

10 **Powers of Labour Welfare Officers to make investigation or enquiry**

The labour Welfare Officers or any other persons authorized by the Government of Odisha on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the fair wage clauses and the provision of these regulations. He shall investigate into any complaint regarding default made by the contractor, sub contractor in regard to such provisions.

11. **Report of Labour Welfare Officers:**

The Labour Welfare Officers or others authorized as aforesaid shall submit a report of the results of his investigation of enquiry to the Superintending Engineer concerned indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the contractor's bill be made and the wages and other dues be paid to the labourers concerned.

12. Appeal against the decision of Labour Welfare Officers.

Any persons aggrieved by the decision and recommendation of the Labour Welfare Officer or other person so authorized may appeal against such decision to the Labour Commissioner 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 contractor.

13. Inspection of registers:

The contractor shall allow inspection of wage book, card to any of his worker or his agent at a convenient time and place after due notice is received, or to the Labour Commissioner or any other person authorized by the Government of Odisha on his behalf.

14. Submission of return :

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

15. Amendment:

The Government of Odisha may from, time to time add to or amend these regulations and on any question as to the application interpretation of effect of the regulations the decision of the

Labour Commissioner or any other persons authorized by the Government of Odisha in that behalf shall be final.

Clause – 34 The incentive @1% in case of completion of work (**Rs.10 crore & above**) ahead of one month (part of the month shall be excluded) and the maximum amount payable will be fixed at 2% if the work is completed two months ahead at the schedule time shall be payable to the contractor. (Ref. Work Dept. Order No. 8310 dt. 17.05.2006) on approval of competent authority.

DELETED

Clause – 35 DELETED

Clause - 36 The terms and conditions of the agreements have been read/ explained to me and certify that I/We clearly understand them.

1. ADDENDUM TO CONDITION OF CONTRACT:

1.1. The bidder / Tender whose bid has been accepted will be notified of the award by the Engineer-in-Charge prior to expiration of the validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the conditions of contract called the ("Letter of Acceptance") will state the sum that the Engineer-in-Charge will pay the contractor in consideration of the execution, completion and maintenance of the works by the contractor as prescribed by the contract (hereinafter and in the contract called the "Contract Price").

1.2 The notification of award will constitute the formation of the contract, subject only to the furnishing of a performance security (ISD) and additional performance security in accordance with the provisions of the agreement.

1.3 The agreement will incorporate all agreements between the officer inviting the bid/Engineer-in-Charge and the successful bidder. Within 15 days following the notification of award alongwith the letter of acceptance, the successful bidder will sign the agreement and deliver it to the Engineer-in-Charge. Following documents shall form part of the agreement.

a) The notice inviting bid, all the documents including additional conditions specifications and drawing, if any, forming the bid as issued at the time of invitation of bid and acceptance thereof together with any correspondence leading thereto & required amount of performance security including **additional performance security**.

b) Standard P.W.D. Form P-1.

2. TIME CONTROL

2.1 Progress of work and Re-scheduling programme

2.1.1. The Superintending Engineer / Engineer-in-Charge shall issue the letter of acceptance to the successful contractor. The issue of the letter of acceptance shall be treated as closure of the bid process and commencement of the contract.

2.1.2. Within 15 days of issue of the letter of acceptance, the contractor shall submit to the Engineer-in-Charge for approval and programme commensurate to clause no 3 showing the general methods, arrangements, and timing for all the activities in the works along with monthly cash flow forecast.

2.1.3. To ensure good progress during the execution of the work the contractors shall be bound in all cases in which the time allowed for any work exceeds one month to complete, 1/4th of the whole of the work before 1/4th of the whole time allowed under the contract has elapsed, ½ of the whole of the work before ½ of the whole time allowed under the contract has elapsed, 2/th of the whole of the work before 3/4th of the whole time allowed under the contract has elapsed.

2.1.4. If at any time it should appear to the Engineer-in-Charge that the actual progress of the works does not conform to the programme to which consent has been given, the contractor shall produce, at the request of to such programme necessary to ensure completion of the works within the time for completion. If the contractor does not submit an updated programme within this period, the Engineer-in-Charge may withhold the amount of 1% of the contract value from the next payment certificate and continue to withhold this amount until the next payment after the date on which the over due programme has been submitted.

2.1.5. An update of the programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.

2.1.6. The Engineer-in-Charge's approval of the programme shall not after the contractor's obligations. The contractor may revise the programme and submit it to the Engineer-in-Charge again at any time. A revised programme is to show the effect of variations and compensation events.

2.2. Extension of the completion date.

2.2.1. The time allowed for execution of the work as specified in the contract data shall be the essence of the contract. The execution of the works shall commence from the 15th Day or such time period as mentioned in letter of award after the date on which the Engineer-in-Charge issues written orders to commence the work or from the date of handing over of the site whichever is later. If the contractor commits default in commencing the execution of the work as aforesaid, Government shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the earnest money and performance guarantee / security deposit absolutely.

2.2.2. As soon as possible after the contract is concluded the contractor shall submit a Time & Progress Chart for each milestone and get it approved by the Department. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works, it shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the contract documents and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per milestone given in contract data.

2.2.3. Incase of delay occurred due to any of the reasons mentioned below, the contractor shall immediately give notice thereof in writing to the Engineer-in-Charge but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

For

i. Abnormally bad weather, or
ii. Serious loss or damage by fire, or
iii. Civil commotion, local commotion of workmen, strike or lockout, bx officers any of the heads employed on the work, or
iv. Delay on the part of other contractors or trade men engaged by Engineer-in-Chief, in executing work not forming part of the contract.
v. Incase of variation is issued which makes it impossible for completion to be achieved by the Intended Completion Data without the Contractor taking steps to accelerates the remaining work and which would cause the contractor to incur additional cost, or.
vi. Any other cause, which in the absolute discretion of the authority mentioned, in contract data is beyond the contractor's control.

2.2.4 Request for re-schedule and extension of time, to be eligible for consideration shall be made by the contractor in writing fourteen days of the happening of the event causing delay. The Contractor may also, if practicable, indicate in such a request the period for which extension is desired.

2.2.5 In any such case a fair and reasonable extension of time for completion of work may be given. Such extension shall be communicated to the Contractor by the Engineer-in-Charge in writing. Within 3 months of the date of receipt of such request, Non-application by the contractor for extension of time shall not be a bar for giving a fair and reasonable extension by the Engineer-in-Charge and this shall be binding on the contractor.

2.3 Compensation for delay.

2.3.1 If the contractor fails to maintain the required progress in terms of clause 2 or to complete the work and clear the site on or before the contract or extended date of completion he shall without prejudice to any other right or remedy available under the law to the Government on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the **Executive Engineer** (whose decision in writing shall be final and binding) may decide on the amount of tendered value of the work for every completed day/month (as applicable) that the progress remains below that specified in Clauses 2 or that the work remains incomplete.

This will also apply to items or group of items for which a separate period completion has been specified Compensation @ 1.5% per month or for delay of work, delay to be computed on per day basis.

The existing relevant provision in the original documents shall stand modified accordingly. Provided always that the total amount of compensation for delay to be paid under this condition

shall not exceed 10% of the Tendered Value of work or to the Tendered Value of the item or group of items of work for which separate period of completion is originally given.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Government. In case, the contractor does not achieve a particular milestone mentioned in conditions of contract or the rescheduled milestone (s) in items of relevant clause, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of extension of time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice the contract. However, if the Contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor files to make up for the delay in subsequent milestone(s) amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest whatsoever, shall be payable on such withheld amount.

2.4 Management Meetings

2.4.1 Either the Engineer or the Contractor may requires the other to attend a management meeting. The business of a management meeting shall be review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

2.4.2. The Engineer shall record the business of management meetings and to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either the management meeting or after the management meeting and stated in waiting to all who attended the meeting.

SECTION – 5

TECHNICAL SPECIFICATIONS

CONTRACTOR **EXECUTIVE ENGINEER**

CHAPTER –1
GENERAL SPECIFICATION

The terms, the Indian Standard Specification herein after referred to as BIS as used therein, means the relevant Bureau of Indian Standard codes with all amendments published up to date. A statement of relevant BIS is applicable to this contest is enclosed.

LIST OF INDIAN STANDARDS

Sl. No.	Short Title	B.I.S Number/ year/ Reaffirmed year
(I)	**CEMENT**	
1.	Specification to ordinary and Low heat Portland cement	269-1989
2.	Specification for Portland Pozzolana Cement	1489-1991
3.	Portland Slag Cement (Third revision)	455-1989
4.	Method for physical tests for hydraulic cement (Reaffirmed 1980)	4031-1996
5.	Method of Chemical analysis for hydraulic cement (First revision)	4032-1990
6.	Rapid hardening Portland cement	8041-1978
7.	Hydrophobic Portland cement	8043-1978
8.	High Strength ordinary Portland cement	8112-1976
(II)	**AGGREGATES**	
1.	Specification for coarse and fine Aggregates from natural source for concrete	383-1997
2.	Specification for sand for masonry mortars	2116-1998
3.	Method of Tests for aggregates for concrete	2385-1997 (Part I to Part VIV)
4.	Standard sand for testing of cement (First revision) with amendment 1 and 2 Reaffirmed 1980	650-1991
5.	Methods for sampling of aggregates for concrete	2430 -1969
6.	Method of test for determining aggregates impact value of soft coarse aggregates	5640-1970
(III)	**STEEL**	
1.	Code of practice for bending and fixing of bars	2502-1990
2.	Specification for cold worked steel deformed bars for concrete reinforcement	1786-1995
3.	Code of practice for welding of MS Bars used for reinforced concrete construction.	2751-1966
4.	Code for practice for use of Metal are welding for general construction of mild steel	818-1989
5.	Deformed bars for concrete reinforcement hot rolled mild steel and medium tensile steel (Revised)	1139-1966
6.	Recommendations for detailing of reinforcement in reinforced concreted works	5525-1990
7.	Specification for Mild Steel and medium tensile steel Bars for Concrete reinforcement.	432-1995 (Part I)
8.	Code for practice for safety and health requirement in Electric and Gas welding and cutting operations	818-1968
9.	Code for practice for fire precautions in welding and cutting operation.	3016-1965
10.	Measurement of building and Civil Engineering works, method part VIII steel work and iron work	1200-1997 (Part VIII)
11.	Code of procedure for manual or metal ARC and welding of Mild steel	823-1964
12.	Specification for filler rods and wires for gas welding	1278-1972
13.	Recommendations for welding cold worked steel bars for reinforced concrete construction	9417-1979
14.	Hard drawn steel wire fabrics for concrete reinforcement	1566-1995
(IV)	**CONCRETE**	

1.	Method of Measurement of building and Civil Engineer works Part-II cement concrete works.	1200-1997 (Part-II)
2.	Code of practice for plain and reinforced concrete	456-2000
3.	Specification for pre cast concrete coping blocks.	5751-1997
4.	Methods of tests for strength of concrete	516-1999
5.	Code of practice for laying in situ cement concrete lining on canals	3873-1993
6.	Specification for Admixtures for concrete	9103-1999
7.	Method of Test for Autoclaved cellular concrete products.	6441-1977-73 (Part-I to IX)
8.	Method of Sampling and Analysis of concrete	1199-1999
9.	Specification of Batch type concrete mixtures	1791-1963
10.	General requirements for Concrete Vibrators immersion type	2505-1999
11.	Specification for concrete vibrating tables	2514-1963
12.	Method of test for permeability of cement mortar & concrete	3085-1997
13.	Specification for fly ash for use as pozzolana as admixture for Concrete	3812-1999 Part-II)
14.	Specification for Portable swing weigh batch for concrete (single and double bucket type)	2722-1964
15.	Code of practice for installation of joints in concrete pavements	6509-1995
16.	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures	457-1991
17.	General requirement for concrete vibrator screed board type (First revision)	2506-1990
18.	Code of practice for concrete structures for shortage of liquids	3370(Part-1 to 4)
19.	Code of practice for use of immersion vibrator for consolidating concrete (First revision)	3558-1999
20.	Method for testing performance of batch type concrete mixer	4634-1990
21.	From vibrators for concrete	4656-1991
22.	Concrete batching and mixing plant	4925-1991
23.	Ready mixed concrete (First revision)	4926-2003
24.	Code of practice for sealing joints in concrete lining on canals	5256-1998
25.	Vibrating plate compactor	5889-1994
26.	Concrete transit mixer and agitator	5892-1991
27.	Concrete pavers	7245-1991
28.	Concrete slump test apparatus	7320-1999
29.	Method of making curing and determining compressive strength of accelerated cured concrete test specimen	9013-1999

(V) EARTH WORK

1.	Method of Measurement of building and Civil Engineering Works Part I, Earthwork.	1200-1997 (Part-I)
2.	Safety code for piling and other deep foundations	5121-1995
3.	Code of practice for Design installation, observation and Maintenance of uplift pressure pipes for Hydraulic structures on permeable foundation.	6532-1991
4.	Safety code for excavation works	3764-1996
5.	Code of practice for protection of slope for Reservoir embankment	8237-1997
6.	Code of practice for earth work on canals	4701-1995
7.	Guidelines for lining of canals in expansive soils	9451-1991
8.	Method of test for soils Part-II Determination of water concrete	2720-1973 (Part-II)
9.	Method of test for soils Determination of water content dry density relation using light compaction.	2720-1995 (Part-VII)
10.	Method of test for soils determination of dry density of soils in place by the sand replacement method	2720-1995 (Part-XXVIII)
11.	Method of test for soils determination of dry density of soils in place by the core cutter method	2720-1995 (Part-XXIX)
12.	Classification and identification of soils for general	1498-1997
13.	Safety code for blasting and related drilling operation with Amendment No. I (Reaffirmed 1978)	4081-1995
14.	Portable Pneumatic drilling machine (First revision)	5441-1991
15.	General requirement for black hold drilling rigs	7209-1991
16.	Safety code for working with construction machinery	7293-1996
17.	Code of practice for stability analysis of earth dams	7894-1997
18.	Guidelines for design of under seepage control measures for	8414-1999

	earth and rock fill dams	
19.	Filtration media sand and gravel	8419-1996 (Part-I)
20.	Guidelines for design of large earth and rock fill dams	8826-1998
21.	Under drainage arrangements of lined canals.	4558-1995
22.	Pre-cast cement concrete stables for canal lining	3868-1995
23.	Methods of tests of soils	2720 (Part-1 to X)
24.	Ammonium nitrate for explosive	4668-1991
25.	Method of test for commercial blasting explosives and accessories.	6609 (Part-1 to V)
26.	Detonators	7632-1990
27.	Method of load test on soils (Second revision)	1888-1997
28.	Method for standard penetration test for soil (First revision)	2131-1997
29.	Glossing of terms and symbolic relating to soil engineering.	2809-1995
30.	Method of sampling and preparation of stabilized soils for testing	4332(Part-I) 1995
31.	Test in over burden	5529 (Part-1)1969

(VI) OTHER SUBJECTS

1.	Safety code for scaffolds and ladders part I scaffolds	3696-1996
2.	Safety code for scaffolds and ladders Part 2 ladders.	3696-1996 (Part-II)
3.	Recommendation s on stacking and storage of construction materials at site.	4082-1996
4.	Plywood for general purposes (Second revision amendment 1 to 3)	303-1998
5.	Test Sieves	460-1990
6.	Code practice for under drainage of lined canals (2nd revision)	4558-1995
7.	Code of for practice for in situ permeability test	5529 (Part-1 & 2)
8.	Structural steel (Standard quality) (with amendment No.1 to 3)	IS: 226-1975
9.	Hard drawn steel wires (Third revision)	432-1982 (Part-II)
10.	Concrete pipes (with and without reinforcement) (2^{nd} revision)	458-1988
11.	Code of practice for lying of concrete pipes	783-1959
12.	Specification for mild steel tubes, tubular and other wrought Steel fittings Part-I mild steel tubes (fourth revision) (With Amendments No. 1 to 5)	1239-1979
13.	Hard drawn steel wire fabric for concrete reinforcement (Second revision)	1566-1995
14.	Asbestos cement pressure pipe (Second revision)	1592-1996
15.	Preformed filler for expansion test in concrete payment and structures (non extruding and resilient type)	1838-1995
16.	Cast iron detachable joints for use with asbestos cement pressure pipes.	IS:8794-1978
17.	Structural steel (Fusion welding quality) (Second revision)	IS: 2062-1999
18.	Code of practice for laying of cast iron pipe (With amendment No. I)	IS: 3114-1994
19.	Methods of testing for concrete pipes	IS 3597-2003
20.	Rubber sealing rings for gas mains water mains and sewers	IS: 5382-1969
21.	Centrifugally cast (spun) iron low pressure pipes for water gas and sewage (First revision)	IS: 6163-1978
22.	Code of practice for laying of asbestos cement pressure pipes	IS: 6530-1997
23.	Cast iron detachable joints for use with asbestos cement pressure pipes.	IS: 8794-1978
24.	Other Publications: Ministry of shipping and transport Specification for Road and Bridge works No. 7900	

(VII) STONE PITCHING AND LAUNCHING APRON

1.	Methods of test for determination of strength properties of natural building stone.	IS: 1121-1998 (Part-1 to 4)
2.	Method of test determination of true specific gravity of natural building stone (First revision)	IS: 1122-1998
3.	Method of identification of natural building stone (1^{st} Revision)	IS: 1123-1998
4.	Method of test for determination of water absorption apparent specific gravity and porosity of natural building stone (1^{st} Revision)	IS: 1124-1998
5.	Method of test for determination of weathering of natural building stones (First revision)	IS: 1125-1998
6.	Method of test for determination of durability of natural building stone (First revision)	IS: 1126-1998
7.	Recommendations for dimensions and workmanship of natural building stones for masonry work (First revision)	IS: 1127-1998

8.	Recommendation of dressing of natural building stone (1st Revision)	IS:1129-1998
9.	Sand for plaster (First revision)	IS:1542-1999
10.	Code of practice for construction of stone masonry	IS: 1597-1996
11.	Rubble stone masonry	IS: 1597-1996 (Part 1to II)
12.	Method for determination of resistance to wear by abrasion of natural building stones (1st Revision)	IS: 1706-1998
13.	Sand for masonry mortars (1st Revision)	IS: 2116-1998
14.	Code of practice for preparation and use of masonry mortars (1st Revision)	IS: 2250-1995
15.	Stone facing	IS: 4101-1995 (Part-I)
16.	Method of test for determination of water transmission rate by capillary action through natural building stones	IS: 4121-1998
17.	Method of test for surface softening of natural building stones by exposure to acidic atmospheres	IS: 4120-1998
18.	Methods of test for determination of permeability of natural building stones (1st Revision)	IS: 4348-1998
19.	Method of test for toughness of natural building stones	IS: 5218-1998
20.	Gujarat State, Section 2, Engineering properties of building stones	IS: 7779-1975 (Part1/Sec.2)
21.	Recommendation practice for quarrying stones for construction purpose.	IS: 8881-1977

Notes: *In addition to the relevant BIS codes, the specifications prescribed and guidelines issued by Central water Commission for Standard Specifications shall be followed where BIS specifications are not available.*

General Information

1.0. SCOPE OF WORK

The work pertains to **"Improovement to Jamunaposi Minor from RD 2511m to 2611m (Construction of Troughwall) for the year 2026-27."** in the District of **Kendujhar** of the State of Odisha.

1.1. LOCATION OF WORK SITE.

The work site about 230 Km. from the State Capital, Bhubaneswar and the place is about 19 km from Kendujhar.

1.2 TRANSPORTATION/ COMMUNICATION FACILITIES :

The Jamunaposi village is approachable by all weather roads. Trucks, buses and small vehicles ply regularly and frequently along the MDR from **SH-49**..

1.3 GENERAL INFORMATION

The information and data related to work and site conditions described thereafter, represent the site conditions in general. It shall be presumed that the contractor visits the site, of proposed works and satisfies himself, as to the nature and location of work and local conditions in general and particularly about the availability of electrical power supply, water supply, storage and handling of materials, disposal of soil, road communication data and bore hold data, availability of labour and other related matters, planning for execution etc. before quoting his percentage rate for the work. The department therefore will not bear any responsibility of site conditions and consequence thereof.

1.4 AVAILABLITY OF LABOUR

Labour required for the works may be available to some extent in the vicinity of project area. It is preferable to engage local people as far as practicable. However, the contractor must make his own arrangements for execution of works after proper assessment of availability and requirement of labour and/ or machineries and equipments.

1.5 TOWNS:

The town Keonjhar is approximately 19KM from work site. There are two small towns approximately at a distance of 5KM are available very close to the work site for day to day marketing purpose

1.6 AVAILABILITY OF DIESEL AND LUBRICANT.

Diesel, Petrol and other Lubricants to public are available from Diesel/Petrol pumps within 15 K.Ms from the work site.

1.7 OBSERVATION OF RULES

a) The contractor shall take all precautions to ensure safety to the workers. The Department will not take any responsibility for any accidents that may occur on the contractor's installations and execution.

b) The contractor shall take action to rectify the defects, if any in the installation, constructions pointed out by the Departmental Engineer in a reasonable time.

1.8 HOUSING

Private houses may be available for housing in nearby villages of the work site. But the Contractor shall make his own arrangements for housing the labourers, materials, staff and site offices at the work site.

1.9 ELECTRIC POWER FOR CONSTRUCTION PURPOSE

The contractor will take steps to illuminate the work site, borrow area and portions of haul roads as may be required while carrying out the work at his own arrangements. No compensation will be paid to the contractor due to failure of electricity to any or entire part of the work site resulting in stoppage of work and the idle labour. The electric supply for the domestic purpose of the contractor for his labourers will be entirely his responsibility. Supplying electricity as per his requirement to work site, office/camps, stores, workshops, equipments/machineries, crushers' quarries etc. shall be made by the contractor. The contractor has to make his own arrangement to get power supply from NESCO Authorities. If electricity is supplied by the department, the contractor may avail the facility on payment as fixed by the department from time to time.

1.10 MEDICAL AID

There is a Public Health Centre near Project site at and a Government Hospital is available at Kendujhar. The Contractor shall make at his own cost for the first aid arrangements at various work locations in accordance with rules and regulations of prevailing Labour Acts.

1.11 LOCAL ROADS

The existing approach roads to the site of work, to the extent available, can be used by the Contractor. The contractor shall, however construct & maintain connecting roads within the working area and in his labour colony areas including drainage crossings. The contractor shall

construct and maintain haul roads, and other approach roads including river and drainage crossing etc. as may be necessary for the proper execution of the work at his own cost.

1.12 DUMP AREAS

Materials excavated from the foundations and in connection with other items of work shall be dumped as per the direction of Engineer-in-charge, issued from time to time at designated dump yard only. The Contractor shall construct and maintain all approach/haul roads to the working areas at his own expenses.

1.13 OTHER CONTRACTORS

In the matter of dumping, haul roads, diversions, excavations etc., the Contractor shall take into consideration the needs and requirements of other Contractors if any, working in the vicinity. There should be proper and adequate co-operation between the Contractors working in the vicinity. Further, no contractor shall make or cause disruptions, discontent or disturbance to the work, labour or arrangements etc. of the other contactors in the neighborhood.

1.14 USE OF SITES

a) The Contractor will be permitted to use without any charge the site and lands as available for sparing under the control of project authorities, required for execution of work. The contractor shall not commence any operation on such lands except with the prior approval of the Engineer-in-charge.

b) All areas of operation, including those of staff and labour colonies shall be cleared and handed over to the Engineer-in-charge, after completion/ recession of contract. While handing over, the contractor shall make good to the satisfaction of the Engineer-in-charge to any damage or alteration made to areas or other property or land handed over to him for purpose of the work.

c) Temporary structures may be created by the Contractor for storage sheds, office, residence etc for non-commercial use on the land handed over to him, at his expenses and with the permission of Engineer-in-charge. After the completion of the work, these structures should be dismantled and the site cleared and handed over to the Department. The lands required for providing amenities, in connection with the work, will be given free of cost from the Government lands..

1.15 FLOODS

In case of flash flood in the drains and untimely rain during the working season i.e. resulting in overtopping of coffer dam and flooding of the work areas, the Contractor shall make his own arrangements at his own cost to shift the machineries, equipments, materials, labours and if any, departmental machineries hired by the contractor to a safe place. The work shall have to be resumed after receding of floods and necessary strengthening of cofferdam and de-watering will be done by the contractor at his own cost. Suitable extension of time shall however be granted on such occasions for the loss of working time at the request of the contractor.

The silt, debris, sand and other materials accumulated in the working area, due to floods and rain either in monsoon or in non-monsoon, shall be removed by the contractor as required for continuing the work at his own cost. By any chance, if any excavated portion, which could not be filled with concrete or earth by the Contractor, gets filled up during rain/ flood with earth and silt, its removal will not be paid again. The contractor will have to re-excavate such portion of work at his own cost.

It shall be distinctly understood that it is entirely the responsibility of the contractor to make such arrangements as may be required from time to time to protect the men, machineries, materials etc. and the work under progress or already completed i.e. the work for which the measurements were recorded, payment were made etc. If the damages occur either on items in progress or on completed items within defect liability period, then department accepts no liability whatsoever for any amount of damage to work or loss of men, materials, machineries etc. or hindrance caused to the progress. The contractor shall make it good at his own cost.

CHAPTER-2

2.0 GENERAL SPECIFICATION:

2.0.1 The enclosed drawings in the bid document give board dimensions and outline of the works to be executed through this contract. These drawings may however be revised/ modified from time to time and supplementary additional drawing(s) may also be issued as per necessity. During the course of execution there may be changes in dimensions, specifications and shapes of components. The changes in the drawings can be done without any way deviating the terms of the contract and the contractor is to execute the work as per revised drawings and specifications at the same rate as agreed upon for the work awarded under the original contract. The contractor shall not proceed with the work without approved drawings issued by the Engineer-in-Charge. He shall check all drawings and specifications carefully and advise the Engineer-in-charge with immediate effect, if any discrepancies, errors and omissions are found where upon the **Executive**

Engineer will prepare revised additional drawings and specifications as may be required to suit the stage of the work and will provide for work.

2.0.2 Where the drawings are not consistent with the text of the specifications, the text shall govern.

2.0.3 The rates shall be for finished items of works as per description in schedule of quantities and according to drawings, specification and conditions of contract in the Agreement and provisions in Bureau of Indian Standards and shall include all general and incidental charges which will not be paid separately. Such general and incidental charges are listed in succeeding Para for the convenience of the Bidders but are not exhaustive. Omission of any such items here in but required for delivering finished items of work, shall not be plea, that such items are not covered by the rate quoted by the Bidders.

2.0.4 Formation and maintenance of haul roads including river and drainage crossings within the work site is to be made by the Contractor at his own cost. The existing approaches and haul roads, if any under the control of the Department may be made use of but improvement, if required shall be done by the contractor at his own cost.

2.0.5 Labour and materials required for construction of reference points, benchmark pillars etc. for setting out work shall be at contractor's cost.

2.0.6 Scaffolding/ staging and gang-ways as and when required for the work will be done by the contractors at his own cost. No additional payment in this regard, will be entertained.

2.0.7 The finished item rates quoted by the Bidders include all leads, lifts & de-lifts, fees, taxes, incidental charges, idle labour charges, royalty if any etc.

2.0.8 Centering, shuttering i.e. Form work complete includes cost of materials, labour, maintenance, erection and removal.

2.0.9 Construction of coffer dam, dewatering of any water, which may accumulate in the areas required for carrying out the items under schedule of quantities, includes the initial dewatering of the period formed after the formation of coffer dam or any type of cross bund and all seepage that may accumulate in the area before or during construction.

2.0.10 Protection of components of work during the rainy season shall be the responsibility of the contractor. The responsibility for the safety of the structure rests, entirely on the contractor and any damages that may occur has to be made good by the contractor at his own cost.

2.0.11 The sequence of construction adopted by the Contractor shall have to be approved by the competent authority.

2.0.12 The contractor has to make his own design for coffer dam or any type of cross bund required during course of execution. All materials for the coffer dam or cross bund shall be arranged by the Contractor at is own cost. The contractor shall maintain the coffer dam till completion of the work.

2.1 CONSTRUCTION MATERIALS:

2.1.1 Before collecting materials required for execution of the respective items of work as laid down in the schedule of quantities and in the detailed specifications descried hereafter in the subsequent sections, the contractor shall ensure that samples of materials proposed to be used are first approved by the Engineer-in-charge. When directed the samples of materials proposed to be used should be furnished to the Departmental Quality Control Laboratory for testing through the field staffs.

2.1.2 All such testing charges shall be borne by the Contractor. At the same time, the contractor will provide necessary assistance if required for collection and sending of samples to the Departmental Q. C. Laboratory as directed.

2.1.3 On the basis of satisfactory test results confirming to technical specification collection of materials shall be started in the field. The testing of materials shall be checked in the field Laboratory by the Department as well as staff of Quality Control Organization and designated SQM appointed by the Department. If any, field test result is found unsatisfactory; the materials shall be rejected and shall be removed from work site by the contractor at his own cost. In no case the defective materials shall be used in the work.

2.1.4 On receipt of notice from the Engineer-in-Charge and/or observation of Quality Control Division, in charge of the project, the contractor will rectify the defects within the stipulated period as well as within the defect liability period, at his own cost. If the defects are not rectified, the Engineer-in-charge shall assess the cost, get the defect rectified and recover the cost for the same from the dues of the contractor.

2.1.5 A quarry chart indicating possible source of materials may be seen in the office of the **Executive Engineer, Keonjhar Irrigation Division, Keonjhar** The quarry chart is only an indication of source of material and the department does not accept the responsibility if the materials are not available in full quantity and quality. The contractor must however satisfy himself after inspection of quarry site and consultation with the concerned departments that the materials will be made available to him. Department shall not bear any responsibility for non-availability of quarry materials as per required specification and quality or quantity in the quarries shown in the departmental quarry chart.

2.1.6 No claim for carriage of water required for work or workmen whatsoever will be entertained. The Contractor will arrange required quantity & quality water at his own cost.

2.1.7 Decision regarding usefulness of excavated materials rests fully on the Engineer-in- charge in accordance to the Quality Control tests results.

2.1.8 DISCHARGE RECORDS:

2.1.9 The rainfall data pertaining to the area and the hydraulic data for streams crossing the canal furnished in the relevant reports and drawings are only for information of the bidders. The Government of Orissa does not guarantee the reliability or accuracy of any of the data provided and shall assume no responsibilities for any conclusions or interpretations that may be made out of them. The contractor shall undertake, at his expense, such studies as are necessary to assess the reliabilities and accuracy of the information presented in the Data.

2.2. SETTING OUT OF WORK:

(A) Temporary Bench Marks (TBM) shall be fixed at suitable locations carrying values from G.T.S. Bench Marks fixed by Survey of India. Temporary Bench Marks shall be set up by the Department at every 0.5 Km intervals at convenient locations along the canal to serve as reference levels. The contractor shall verify it properly and establish additional reference Bench Marks as may be needed at his own cost for facilitating the setting out and taking levels for measurement of work with the approval of the Engineer-in-Charge. The temporary bench marks shall be marked on a concrete pillars of 30 cm. (L) x 30 cm (B) x 75 cm (D) which shall be embedded 55 cm into the firm ground and projecting 20 cm above the ground. The Bench Mark pillars shall be constructed in plain cement concrete of M-15 grade. The pillars shall be protected from being disturbed. The top RL values of the bench marks shall be conspicuously carved and painted on the pillars. All the cost required for setting out of works shall be borne by the Contractor.

(B) Before starting any work and during execution (if required), the contractor shall erect further Reference Bench Marks. Reference lines and check profiles at convenient locations shall be made by the contractor at his own cost as per the direction of the Engineer-in-Charge. The centerline of the canal and the reference line for all alignments for demarcation purpose shall be laid by dug belling on the ground. The reference line shall comprise the base line properly dug belled on the ground with the numbered concrete/masonry RD pillar suitably spaced.

(C) Center line of the canal shall be marked by fixing pillar/stone at 30m intervals. Profiles of the canal in filling as well as cutting reaches shall be marked at 50m intervals in straight reaches and at 25m intervals in curves. A reference line shall also be marked on ground away from the outer edges of cutting and filling reaches with stone pillars at suitable intervals for future reference.

To ensure correctness of execution, the outer edges of canal in cutting and the outer toe lines of canal in filling should be marked by fixing pillars or pegs at suitable intervals or by dug belling entire length.

(D) The check profiles shall be located 15 meter apart or longer as directed by the Engineer-in-Charge to serve as a guide for execution of all slopes and steps to the elevations and profile or profiles indicated in the approved drawings. All important levels and all reference points with respect to bench marks and reference lines respectively shall be fixed and co-related by the contractor.

(E) The zones of full cutting section, full filling section, partial cutting and filling section shall be separated by conspicuous demarcation in the field. The curves stipulated in construction drawings shall be carefully laid in the field by adopting approved method of curve layout. The curves shall be marked on the ground by fixing pegs at very closer intervals and joining the peg points by dug belling to a suitable depth.

The locations of different structures indicated in construction drawing/approved L.S. & D.S shall also be clearly marked on the ground along the alignment of the canal. The control structure locations of off taking canals shall also be clearly demarcated, so that unnecessary excavation or filling at these locations can be avoided.

The spoils dumping zones shall clearly be demarcated in the field. These zones should be at least 2m beyond the location of catch water drains.

(F) To ensure accuracy in execution of cutting, the canal embankment, spoil banks and the structures, their layout shall be given in an appropriate manner with pegs and pillars suitably placed in relation to outer dimensions of these elements.

(G) All materials, labours, equipments & machineries, T&P etc for setting out works including construction of reference bench marks, reference lines, check profiles and surveys as may be required at the various stages of the construction, shall be supplied by the contractor at his own cost. The cost of such works shall be deemed to have included in the cost of items in schedule of quantities.

2.3 CLEARING AND GRUBBING:

A. CLEARING AND LEVELING SITE:

The portion of the right-of-way, which is required for constructing the work under these specifications, shall be cleared of all trees, bushes, rubbish and other objectionable materials. Trees designated by the Engineer-in-charge shall not be cut and shall be protected from injury. Such cleared materials shall be disposed off as provided in the sub-paragraph 'C' below or

removed from the site of work before commencement of the work as approved by the 'Engineer-in-charge. The clearing operation shall be in accordance with clauses 4.1., 4.1.1., 4.2 and 4.3 of IS: 4701-1982 Indian code of Practice for earth work in canals. Surface boulders either loose or partly embedded in the ground will have to be removed and stacked as directed.

B.(i) GRUBBING:

The area described or shown on the relevant site plan shall be cleared of all obstructions loose stones, non required materials and rubbish of all kinds. All brushwood shall be cleared and the roots grubbed up. No trees shall be cut down and removed without the instructions of the Engineer-in-Charge. Those which are cut down shall be grubbed up. The same remarks apply to jungle clearance. Trees to be preserved will be designated by the Engineer-in-Charge.

The products of the clearing shall be stacked in such place and manner as may be ordered by the Engineer-in-Charge and the ground shall be left in a perfectly clean condition. All products of the clearing shall be property of Govt. and shall be disposed of as per the direction of the Engineer-in-Charge.

All holes or hollows, whether originally existing or produced by digging up roots below the designed levels, shall be carefully filled up with earth, well rammed to the design density and leveled off as directed.

B. (ii) PREPARATION OF BED:

Ant hills shall be completely dug out before earth work is started. Removal of shrubs, loose stones and digging of anthills, involved in the preparation of bed, shall be deemed to include in the rates of earthwork in accordance with this clause. In cases where the work of preparation of bed is rather extensive, the Engineer-in-charge will usually provide a separate schedule item of such preparation. But in the absence of such schedule provision, the contractor shall understand that his tender rate is inclusive of all such work without any extra charge. The contractor shall therefore examine the site before tendering and make provision for all such additional items for bed preparation in his earth work tender rate. Old bunds will be benched properly as directed by Engineer-in-charge before addition of earth on it. The size of benches shall be 500mm x 500mm unless other sizes specified. The benches shall be inspected by the Engineer-in-charge or Engineer designated for the purpose and approved the surface before new earth work is laid on it.

C. DISPOSAL OF CLEARED AND GRUBBED MATERIAL:

The disposal of cleared and grubbed materials shall be in accordance with clause 4.1.1 of IS 4701-1995 code of practice for earth work on canals. All waste materials burnt shall be pilled neatly when suitable condition is achieved i.e. when burnt completely to ashes. Pilling of waste material after burning shall be done at such a location and in such a manner as it would not cause any fire risk. During fire, necessary precautions shall be taken to prevent spreading of fire to areas beyond the limit areas. Suitable materials and equipments for prevention and suppression of the fire shall be kept available at all times. The materials to be disposed off shall be buried.

D. PAYMENT:

For the clearance of light jungles, heavy jungle with or without uprooting etc., payment will be made as provided for in the items of bill of quantities. Separate payments will not be made for clearing, grubbing including disposal etc required or otherwise specified in the contract document. No payment towards removal of small stones and boulders of size less than 0.5cum will be made, and the rate quoted for excavation will be considered to include these above items. However, payment will made for the removal of surface boulders of sizes greater than 0.5cum either loose or partly embedded in the ground, at the rate quoted in bill of quantities for the actual quantity so removed based on stack measurement applicable for the relevant strata classification after deducting 40% towards voids.

2.4. USE OF WATER:

2.4.1 WATER FOR DUST ABETMENT:

The contractor shall procure and apply water for dust abatement. Water applied for dust abatement will not be eligible for payment. The cost of procuring and applying water including all expenses for all means of conveying water to the point of use, their collection, usage, and all other incidental expenses including creation of source of water will not be paid separately and the cost shall be deemed to have been included in the concerned unit price bid in the bill of quantities of the contract for the relevant finished item of work for which water for dust abatement is required.

So also the cost of procuring and applying water required for the works hall be included in the price bid in the bills of quantities for the items of work for which the water is used.

2.4.2 PREWETTING OF CANAL PREMISES AND ADJACENT AREAS:

The contractor shall furnish all labour, materials and equipment and shall procure and apply water required for pre-wetting the areas under canal bed and embankments.

Water applied for pre-wetting areas as detailed above will not be eligible for payment. The cost of procuring and applying water including all expenses for all means of conveying the water to the point of use, their collection, usage and all incidental charges including creation of sources shall be included by the contractor in the concerned unit price bid in the bill of quantities for that item of work where the water shall be used and no separate payment for the same will be made.

2.5 DRAINAGE ARRANGEMENTS:

2.5.1 CROSS DRAINAGE:

The contractor shall handle all flows from natural drainage channel intercepted by the work under these specifications, and shall perform any additional excavation and grading for drainage as directed by Engineer-in-Charge and shall provide and maintain any temporary construction required to bypass or otherwise cause the flows to be harmless to the work. When the temporary construction is no longer needed and prior to acceptance of the work the contractor shall remove the temporary construction and restore the site to its original condition as instructed by the Engineer-in-charge.

In addition to main drain, if cross drains, longitudinal drains are considered necessary for proper drainage, then the drainage systems consisting of network of cross and longitudinal drain will be led into by the contractor at his cost to prevent stagnation of water at the place of construction. The drains shall be constructed to the designed section and shall be either open or filled up with material to ensure free flow of water without clogging.

2.5.2 DRAINS, BERM DRAINS AND DOWEL BANKS:

A. DRAINS:

During excavation of canal and structures, the contractor shall perform construction of drains, berm-drains and chutes and any other drains as directed by the Engineer-in-charge.

The location, grades and sections of the drains shall be as shown in the drawings and or as directed. Payment for excavation for the above drains, channels and embankment will be made at the unit price bid in the bill of quantities for execution of canal, which unit price shall include the cost of placing the excavated materials in embankment or otherwise disposing of the same to dump yard and to perform all work necessary to maintain it in good order during construction.

B. BERM DRAINAGE AND DOWEL BANKS:

Drains along the berms and Banks & cross drains of the canal shall be constructed where shown in the drawings to its dimensions and grades or as directed by Engineer-in-charge.

The surface of the berms shall be sloped transversely and dowel banks shall be made along with sides of the banks and berms where shown in the drawings or as directed. The dowel banks may be made by balding of material in place following completion of a canal reach.

Payment towards construction of dowel banks and sloping berms is to be included by the contractor in the unit price per cubic meter bid in the bill of quantities for construction for canal embankment including reconstructing and remodeling.

2.6 MONSOON DAMAGES:

Damages due to rain or flood or cyclonic storm etc either in cutting or in banks shall have to be made good by the Contractor till the work is handed over to the department. The responsibility for de-silting and making good the damages due to above reasons rests with the Contractor. No extra cost is payable for such operations and the contractor shall, therefore, have to take all necessary precautions to protect the work done during the construction period and up to complete handing over to Department.

2.7 REMOVAL OF SILT AND WATER:

Accumulated silt and water in the canal and structures for the works partly done by the contractor in current or previous seasons should be removed by the contractor at his cost and no extra payment will be made for such removal of silt and water. The unit rate of excavation is deemed to include cost of removal of such silt and water.

2.8 PROCEDURES FOR MEASUREMENT:

Before commencement of work, initial levels to indicate existing ground levels shall be taken at 15m intervals longitudinally along the alignment of the canal and transversely along the cross sections at 5 m intervals in flat ground and 3 M in undulating terrain or where there is sudden change in levels. The cross sections shall be extended beyond the limit of work to a suitable distance and minimum 5m beyond the toe lines of slopes on both sides. The interval stipulated shall be made closer depending on the topography or any stipulation made by the Engineer-in-charge.

All initial levels shall be recorded in ink in authenticated level books issued by the Engineer-in-charge in presence of contractor or his authorized agents who is illegible to sign the level book. The level books shall be signed by the Junior Engineer / Assistant Engineer when he records the levels. The Assistant **Executive** Engineers/Deputy **Executive** Engineers and **Executive** Engineers shall exercise checks strictly in accordance with the codal provisions.

No construction work shall be allowed to start unless the above formalities are fulfilled i.e. the level books are duly signed by the contractor or by his authorized agent and Department officers designated to sign it. The contractor or his authorized agent shall sign each page of the level books/field books in token of acceptance unless otherwise the work shall not commence. These cross sections shall form the basis of all future measurements and payments. Each dimension

shall be measured to the nearest 0.01m, areas shall be computed to nearest 0.01m^2 and Volume shall be computed to nearest 0.01 m^3.

CHAPTER- 3

3.0. EARTH WORK:

3.1. GENERAL:

To the extent that they exist, plans, reports and estimates for the Government's studies for construction of the canal including its components will be made available for inspection by the Bidders in the office of the concerned Engineer-in-charge. Such information is made available solely for the convenience of Bidders. The Government does not guarantee that the information is accurate or complete. Bidders are cautioned that this information is subject to revision and that the Govt. disclaims responsibility for any interpretation, deduction or conclusions, which may be made there from. It is not intended that this information will limit or prescribe the excavation and handling procedures of the contractor, and the Govt. reserves the right to utilize and distribute earthwork materials during the progress of work as it serves the interest of the Government.

Drawing showing the typical sections of the canal and canal structures annexed to these specifications provides such details as would enable the contractor to execute the work in general conformity there-with under these specifications which have been prepared as definitely and in as much detail as possible with regard to design data presently available. These drawings will be supplemented by such additional, general and details drawings or directions as may be considered necessary or desirable as the work progresses. For all changes in approved drawing/design, the recommendation of **Executive** Engineer and approval of Chief Engineer will be essential. Where details shown in these drawings differ from the required specifications, the specifications shall govern. The contractor shall do no work without proper drawings. He shall check all drawings and specifications carefully and advise the Engineer-in-charge immediately if any errors, discrepancies and omissions are discovered where upon the **Executive Engineer** will prepare and lodge such revised additional drawings and specifications as may be required to suit the work. All such additional general and detailed drawings shall be open for inspection under the same terms and conditions as provided in agreement.

All works of the contract shall be executed as per the specific and relevant clause/clauses of latest revised I.S. codes unless otherwise specified. Materials used should, confirm to the desired standards prescribed in the relevant codes. Wherever a Para of IS Code is cited in specification, it goes without saying that the latest revision of IS code shall apply.

3.2. EXCAVATION OF CANAL:

3.2.1. CLASSIFICATION OF EXCAVATED MATERIALS:

Information available during pre-construction survey as soil exploration data is indicative only. Payment shall be made on actual classification of soil met with during excavation. Materials excavated shall be measured and classified during excavation to the lines shown in the drawings and as provided in these specifications. All materials required to be excavated will be paid for at the applicable item rate in the schedule for excavation. No additional allowance above the rate in the schedule will be made on account of any of the material being wet and requiring additional time for drying, stock piling and re-handling etc. Bidders must consider, for quoting his rates, all responsibility and conclude as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations. The classification of excavation shall be decided by the Engineer-in-charge and binding on the contractor. In case of dispute, the decision of CCE/ SE shall be final. Merely the use of explosive in excavation will not be considered for higher classification, unless blasting is clearly necessary in the opinion of the Engineer-in-charge.

3.2.2. EXCAVATION FOR CANAL/ DRAINAGE CHANNELS:

a) The excavation may be carried out manually or mechanically and as per specification drawing and direction of Engineer-in-charge.

b) The excavation for canal in all kinds of soil and D.I. Rock shall be done according to the dimensions and grades shown on the drawing. Proud equivalent to thickness of lining on sides and in bed on the underside of the lining shall be left unexcavated temporarily and the removal of this proud shall be done just before trimming and placing CNS layer and or concrete for lining.

c) Blasting shall be done in such a manner so as not to cause over break which in the opinion of the Engineer-in-charge is excessive. Special care shall be taken to prevent over break or loosening of material on bottom and side slopes against which concrete lining is to be placed. Final layer in hard rock shall be carried out by control blasting or with pneumatic pavement breakers or by chiseling. Blasting is restricted within 30m from existing structures. The method of drilling and blasting to be resorted to for rock excavation shall be got approved from the Engineer-in-charge.

d) Except for the area of rock, all areas to be excavated for canal sections shall be pre-wetted so that at the time of excavation moisture content shall be about optimum. However, in case the excavated material from canal is not to be used for embankment, such pre-wetting is not necessary.

e) The excavation shall be allowed to progress from the valley ends of the reach towards the ridge in conformity with the layout given. All useful earth (after Q.C test results) from excavation shall be used in for filling in banking sections, with varying leads and with all lifts either manually or mechanically Excavated materials which is not useful for banking or which is in excess after meeting the banking requirement of the reach shall be disposed as specified in I.S. Code 4701-1995 either by head lead or by mechanical means or by both in spoil bank or at any specified place with all lifts and with varying leads as directed by Engineer-in-charge.

f) The re-gradation for exit channels and approach channels for structures and diversion of drains, nallah shall be done according to the dimension and grade as shown on the approved drawings or as instructed by the Engineer-in-charge.

g) The contractor shall not be entitled for any additional rates on agreement items.

h) When cutting on cross sloping ground, the contractor shall cut a catch water drain on the higher side to prevent water from flowing down the cutting slope.

3.2.2.1 **EXCAVATION OF SOIL AND DIS-INTEGRATED (D.I.) ROCK:**

Excavation of soil shall comprise of all kinds of soil including vegetable or organic soil, turf, sand, silt, loam, clay mud, peat, black cotton soil, loose or compact moorum, soft/ stiff/heavy/hard soil, stony earth mixed with gravel and boulder up to 0.5 cum size. Excavation of D.I. shall comprise of soling of roads/paths, hard core, macadam surface, lean concrete, stone masonry, brick work, soft conglomerate, lime stone, soft sand stone, soft laterite, and all types of D. I. rock, which does not require blasting and can be removed or split with pick axe and crowbars. If however the contractor resorts to blasting in such strata and in D.I. rocks for his convenience, no extra payment shall be made and the materials shall not be classified to higher grade.

Excavation for canal shall confirm to provisions of relevant I.S. Codes, Sides slopes are to be provided as per the approved drawings, specification and provision of I.S Code.

3.2.2.2. EXCAVATION OF HARD ROCK:

This shall include all solid rock in place of such hardness and textures that it cannot be removed by pick axes and crowbars and can only to be removed by means of appropriate drilling and blasting operations or by rock breakers or other mechanical devices. All boulders or detached pieces of solid rocks having volume greater than 0.50 cum, can be classified as Hard Rock when removed by blasting etc.

The excavated rock so obtained shall be carried and deposited neatly in regular stacks in specified dump yard with all lifts and varying leads as indicated by the Engineer-in-charge. The volume of rock shall be calculated after deduction of suitable void % and compared/ correlated with the pre-measurement volume before payment.

The excavated materials shall be the property of the Department. The same shall be issued to the contractor, if found suitable for the work, at the approved issue rate of the Department.

Payment for hard rock shall be made as per level sections (pre & finished) with 3m intervals in longitudinal and 1m intervals in transverse direction. A closer interval of levels may be adopted if considered necessary as per opinion of the Engineer-in-charge. Boulders having volume more than 0.5 cum shall be pre- measured.

Recovery of useful materials of all sizes will normally be 0.70cum per cum of excavation measured in dump condition at stacks. In case of change in recovery due to rock conditions, percentage shall be fixed by the Chief Engineer-in-charge.

3.2.2.3 OVER EXCAVATION:

The canal shall be excavated to exact designed section in all kinds of soil and D.I. rock No over excavation will be allowed in such reaches. However, over excavation in case of hard rock may be allowed to the extent of 10cm on an average and may be paid for. But over excavation more than 10cm due to poor geological condition shall be certified by the Superintending Engineer and shall be approved by the Chief Engineer.

In case of poor soil condition on which concrete lining cannot be laid directly, the canal prism shall be over excavated to accommodate suitable cohesive non-swelling (CNS) soil to its designed thickness placed uniformly in compacted layers as directed by the Engineer-in-charge. Payment of CNS layer, watering and compacting shall be maid under respective item of the agreement.

3.2.2.4 DEWATERING TRENCHES AND WET EXCAVATION:

Subsoil water met within canal excavation shall be diverted to nearby drain/nallas by cutting an open channel. When the drain/nalla bed is higher than the subsoil water level met with, pumping shall be resorted to for dewatering. In case where topography of the area is such that surface water is not possible to be drained off by excavating the channel, pumping shall be resorted to till completion of the work. No distinction shall be made as to whether the materials being excavated are dry, moist or wet. Care should be taken to discharge the drained water not to cause damage to works, crops or any other property. No separate payment shall be made for dewatering by pumping of by any other method. The rates quoted by the contractor, to complete the item in all respect, are inclusive of dewatering by pumping or any other suitable method and diversion etc.

3.2.2.5 MEASUREMRENT AND PAYM ENT:

The payment shall be made on volumetric basis for the quantities excavated to the required extent. The cross sections shall be taken initially before commencement of work as stipulated in earlier Paragraphs. On completion of excavation, final cross sections shall be taken at the same points longitudinally and transversely. These executed/final levels shall be marked on the initial cross sections and the quantities between initial and final cross sections shall be worked out and paid.

In case of canal excavation in hard sheet rock, cross sections, shall be taken at 3.0 m. interval longitudinally and in 1.0m intervals transversely or closer intervals, as decided by the Engineer-in-charge. Isolated boulders having volume more than 0.50cum not covered in section measurement shall be pre-measured.

The unit rate quoted by the contractor includes entire cost of labour, materials tools & plants, machineries, required for the work, including setting out works, marking, taking levels, providing model sections, drilling & blasting/control blasting, chiseling with transportation, loading & unloading, stockpiling, re-handling when considered necessary, dewatering and diversion arrangements, providing temporary ramps, steps, haul & approach roads, depositing excavated materials in canal banks or in designated dumping yards, making good to damaged portions during work periods as per the approved drawings and all other incidental charges and as per direction of the Department.

3.3 EXCAVATION FOR STRUCTUTRES:

A. GENERAL:

After clearing the top surface, limit of excavation for the foundation of structures shall be true to the lines, grades and dimension/elevations shown in the drawings or as directed by the Engineer-in-charge as per actual site conditions revealed at foundation level. In so far as practicable the useful materials (after Q. C. Tests) removed from excavation of structures shall be used for back filling of structure or in embankment or disposed of in dump yard.

B. FOUNDATION FOR STRUCTURES:

Foundation tranches in all kinds of soil, other than rock, having depth more than 1.5 m. deep in to which men enter shall be securely shored and shuttered and timbered. All loose stones, projecting clumps of earth, pockets of material which might come down on the workers in the trenches or any condition which may hazard, shall be either removed or the excavated sides adequately braced and the trench suitably guarded. On stiff slopes, workmen shall not be permitted to work one above the other. When depth of cutting more than 3.00m, recommended side slopes and berms shall be made for safety point of view and sheet piling prior to commencement of work in case of excessive depth of excavation.

The contractor shall prepare the firm foundation base for the structure by suitable methods. The bottom and the side slopes of common excavation upon or against which the structure is to be placed shall be finished to the prescribed dimensions as in the approved drawings and the surfaces so prepared shall be moisten and compacted with suitable tools to form firm foundation condition. The item rate of contractor includes moistening and compacting.

If the Engineer-in-charge considers it's necessary to consolidate the foundation strata by grouting cement slurry, then drilling and grouting or any other foundation treatment shall be done by the contractor as directed by the Engineer-in-charge and the payment will be as per the general contract document in respect of extra items. Densities of the compacted foundation materials and the testing there of shall be in accordance with relevant IS specification.

When unsuitable materials are encountered at the foundation level, the Engineer-in-charge will direct additional depth of excavation to remove the unsuitable materials. The additional excavation shall be refilled with selected bedding materials and compacted to required density. But in case of excess excavation in rock, it shall be filled up by M-10 grade cement concrete and no payment will be made for excess excavation as well as concreting. No blasting shall be allowed within 30m from the existing structures.

If ground water or surface water is met with during foundation excavation, dewatering and diversion of water shall be resorted to by suitable and adequate arrangements. A sump separated from foundation area shall be made for collecting and pumping water. The item rate of contractor includes diversion of water, making sumps and dewatering etc.

C. OVER EXCAVATION:

Foundation excavation shall be made to the exact level and dimension of the approved drawings. If at any point the foundation materials is excavated beyond the lines required to receive the structure, or foundation material is disturbed or loosened during the excavation process, it shall be refilled with bedding materials and compacted to required density. Cutting/Filling for such excess excavation or over excavation and compaction shall be at the expense of the contractor. If required, extra excavation in sides for bonafied purpose of the work such as working spaces etc may be made with the due permission of the Department.

Should remains of old building/structures be met with during foundation excavation, the materials shall be removed with wedges and levers. Blasting shall not be allowed, without the permission in writing of the Engineer-in-charge. If bad ground of loose soil is met with at foundation level, the contractor shall report the fact to the Engineer-in-charge who shall issue such orders as may be

necessary. For extra excavation, concrete or any other suitable foundation treatments arising from bad ground, the contractors shall be paid treating this as additional work as per the contract documents. All excavated earth which is unsuitable or surplus to the requirements for back filling in structure or filling in canal embankments etc. shall be dumped, as instructed by the Engineer-in-charge at the contractor's expenses.

D. DISPOSAL OF MATERIALS:

All suitable materials removed from excavation or as much thereof as may be needed, as directed by the Engineer-in-charge, shall be used in the construction of canal embankments, base material of road and for selected bedding materials for backfill around the structures. If there is an excess of materials in the excavation, it shall be used to strengthen the embankment on either side of the canal, deposited in low areas uphill of the canal to eliminate trapped drainage or otherwise dumped as directed by the Engineer-in-charge. The disposal of the excavated materials shall be in accordance with clauses 8.1 and 8.2 of IS:4701-1982 or its latest edition. Unsuitable materials shall be deposited in dumping yard.

E. MEASUREMENT AND PAYMENT:

The measurement shall be made on volumetric basis out of level sections for the quantities excavated to the required extent as per drawings. The cross sections shall be taken initially before commencement of work as stipulated in earlier Paragraphs and final/executed levels shall be taken on the same points to calculate the excavation area and subsequently the quantity by multiplying length. The contractor will arrange necessary shoring, shuttering if necessary and no separate payment will be made for any such incidental charges. The interval of levels shall be 5m in longitudinal direction and 3m in transverse direction and even closer intervals if situation arises as per the direction of Engineer-in-charge.

Payment shall be made on the unit rates quoted by the contractor for respective items. The unit rate of the contractor includes entire cost of labour, materials tools & plants, machineries, required for the work, including setting out works, marking, taking levels, providing model sections, drilling & blasting/control blasting, chiseling with transportation, loading & unloading, stockpiling, re-handling when considered necessary, dewatering and diversion arrangements, providing temporary ramps, steps, haul & approach roads, depositing excavated materials in canal banks or in designated dumping yards, making good to damaged portions during work periods as per the approved drawings and all other incidental charges and as per direction of the Department.

3.3.1 BACK FILL AROUND STRUCTURES.

A. GENERAL:

The item of the schedule for back fill around structures including pipe portions/body of the structures include all back fill with suitable materials (from Q.C test results) required to place under these specifications.

B. MATERIALS:

The type of materials used for backfill, the quantity thereof and the manner of depositing the materials shall be subject to approval of Engineer-in-charge. In so far as practicable, back fill material shall be obtained from material removed from excavation if found suitable, for filling around the structures. But when sufficient suitable materials are not available from this source or from adjacent canal excavation, additional material shall be obtained from approved borrow areas. The borrow pit excavation shall be in accordance with the clauses of IS: 4701-1982 & its latest edition.

Where sand filling is specified, the sand shall be clean, coarse, free from admixture or foreign materials and approved by the Engineer-in-charge before filling is commenced. Should there be a necessity to fill in a basement with sea sand, prior written approval of the Engineer-in-charge shall be obtained. Sand filling should be saturated with water and compacted to required density before the construction is allowed to proceed.

Filling around structures shall have well consolidated in layers of 15 cm. by ramming with iron rammers and cut ends of crowbars. In filling reaches at finished level, the surface shall be saturated with water for at least 24 hours, then allowed to dry and rammed properly to consolidate to required density in order to avoid future settlements.

Except or otherwise provided below, backfill materials to be compacted shall contain no stones larger than 80 millimeters in any dimension and if not to be compacted, shall contain no stones larger than130 millimeters in any dimension. If the foundations excavation of the structure is in swelling soils, a layer of cohesive non-swelling soil conforming to IS: 9451-1985 (Latest revision) should be interposed between the swelling soil and the structures of suitable thickness and compacted to at least 95% of Standard Proctor Density.

C. PLACING BACKFILL:

Backfill shall be placed to the lines and grades shown on the drawings as prescribed in this paragraph or as directed by the Engineer-in-charge. The surface to receive the back fill, shall be first prepare free from all roots, vegetation or spoils and to be wetted properly. All backfill shall be placed carefully and spread in uniform layers so that all spaces around rocks and clods will be

filed. Backfill shall be brought up as uniformly as practicable on both sides of walls and all sides of structure to prevent unequal loading.

Backfill shall be placed to about the same elevation on both sides of the pipe positions of the structures and sufficient earth should be covered over the top of the pipe to prevent damage from movement of construction equipment. If a haul road is built over a pipe all backfill about and over the pipe shall be placed to a uniform surface and no humps or depressions will be permitted at the pipe crossing.

D. STRUCTURES ON FILL:

Unless otherwise the situation compels, a structure on fill should be avoided. But where the situation warns, all fills required for the structure foundation and all fills up to the bottom of the pipe shall be placed on sufficiently compacted soil. The embankment over the natural ground up to pipe bottom and over the pipe shall be laid in accordance with clauses of 9.2.4, 9.2.5 and 9.2.6 of IS: 783 code of practice for laying of concrete pipe.

E. MEASUREMENT AND PAYMENT:

The unit price bid for payment for backfill around the structure up to ground level/ required level will be made as provided in the Bill of Quantity of the bid. Refill of excavation performed outside the established pay line shall be placed in the same manner specified for the adjacent backfill and such refill shall be placed in the expenses of the contractor.

3.3.2 COMPACTION OF BACKFILL AROUND STRUCTURES:

(A) GENERAL:

Unless otherwise shown in the drawings backfill around the structures shall be compacted to its required density. The compacting equipments shall be so selected as to give maximum safety to the structures. Excessive vibration should be avoided from safety point of view.

The compaction of backfill under or over the pipes shall be in accordance with clauses of 9.2.4, 9.2.5 and 9.2.6 of IS: 783 (Latest edition). In case of very high embankments, the embankments shall be built to an elevation of the top of the pipe and then trenches shall be excavated to lay the pipes. After the pipes have been placed, suitable backfill materials shall be laid around the pipe and carefully compacted in layers, not more than 15cm up to the top of the pipe. Compaction of backfill should be done in horizontal layers and heavy stones shall neither be dropped nor shall be allowed to roll down the sides of the embankment against the pipes.

(B) MATERIALS AND COMPACTION:

Selected and approved materials shall be used for backfill and compaction around the structures. The materials should not contain deleterious and foreign harmful contents and even stones larger than 80mm size in any direction. It is always preferable to use excavated bed materials if found suitable and approved by Q. C. Department or otherwise suitable materials from approved burrow pits. Watering to optimum moisture contents and compaction to achieve maximum dry density shall be obtained.

(C) MEASUREMENT AND PAYMENT:

The cost of compaction of the backfill to different compaction efficiency will be paid as per the price bid for respective items of watering and compaction.

3.4. DRILLING AND BLASTING:

3.4.1. GENERAL:

Blasting where required shall be permitted only when proper precaution have been taken for the protection of persons and property in accordance with I.S: 4081 – 1995 (Indian Standard Specification for safety Code for blasting and related drilling operations). While carrying out excavation, adequate precautions in accordance with I.S: 3761-1996 (Indian Standard Specifications for safety Code for excavation work) shall be observed.

The contractor shall obtain area blasting license order where blasting is to be taken up, from the competent authority and shall engage experienced and licensed persons and trained workmen in drilling and blasting works. The contractor shall submit authenticated copies of all such documents to the Engineer-in-charge's office and shall obtain written permission before conducting such drilling and blasting operations.

All contractors who execute blasting operations in connection with works for purpose of quarrying stones, road construction, excavating foundations, well sinking or for any other purpose shall observe the rules and precautions as per standard norms and any further additional instructions which may be given by the Engineer-in-charge.

Any damages done to the work or property by blasting shall be repaired immediately. Blasting may be done only to depth and extent approved by the Engineer- in-charge with explosives of approved quality and charge and in such locations is made no damage to the rock outside the prescribed limits of excavations. Explosives shall be stored in a safe place at a sufficient distance from the work and under special care of a watch & ward so that in case of accidents, no damage occurs to the other parts of works. All storing, handling, transport and use of explosives, detonators and the equipment there of shall be strictly in accordance with the Indian Explosives act and the explosives Rules-1940 and as amended from time to time.

Holes shall be drilled not exceeding two thirds of the depth of rock to be excavated from the elevation at which the hole is started. The holes shall not be larger than as necessary to permit easy passage of whole sticks of explosives to the bottom of the holes. As the excavation approaches its final limits, the depth of holes shall be reduced progressively. When ever in the opinion of the Engineer-in-charge, further blasting may injure the rock upon or against which concrete is to be placed, the use of the explosives shall be discontinued and the excavation shall be completed by wedging, barring, Chiseling, drilling or broaching or by other suitable methods. Care should be taken to remove all loose slabs before masonry/concrete is placed for the spillway. Rock bolting compared to excavation of rock may be useful at places in excavation of foundation. The engineer-in-charge will direct where to locate rock bolt and where to excavate by wedging barring.

The final prepared foundation shall roughly present a saw tooth out line and shall have at least 50% horizontal or nearly horizontal area to give resistance against sliding or as per direction.

3.4.2. PERSONNEL:

Excavation by blasting shall be permitted only under the personal supervision of competent and licensed persons and trained workmen employed by the contractor at his cost. All supervisors and workmen in charge of work of handling, storage and blasting shall be adequately insured by the contractor.

The storage of explosives shall be in charge of a very reliable person of the contractor's men. The Engineer-in-charge may cause police inquiry being made as to his reliability, antecedents etc. The contractor shall have to provide security to the persons as well as to the explosives in consultation with the civil authorities of the District Administration.

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

3.4.3 STORAGE OF EXPLOSIVES :

The contractor shall build at his cost a magazine for storing the explosives and portable magazine for carrying the explosives to work spot from the magazine or one storage magazine to be built near the site at safe distance of the work on which explosive are to be used. The location, size of the magazine, its capacity and design shall be subject to the approval of the Inspector of Explosives, Govt. of India and copy of all such records shall be submitted by the contractor to the Engineer-in-charge's office. As a rule, the explosive should be stored in clean, dry, well ventilated, bullet proof and fire proof building on an isolated site.

The explosives, detonators and fuse coils shall each be separately stored. A careful and day to day account of the use of explosives shall be kept by the contractor in a register in the manner prescribed by the Engineer-in-charge. The Engineer-in-charge and his authorized representatives may also make surprise visits to the storage magazine at any time they desire. In case of unaccountable storage or shortage of explosives or account is not maintained in the manner prescribed is found, the contractor shall be liable for penalization deemed fit. The action taken under this clause shall be in addition to that which might be taken by the competent authorities or in the Court of Law. The magazine shall at all times be kept scrupulously clean.

No unauthorized person shall at any time be admitted inside the magazine. A notice shall be hung near the storage prohibiting entrance of unauthorized persons.

The magazines on no account be opened during or on approach of a thunder storm and no person shall remain in the vicinity of the magazine during that period.

Magazine shoes without nails shall at all time are kept in the magazine, and a wooden tub or cement through about 300 millimeters high and 450 millimeters in the diameter filled with water shall be fixed near the door of the magazine.

Person entering the magazine must put on the magazine shoes which shall be provided by the contractor for the purpose and be careful.

i. Not to put their magazine shoes to touch ground outside the clean floor.
ii. Not to allow the magazine shoes to touch ground outside the clean floor.
iii. Not to allow any dirt of grit to fall on the clean floor.

Persons with barefoot shall before entering the magazine dip their feet in water and then step direct for tub over the barrier (if there be one) on the clean floor. A brush or brrom shall be kept in the lobby of the magazine for the cleaning out the magazine on each occasion it is opened for the receipt, delivery or inspection of explosives, No matches or inflammable material shall be allowed in the magazine. Light shall be obtain from an electric storage battery lantern.

No person having articles of steel or iron on him shall be allowed to enter the magazine Oily cotton , rags waste and article liable to spontaneous ignition shall not be allowed inside the magazine workmen shall be examined before they enter the magazine to see that they have none off the prohibited articles on them.

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

Boxes of explosive shall not be thrown down or dragged along the floor and shall be stacked on wooden trestles.

Where there are white ants, the legs, of the trestles shall rest in shallow copper, lead or brass blows containing water. Open boxes of dynamite shall never be exposed to the direct rays of the sun. Empty box or loose packing materials shall not be kept inside the magazine. The magazine shall have lighting conductor, which should be got tested at least once a year. The contractor shall within 15 days comply with all the recommendation made by the officer testing the lighting conductor, failing which the Engineer-in-charge shall entitle to comply the same at the contractor's expense which shall not open to question or the Engineer-in-charge may consider any action that he may consider fit.

The following shall be hung in the loby of the magazine.

i) A copy of rules both in English and Oriya.
ii) A statement showing: the stock in the magazine at the particular time.
iii) A certificate showing the last date of testing of the lightning conductor.
iv) A notice that "Smoking is strictly prohibited"

The magazine shall be inspected at least twice a year by an officer representing the Engineer-in-charge who shall see that all the rules and strictly complied with. He shall notify all omissions etc. to the contractor who shall rectify the defects within a period of 15 days. (fifteen days) from the date of receipt of the notice failing which the Engineer-in-charge may take whatever he considers suitable

3.4.4 CONTAINER TO TRANSPORT EXPLOSIVES:

For the transport of the explosives and detonators between the store and site, closed and strong containers made of soft materials such as timber, zinc, copper, leather shall be used. Explosives and detonators shall be carried in separate boxes. For the conveyance of primer special containers shall be used.

The boxes and containers used shall be kept closed. Explosives shall be stored and used chronologically to ensure the ones received earlier being use first.

A make up house shall provided at each working place in which cartridge will be made up by component and licensed man as required for the work. The makeup house shall be separated from other buildings. Only electric storage battery lamps will e used in this house.

No smoking shall be allowed in the makeup house or generally while dealing explosive.

No child under 16 years of age & person who is in a state of introduction shall be employed on the loading & unloading or transport of explosive or be employed in or allowed to enter in premises where explosives are handled and / or stored.

3.4.5 DIPOSAL OF DETERIORATED EXPLOSIVES:

All deteriorated explosive shall be disposed off in an approved manner. The quantity of the deteriorated explosives to be disposed off shall be intimated to the Engineer-in-charge prior to its disposal.

3.4.6 PREPARATION OF PRIMERS:

The primers shall not be prepared near open flames of fire. The work preparation of primers shall always be entrusted to the same personnel. Primers shall be used as early as possible after they are ready.

3.4.7 CHARGING OF HOLES:

The work of charging of holes shall not commence before all the drilling work at the site is completed and the contractor's supervisor be satisfied himself to the effect by actual inspection. While charging open laps shall be kept away. For charging with powdered explosives, a naked flame shall not be allowed. Only wooden tamping rods without any kind of metal on the rod shall be allowed. The tamping rods shall have cylindrical ends. Bore hole must be of such size that the cartridges can easily pass down & they shall not however be too big.

Only one cartridge shall be inserted at a time and gently pressed into hole with the tamping rods, the sand, clay other temping material used for the holes completely shall not be tampered too hard.

3.4.8. BLASTING:

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

The site of blasting operations shall be prominently demarcated by red danger flags. The order of fire shall be given only by the Contractor's supervisor in charge of the work and his order shall be given by only after giving the warning signal three times, so as to enable all the labour, watchmen, etc to reach safe shelters.

All the roads and foot paths leading to the blasting area shall be watched. Road closing barriers should be provided to close the traffic on these roads at least 400 meters away when the firing is to take place.

In special cases, suitable extra precautions shall be taken. The Engineer may however permit blasting for underground excavation, without restriction of fixed time, provided that he is satisfied that proper precaution are taken to give sufficient warning to all concerned and that work of other agencies on the site is not hampered. For lighting the fuse, a lamp with strong flame such as carbide lamp shall be used.

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

3.4.9. BLASTING WITH POWDER

Blasting operations shall be under charges of competent persons specifically for this purpose and be carried out during fixed hours of the day preferably during early hours of midday or at Lunch hour or at the close of the working day in the presence of competent persons. Prominent sign-board indicating the blasting timings should be put at a number of places. The Engineer shall see that the safety precaution are taken and observed.

Red flags shall be prominently displayed and all the people except those who have actually to light the fuse must evacuate to a safe distance from the blast not less than 150 meters as a rule.

Sirens shall be sounded five minutes prior to the blast with waiting note and an all clear shall be given with a long blast at the end of the operation. These sirens should be kept at different locations so as to identify the danger zones.

the charged holes are to be lighted in the presence of the superior who must see that the fuses of all holes charged have properly ignited. The number of blasts to be fired and the actual number of shots heard must be compared and the person responsible must satisfy himself by examination that all blasts have exploded before work people are permitted to approach the site. Withdrawal of a charge, which has not exploded, is not to be permitted under any circumstances, but the tamping and charge should be drilled at a distance of about 23cm. from the old hole and fired in the usual way. The result shall be carefully examined by the all persons in charge of blasting and the operation continued until the original blast is exploded.

3.4.10 BLASTING WITH DYNAMITE & OTHER HIGH EXPLOSIVES:

Sub-Para (a) of the Para 4.15.2 instruction for blasting with powder shall apply. The strength of special gelatin to be used in the excavation of foundation as per the percentage mentioned below.

60% Special gelatin for softer rock strata.

70% special gelatin medium hard rock strata

80% special gelatin for hard rock strata

Before holes must be such a size that the cartridges can easily be passed through, and the responsible man in charge of blasting (Supervisor) shall take particular note of these positions and check them again after holes are drilled.

The supervisor himself must supervise preparation of all charges necessary for the bore holes. Blasting plans shall be evolved after trial blasting at the site. The first few rounds blasted at the work site shall be considered as test/trial blasting to find the most economic and efficient drilling and firing pattern consistent with limiting the blast induced peak particle velocity (PPV) within permissible range. He shall adjust the drilling pattern, hole depth, number of holes, change per hole and firing sequence including the types and number of delay of ensuring most favourable angle of breakage. The blasting plan, so evolved and approved by the Engineer-in-charge will restrict the development of crack zone beyond the drilled contour and limit the PPV's influencing the damage prone features/ structures range. Through tail blasting and vibration measurement, the value of variable shall be determined from the following equation.

$V=K (Q1/2) 17/D$

Where V=Peak particle velocity in mm/sec

Q=Cooperating charge in 1 kg.

D= Distance from the blasting zone in meters.

K=transmission factor constant which depends upon rock characteristics homogeneity of rock and presence of faults and cracks.

Broadly, a peak particle velocity range of 70-100 mm/sec shall be permissible in good rock excavation. The number of holes to be blasted in & around will be governed by the blasting plan evolved through trial blasting as explained above with the frame work of permissible PPV. If blasting is to be done in the civility and any risk phone feature of structures, the permissible PPV shall be reduced and Engineer-in-charge shall lay down the safe limits of PPV.

3.4.11 EXPLOSIVES AND BLASTING:

Explosives required for rock blasting are to be procured by the contractor at his own cost. It shall be the responsibilities of the contractor to store the explosive purchased by him in accordance with the rules of the explosive act and other rules framed by Government of India. Blasting materials such as gelatin, Detonators and fuse coils will have to be procured by the contractor & the contractors should make his own arrangements for their transport to work spot at his cost and their safe custody in a portable magazine, as per the rules in force and furnished the following details as per the format given below.

Capacity	License No. & Date	Validity Period

The contractor shall acquaint himself with all the applicable laws and regulation concerning, storing, handling and the use of explosives. All such laws, regulations and rules as prevalent from time shall be binding upon the contractor.

The provision detailed in the specifications are supplementary the above laws, rules and regulations, and are also applicable except where they conflict with the above mentioned laws. Further the Engineer-in-charge may issue modification alternation and new instructions from time to time. The contractor shall comply with the same without these being made a cause for any claims.

All these materials such as explosives, detonators, fuse coils tamping materials etc. that are proposed to be used in blasting operations shall have the required make and strength. The use of fuse with only on protective coat is prohibited. The fuse shall be sufficiently water resistant as to be unaffected when immersed in water for thirty minute. Rates of burning of the fuse shall be uniform and not less that 4 (four seconds per 35 millimeters of length with 10 percent (ten percent) tolerance on either side. The fuse known as instantaneous fuse shall not be used.

Before use, the fuse shall be inspected and most damaged or broken ones discarded. The rate of burning of all new types of fuse or when they have been in stock for long shall be checked before use. The detonators used shall be capable for giving an effective blasting of the explosive.

3.4.12 ELECTRICAL FIRING:

Only the contractor's Supervisor in charge shall possess key of the exploder and short firing accessories and he shall keep it always with himself, special apparatus shall be used as a source of current for the blasting operations. Power lines shall not be tapped for the purpose.

The detonators shall be checked before use. For blast in series only detonators of the same manufacture of the same group of electrical resistance shall be used. Such of electrical lines as could constitute danger for the work of charging shall be removed from the site.

The firing cables shall have a proper, insulating cover so as to avoid short circuiting due to contract with water, metallic parts of rock. The use of the earth as a return line shall not be permitted.

The firing cables shall be connected to source of current only when no body is in the area of blasting. Before, firing, the circuit shall be checked by a suitable apparatus. After firing whether with or without an actual blast the contact between the firing cables and the source of current shall be cutoff before any one is allow to leave the shelter.

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

3.4.13 PREACAUTIONS AFTER BLASTING:

After the blast, the contractor's supervisor must carefully, inspect the work and satisfy himself that all the charges have exploded. After the blast is taken placed in under ground works, workmen shall not be allowed to go to the place till all the toxic gases are evacuated from the face.

3.4.14 MISFIRES:

If it is suspected that part of the blast has failed to fire and delayed, sufficient time shall be allowed to elapse before entering the danger zone. When fuse and blasting caps are used a safe time should allow and then the contractor's supervisor alone shall leave the shelter to see the misfire.

None of the drillers are to work nearer this hole under one of the two following operations have been carried out by the supervisor.

Either (i) the supervisor should very carefully (when the tamping is of camp clay) extract the tamping with a wooden scraper or jet of water or compressed air (using pipe of soft materials and withdraw the fuse with the primer and detonator attached after which a fresh primer and detonator with fuse should be placed in this hole and fired out or (ii) the hole may be cleared of 300mm of capping and the direction then be ascertained by placing a stick in the hole. Another hole may be drilled at least 225mm away and parallel to it. This hole should then be charged and fired. The balance of the cartridge and detonator found shall be removed.

Before leaving the work, the contractor's supervisor should inform the supervisor of the relieving shift of any case of misfires and should point out the position with Red Cross denoting the same, also stating what action if any, he has taken in the matter. A register of misfires and their location and how they were dealt with shall be maintained by the contractor.

The contractor's supervisor should also at once report at the contractor's office all cases of misfires, the cause of the same and what steps were taken in connection there with the name of the day and night shift supervisors of the contractor must be noted daily in the contractor's office. If misfire has been found to be due to a defective detonator, or dynamite, the whole quantity of box from which the defective article was taken must be returned to the contractor's office for inspection, and shall be disposed off as per Rules/Acts.

Blasting operation, when considered necessary shall be resorted to only with the written permission of the Engineer-in-charge. Prior inspection shall be carried out for the safety and stability of the public and property. Blasting operations in the proximity of overhead power lines, communication lines, utility lines or other structures shall not be carried on until the operator or the owner or both of such lines have been notified and precautionary measures deemed necessary have been taken.

Any damage to the neighboring buildings, properties, standing crops, and life due to blasting shall be made good by the contractor at his cost.

3.4.15 MEASUREMENT AND PAYMENT:

The price included in the schedule for the work required by this section shall be all inclusive constituting full compensation for mobilizing, demobilizing and supplying all equipment, materials, labour, supervision and all incidental work except for any item specifically exempted there from and for which in addition specific payment item has been included in the schedule.

Measurement for all works done should be on the level sections initial levels and final levels will be taken at every 3m longitudinal and 1m transverse or closer grid if required and the contractor shall accept such levels, either in the level book or in graph sheets, or in both as directed by the Engineer-in-charge. If the dumps the excavated materials in an irregular way or not confirming to the dumping specifications, the department will withhold 20% (of the rate) and the same can only be released after the contractor removes the materials to the proper place for dumping and stacks as per specification.

No allowance shall be made for over excavations beyond the specified minimum lines of excavations except where specifically authorized. No extra payment for any over breakage and subsequent repairs shall be payable and deemed to have been included in the applicable item of schedule of bid.

Payment of common excavation shall be made on the basis of the unit price entered for the particular item in the schedule.

In case hard rock boulders met during excavation for which blasting is restored to, the blasting shall be taken up & blasted debris shall be stacked neatly in closely packed regular size stack as directed by the Engineer-in-charge and payment will be made for the solid quantity of rock calculated after deducting 40% voids measured at stacking condition.

3.4.16 DEWATERING:

GENERAL:

Dewatering shall be carried out by the contractor at his own cost as deemed to have been included in the unit price of the particular item in the schedule of bid. Dewatering shall be carried out as per approval of the Engineer-in-charge to enable excavation, mucking, inspection, final preparation of the surface, providing anchor bars, grouting, laying of concrete & masonry and allied constructional activities as per requirement of site.

3.4.17. DEWATERING BY ELECTRICAL/DIESEL PUMPS:

Electric/Diesel Pumps (as approved by the Engineer-in-charge) of requisite capacity shall be installed in order to handle seepage. In case of electric pumps circuits shall be isolated from any other electric installation and the switch gears and pumping equipment shall be maintained in satisfactory condition to avoid loss of energy. If diesel pumps are used, all costs of POL, running and maintenance shall be borne by the contractor deemed to have been included in the unit price of the particular item in the schedule of bid. Similarly the cost of electricity, running and maintenance of electric pumps, if used, shall be deemed to have been included in the unit price for the particulars item in the schedule of bid.

No payment will be made separately for de-watering. All dewatering is to be done at the contractor's cost and the rates for all items should include the dewatering operation.

3.5 EMBANKMENTS:

3.5.1. PREPARATION OF SURFACES FOR EMBANKMENTS:

The preparation of surfaces for embankment shall be in accordance with clause no. 6.1 & 6.5 of IS: 4701-1995 (or its latest edition).

Before commencing the work, the toe of the slope on each side of the Banks shall be dog belled and marked by pegs firmly driven into the ground at intervals of about 15 meter. Profiles made by bamboos & strings or earth or by any other convenient materials shall be set up for the guidance of the workmen about 15 meters apart over straight reaches and about 7.5 meters apart at curves.

Except in areas of rock, the areas under canal embankments shall be pre-wet by sprinkling water before cleaning, grubbing or excavation operations or embankments construction begin. The moisture content shall be optimum to a depth of one meter below the original ground surface or to impervious material whichever less as directed by the Engineer-in-charge. Whenever possible all water shall be added uniformly in one application. Areas, on the sides of the canal banks upon which the Engineer may direct spoil banks to be constructed will not require application of water.

The contractor is cautioned to control carefully the application of water and to cheek on the depth and amount of water penetration during application so as to avoid over watering, accumulation of water in depressions or excessive run off.

If at any location on which embankment is to be constructed, there is excessive moisture as determined by the Engineer, steps shall be taken to reduce the moisture by excavating drains, or by allowing adequate drying time or by any other approved means.

The contractor shall not be entitled for any additional allowance above the unit prices bid in the schedule on account of the requirement for excavating drains or allowing additional time for drying, or increased cost due to poor traffic ability on the embankment foundations or on the haul roads, or reduced efficiency of the equipments the contractor elects to use or on account of any other operational difficulties caused by overly wet embankment foundation.

Where the ground surface under any embankment is not suitable as determined by the Engineer for a foundation for the embankment, the contractor shall strip the area under the embankment of such unsuitable material to such depth as may be directed. The material so removed shall be disposed off as provided in paragraph 3.3.(D). Measurement for payment of stripping the unsuitable materials under embankments shall be made only to the lines and to such depth as may be directed and payment therefore will be made at the unit prices per cubic meter bid in the bill of quantities for excavation for canal/construction of embankment.

Before beginning the construction of embankments the surface area of ground to be occupied shall be cleared of all roots and vegetable matter of any kind stripped to a suitable depth. The depth to which top soil is removed shall be adequate to remove all perishable material and any soil which may become unstable on saturation or may interfere with development of proper bond between foundation and embankment. It is not necessary to remove all the soil containing fine hair like roots. The underline table may offer as a guide for lines for finding depth of stripping.

Type of vegetable cover in the soil	**Depth of stripping.**
1. Soil containing light grass cover	5.00 cm to 10.00 cm.
2. Agricultural Lands	To bottom of ploughed zone I.e. 15.00cm to 20.00cm.

When the ground surface under the canal embankments excepting rock surface, is below the full supply level (FSL) of the canal, the surface shall be scarified making open furrows not less than 20 centimeters deep at intervals of not more than 1.0 (One) meter. However, where the ground surface is below the bed level (BL) of the canal the entire surface of the foundation of embankments shall be stripped to a depth of not less than 20cm.

Immediately after preparation of the embankment foundation, the contractor shall excavate cut off trenches. Following this operation as soon as feasible and as approved by the Engineer the contractor shall place and compact earth in the cut off trenches and place one meter of embankment over the entire embankment foundation and compact where required. This procedure will seal the foundation against loss of moisture and provide some consolidation of the foundation.

The cost of scarifying the foundation surfaces under the canal embankments and other embankments shall be paid at the unit price of bid as in bill of quantities.

Payment for excavation for cut off trenches shall be made at the unit price of bid in the bill of quantities for excavation for canal.

Payment for compacting embankment in the cut off trenches shall be included in the unit price of bid in the bill of quantities for watering & compaction of embankments.

Water applied for pre-wetting areas under the canal embankments and under other embankments will not be measured for payment and shall be included in unit price of bid in the bill of quantities for excavation for canal and or construction of embankment of the canal.

In case of existing canals, where the slopes in canals and embankment portions are to be modified, benching of slopes shall be done or old bunds shall be sloped as directed by the Engineer-in-charge duly clearing the surface area under slopes from all roots and vegetable matter and stumps, shall be pulled or otherwise removed and roots grubbed. The stumps and roots removed shall be suitably disposed off.

The measurement of benching operation if done shall be done separately and the payment shall be made at unit price of bid in the bill of quantities for cutting.

3.5.2 CONSTRUCTION OF EMBANKMENTS:

(A) GENERAL:

Canal embankments shall be constructed to designed section as shown on the drawings duly providing for compaction allowance of two cm. per meter height of embankment for settlement. The top of the entire service bank shall be graded to be suitable for a road way in accordance with subparagraph (B) below and the top of the other embankment shall be graded to scarify as directed.

Before commencing overhaul of material from the borrow area, levels of the banks proposed for construction of embankments shall be taken in grid as directed by Engineer. After completing the construction of embankment, final cross section levels shall be taken on the same grid and the volume shall be arrived at and payment shall be made accordingly.

All materials shall be deposited in embankments so that cobbles, gravel and boulders are well distributed through other materials and not nested in any position within or under the embankment as enunciated in clause 6.4 of IS: 4701 – 1995.

In area, where required excavation does not furnish suitable or adequate material for constructing embankment, material shall be obtained from area where material in excess of that required to construct the adjacent embankment is available.

Where the original ground surface is below the canal bed level, and where construction of a fill below the bottom of the canal is prescribed such fill shall be placed as a compacted embankment.

B. ROADS AND RAMPS:

In conjunction with construction of canal embankments, the contractor shall construct, operate and maintain roads and earth ramps adjacent to the canal and structures where shown on the drawings and or where directed by Engineer-in-charge at his own expense. Suitable materials from canal excavation shall be placed in canal embankments for the roads and ramps. If sufficient material is not available from canal excavation, then the Engineer may direct to collect earth from borrow areas.

The width of road shall be provided as shown in the drawing and where the width of road is not shown in the drawings, it shall have a width of not less than 4.2 meters. The work i.e. construction, operation and maintenance of road and for earth ramps may be obtained with a motor grader provided for safe travel with a two wheel drive automobile in high gear to moderate speed. Special rolling or compaction may not be normally required. If compaction is directed, the embankments shall be compacted in accordance with section 3.5.2 (D).

C. EMBANKMENTS NOT TO BE COMPACTED:

Embankment not to be compacted shall be formed conforming to clause 6.6.1 of I.S: 4701-1995. The material for these embankments shall have optimum moisture content before earth moving equipment is routed over the embankment. The embankments shall be built in layers not exceeding 30 (thirty) cm in thickness. Embankments shall be built in approximately horizontal layers carried across the entire width of the embankments to the required slopes. Embankments shall not be widened with loose materials dumped from the top. Embankments may be built by excavation and hauling equipment or by excavating and hauling equipment shall be made in horizontal layers and shall be kept as close to level as practicable. The travel over the embankments during construction shall be routed so as to distribute the compacting effect of the equipment to the best practicable advantage. Finer portions of the materials excavated shall be placed in that part of the embankment nearest to the water and coarser materials shall be placed in the outer part of the embankment.

Excess quantity excavated from the pits shall be deposited in spoil banks in layers to required sections as shown in the relevant plans or ordered by the Engineer-in-charge. Ramming & breaking clods and smooth sectioning may not be necessary for spoil bank but a neat & straight toes even slopes and top surface shall be formed as the depositing proceeds.

D. EMBANKMENT TO BE COMPACTED:

The requirements for compacted embankments shall be as specified in section 3.6. All materials to be used to get compacted embankments shall be placed moistened and compaction shall be done as provided in corresponding Sections.

The materials to be used for such embankments, either obtained from canal excavation or from burrow pits, shall be as suitable as determined from the Q. C tests and as advised by the Engineer-in-charge. The materials shall conform to clause 6.4 of IS: 4701-1995.

Before the materials for the 1st layer of embankment is placed, the foundation of the embankment shall be prepared as provided in paragraph 3.5.1 and shall be moistened and compacted in the manner herein after specified for each layer of compacted embankment to be placed thereon. The embankments shall be compacted to the elevation and to the top widths and side slopes shown on the drawings or prescribed by the Engineer-in-charge.

The layers shall be placed in rows approximately parallel to the axis of the bank. The base of embankment at every height is to be made to its full width of each zone as shown in the drawing plus offsets of not less than 0.45 meters beyond the finished profile on either side for compaction. No payment will be made for the off sets or for the subsequent removal and unit price quoted for the banking is deemed to be included. No additions will be allowed to the slope for full design section of the bank after the bank is raised. The embankment shall be compacted to 95% proctors density using pneumatic Tampers, ship foot rollers or vibratory or power road rollers.

Where the original ground surface is below the bottom of the canal and compaction to embankment is prescribed, such fill shall be placed as compacted embankments. Where the original ground surface is below the base of structures for where slopping concrete walls or slabs extend above the original ground surface and it is practicable as determined by the Engineer-in-charge to embankments shall be constructed to lines and grades as directed to form suitable foundation for the structure of for the sloping or slabs.

3.5.3. BORROW AREA:

3.5.3.1. GENERAL:

(a) All materials required for the construction of embankment and backfill for cut-off trenches and around the structures which are not available from canal excavation, excavation of structures or from excavation of other ancillary works, shall be obtained from the designated borrow area after

stripping and duly approved by the Engineer-in-charge in consultation with Quality Control Unit of the Department. The depth of cut in all borrow areas shall be designated by the Engineer-in-charge and the cuts shall be made up to such designated depths only. Shallow cuts will be permitted in the borrow areas if un-stratified materials with non-uniform moisture contents are encountered. Each designated borrow area shall be fully exploited before switching over to the next designated borrow area. Half hazard exploitation of borrow pits shall not be permitted. The type of equipments used and the operations in the excavation of materials in borrow areas shall be such as to produce the required uniformity of the mixture of materials for the embankments. The contractor has to arrange borrow areas at his own cost and responsibility. No compensation, whatsoever for change in limits and locations of the borrow areas and depth of cut for getting suitable earth shall be paid to the contractor. The borrow area shall not be designated within a distance of five times the height of embankment from the outer toe of the embankment.

(b) Borrow pits shall be operated so as not to impair the usefulness or the appearance of any part of the work or any other property. The surfaces of wasted materials shall be left in a reasonably level and even condition.

3.5.3.2. PREPARATION OF BORROW AREAS:

All areas required for borrowing earth for embankment shall be cleared of all tree stumps, roots, bushes, rubbish and other objectionable materials. Adequate lighting and fencing arrangements to the burrow areas should be provided by the contractor.

Proper care shall be taken to exclude all organic matters from the materials to be placed in the embankment. All organic materials shall be burnt to ashes or disposed of as directed. The cleared areas shall be maintained free of vegetable growth during the progress of the work. No payment shall be admissible for preparation of the borrow areas indicated above as this deemed to have been included in the unit bid price of earth work of the BoQ.

3.5.3.3. STRIPPING OF BORROW AREAS:

Borrow area shall be stripped off top soil, sod and any other objectionable materials to the required depth as directed by Engineer-in-charge. The work may be done manually or with suitable machines. Stripping operations shall be limited only to the designated borrow areas. Materials from stripping shall be disposed of in exhausted borrow areas or in the approved adjacent areas as directed. No extra payment shall be admissible for stripping the borrow areas as this is deemed to have been included in the unit bid price for earthwork in the BoQ.

3.5.3.4. BORROW AREA WATERING/DEWATERING:

a. Borrow are watering shall be done by the contractor at his own cost wherever necessary preferably 48 hours in advance, so that materials may be carried with optimum moisture and in the manner specified by the Engineer-in-charge.

b. The initial moisture content of the materials in the borrow areas shall be obtained with the help of field tests and the optimum moisture content required for the materials of the borrow areas from the laboratory tests. The additional moisture requirements as determined by the laboratory test shall be introduced into the borrow areas by watering well in advance of the excavation to ensure uniformity of moisture content. All care shall be taken to reduce excessive moisture in any of the locations of a borrow area before or during excavation to secure the materials with moisture content close to the optimum. To avoid formation of pools in the borrow areas during excavation operation, drainage ditches from borrow areas to suitable outlets shall be excavated, wherever necessary. Upon exhausting of all materials or abandoning the borrow areas, the pits shall be fully drained to ensure no pounding of water.

3.5.3.5. HAUL ROADS/APPROACH ROADS:

Construction and maintenance of haulage roads/ approach roads and roads within working areas will be the responsibility of the contractor. The department will have full right to use those roads for inspection purposes. Proper roads sign as directed have to be provided for safety. For haulage of construction materials, the contractor shall construct ramps and haul roads/ approach roads of sufficient width along the shortest but most practicable route and shall maintain and illuminate these roads to a satisfactory manner. Watering of the haul roads/ approach roads shall be done by the contractor as often as necessary to prevent from rising of dust, formation of cuts and consequent deterioration of the surface. Whenever service roads meant for public through fare traverse through or run close to the borrow area, the contractor shall direct the excavation and haulage operation in such a manner as to ensure uninterrupted use of the service road and safety to the public. At the haul road and service road crossing, the contractor shall install necessary check gates and road signs.

No extra payment is admissible as this is deemed to have been included in the unit bid price of the respective items in the bill of quantities being contingent to the main work.

3.5.4. EARTH FILL MATREIALS:

3.5.4.1. HOMOGENEOUS EARTHFILL:

Canal embankment shall be constructed to the top width and side slopes as shown on the drawings. Suitable excavated materials available from the canal cutting, proud cutting, removal of ramps and excavation for structures shall be used for construction of banks. If suitable and

adequate materials for constructing embankment is not available for embankments, the desired materials shall be obtained from borrow area designated for the purpose as per the instruction of the Engineer-in-charge.

The planning for execution should be such that all the useful excavated materials are utilized in embankment prior to utilization of borrow earth from outside. The embankment earth shall be borrowed only after getting written instruction of the Engineer-in-charge.

Only suitable materials as per specification shall be excavated, loaded and conveyed to the point of placement in the embankment. Unsuitable materials if conveyed shall be removed and disposed clear of the work site as directed by the Engineer-in-charge at the cost of the contractor. The maximum dimensions of stones, pebbles and rock fragments etc. placed in the outside zone of the embankment shall not be more than 15 cm. and the quantity of such stone shall not exceed 5% of total quantity.

3.5.4.2. ZONED EARTHFILL:

i) When an embankment section is designed for zoned section, the embankment shall be divided into zones within which fill materials obtained from canal excavations/ burrow areas having different characteristics are to be placed. Placement of fill within these zones as shown on the drawings shall be performed in orderly sequences and in an efficient and workman like manner. The selected materials shall be filled above the key of lining.

ii.) Chemical and physical tests of the soil in the embankment shall be carried out to ensure that the soil does not contain soluble lime salt content or cohesion less fines, and quantities harmful to the embankments. The useful materials available from canal excavation, excavation of proud and excavation of structures shall be transported over the required leads, as indicated in the respective items of schedule of quantities and placed in then specified layers for embankment.

iii) In areas, where suitable and adequate materials for constructing the inner zones of the embankment is not available from the canal excavation and excavation of structures, the materials shall be obtained from the borrow areas fixed for the purpose. The borrow areas shall be excavated to the dimensions and depths actually required and as per the instructions of the Engineer-in-charge.

iv) The inner compacted zone/ impervious zone shall be constructed of materials having required percentage of clay so that it can be compacted at optimum moisture content by suitable compacting equipments to their maximum dry density or to a density as specified in the drawings as per standard proctor density. Water tightness of materials shall be checked by carrying out in situ permeability tests. Permeability of impervious materials shall not be greater than 10^{-6} cm /sec. The impervious material of inner zone should preferably be free from large size particles. In no case the quantity of gravel shall exceed 5% of total quantity.

v) The rest of compacted zone may consist of any suitable material which provides support to impervious core under various conditions of saturation and draw down. If silt or sandy materials are used, compaction shall be done by using proper machinery utilizing the principle of vibro-compaction. The distribution of materials shall be such that the compacted material shall be homogeneous free from cracks, pockets or other imperfections. The maximum quantity of course materials shall not exceed 5% of the total quantity. The excavating and placing operations shall be such that the materials when compacted shall be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability. The materials shall be compacted to a density as specified in the drawings or as directed by the Engineer-in-charge.

3.5.5. PLACING EARTHFILL:

The embankment shall be constructed with earth fill of required materials as per drawing and specification. The fill shall be free from deleterious materials or layer of materials differing substantially in texture or gradation from the surrounding materials. The useful excavated materials shall be classified as impervious and semi pervious by the Engineer-in-charge. Care shall be taken to utilize the impervious materials towards the waterside of the embankment and semi pervious materials towards outer zone of the embankment as per drawing.

Construction of embankment shall begin at the toe of the fill and in no case shall embankment be widened by materials dumped from the top. The materials shall be placed in the earth fill in the continuous horizontal layers not more than 15 cm iIn thickness after being rolled as herein specified.

The thickness of the layer shall be adjusted by the Engineer-in-charge, if the contractor satisfies the Department that the particular type of compactors used by him give the required density by carrying out trial compaction and requisite tests. The thickness of horizontal layers after compaction shall not be more than 10 cm if compaction is performed by mechanical tampers and not more than 15 cm if compaction by sheep foot rollers and 22.5cm if compaction is performed by vibratory or pneumatic rollers or with similar equipments. Initially, the earth in the embankment fill shall be laid in a greater width than the designed section. Adequate extra width of about 0.6 m on either side of the embankment shall be provided so that the earth fill up to lines of the finished slopes shall have the required compaction as per the drawings and specification. Such extra width shall be removed and utilized in the upper layers of embankment along with slope dressing, for

which no additional payment shall be made as it is deemed to have been included in bid price of earth work in embankment in the bill of quantities.

The inside proud section shall not be removed if the lining work is not included under the same contract such proud section made out of borrow earth from outside only shall be paid as per bid price of the item in the bill of quantities. No payment shall be made for compaction for such proud section left.

No fresh layer shall be laid until the previous layer is properly watered and compacted as per the requirement. If in the opinion for the Engineer-in-charge, the surface of the prepared foundation or the rolled surface of any layer of earth fill is too dry or smooth to bound properly with the layer of materials to be placed thereon, it shall be moistened or worked with harrow, scarified or other suitable equipment in an approved manner to a sufficient depth to provide a satisfactory bonding with the next succeeding layer of earth fill. If the rolled surface of any earth fill is found to be too wet for proper compaction of the layer of earth fill materials to be placed thereon, it shall be raked up and allowed to dry or be worked with harrow, scarifier or any other suitable equipment to reduce the moisture content to the required amount and then it shall be compacted before the next succeeding layer of earth fill materials is placed.

The materials shall be deposited in rows parallel to the axis and spread in the uniform layers braking clods maximum up to 5 cm sizes. The layer shall not exceed 22.5cm in thickness or such thickness as directed by Engineer-in-charge. The work of spreading and compaction shall be so adjusted as not to interfere with each other and in such a way that neither of the operations is held up because of non completion of rolling and watering. The excavation and placing operation shall be such that the materials when compacted shall be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability. If the work is held up due to failure of machinery or any other cause, no claim whatsoever shall be entertained even in case the machinery is supplied by Department. The surface of banking shall at all time of construction be maintained true to required cross section.

During construction a small transverse slope from center towards edges should be given to avoid pools of water forming due to rains.

When compacting the soil against the rock abutment or walls of masonry or concrete structures, the construction surface of the embankment shall be sloped away from the rock or masonry or concrete structure leaving a minimum distance of 0.6 m and at an inclination of 3:1. If the foundation surface is too irregular to allow the use of large roller directly against the structure or rock out crop, the roller shall be used to compact the soil, as close to the structure or the out crop as possible and the portion of the embankment directly against the rock or the structure shall be compacted with pneumatic hand tampers in thin layers. The moisture content of the earth fill placed against the rock or the structure shall be slightly above the optimum to allow it to be compacted into all irregularities of the rock and this shall be determined by the field laboratory. In placing the earth fill under rock foundation the foundation shall first be prepared as detailed earlier. Care shall be taken in placing the first layer of the fill above the filter layer so that no damage is caused by the hauling machinery. Sheep foot rollers shall not be deployed for compaction till it covers the filter thickness and the layer shall be compacted by other means at least greater by 30 cm than the teeth of the roller drum. The soil for the first layer shall be at moisture content sufficient to enable satisfactory bonding of the fill with the filter surface.

3.5.6. WEATHER CONDITIONS:

Embankment materials shall be placed only when the weather conditions are satisfactory to permit accurate control of the moisture content in the embankment materials. Before closing work on embankment, in any continuous reach prior to setting of monsoon, the top surface shall be graded and rolled with a smooth wheeled roller to facilitate run off. Prior to resuming work, the top surface shall be scarified and moistened or allowed to dry as necessary and approved by the Engineer for resumption.

The contractor shall provide suitable protection works to protect the slope from erosion due to rain water. No payment whatsoever shall be made for providing such protection work and rectifying the monsoon damages.

3.5.7 MOISTURE CONTROL:

The water content of the earth fill materials prior to and during compaction shall be distributed uniformly throughout each layer of materials and it shall be between (-)2% to (+)2% of the optimum moisture content. Moisture determination of soil as well as determination of needed moisture in soil shall be carried out as per I.S. 2720-1995.

Laboratory investigations may impose some restriction on the lower limits of the practicable moisture contents on the basis of studies on consolidation characteristics of soil in embankment. Here in after the terms range of optimum practicable moisture content shall refer to the value as described above. As far as practicable, the materials shall be brought to the proper moisture content in the borrow area before excavation. If additional moisture is required it shall be added preferably at the borrow area and only in limited cases/extent. If required, on the embankment by

sprinkling water before rolling of a layer. If more moisture is present than required, the material shall be spread and allowed to dry before starting rolling. Moisture control shall be strictly adhering to. The moisture content shall be relatively uniform throughout the layer of material, if necessary, ploughing; disc harrowing or blending with other materials may have to be resorted to obtain uniform moisture distribution. If the moisture content is more or less than the range of optimum practicable moisture content or if it is not uniformly distributed throughout the layer, rolling and adding of further layer shall be stopped. Further work shall be started again only when the above conditions are satisfied.

In order to have proper control of moisture content in the earth fill no earth work shall be done during rainy days. No compensation shall be made to the contractor due to held up to work for rain or fog and high moisture content in the working process.

3.6. COMPACTING EARTH MATERIALS:

3.6.1. GENERAL:

Where compacting or earth materials is required the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing moistening and compacting operations shall be such that the materials will be uniformly compacted to the required density throughout the required section, and will be homogeneous, free from lenses, pockets, streaks, voids, laminations or other imperfections.

Having decided on the filling materials to be used, standard compaction test shall be conducted on the materials proposed for embankment to indicate best type of equipment to be used and the moisture content at which compaction should be undertaken and the effect of soil moisture content, thickness of layer and number of passes etc. The contractor shall supply all materials, labours, machineries & equipments at his cost for conducting tests.

Following guide lines are prescribed for compaction of different height of earth fill in canals.

3.6.2 ROLLING:

When each layer of materials has been prepared so as to have the proper moisture content uniformly distributed throughout the material it shall be compacted by passing the tamping roller. The exact number of passes for each layer to obtain specified density shall be designed by the field laboratory after necessary test. The layers shall be compacted in strips overlapping not less than 0.6m. Rolling shall commence at edges and progress towards center longitudinally. The rollers of loaded vehicles shall travel in a direction parallel to the axis of the embankment. Turns shall be made carefully to ensure uniform compaction. Rollers shall always be pulled. Density tests shall be made after rolling and dry density attained shall satisfy the specified compaction standards. Standard proctor density test shall be carried out at regular intervals to account for variations in the borrow area materials as well as that in-situ excavated materials. The locations where compactions of the earth fill materials by means of the roller is impracticable or undesirable the earth fill in that locations shall be specially compacted by means of pneumatic tampers.

3.6.3 EARTH FILLS UP TO 3M HEIGHT:

When a finished reach of canal having an earth fill height up to 3 M is subjected to natural compaction by rain and own weight for two seasons or more before it carries irrigation water no compaction arrangements are required to be done.

When it is expected to carry water just after one season, compaction by dozer track chain is to be done. However, this is not necessary if the earth fill could be subjected to profuse watering during lying of each layer.

Roller or by any approved method shall be done.

3.6.4 EARTH FILLS HEIGHT MORE THAN 3 M:

Canal reaches having earth fill height more than 3 m shall always be compacted by any approved method of compaction.

3.6.5 COMPACTING CLAY AND SILTY MATERIALS:

In special cases, where compaction of earth materials containing appreciably amount of clay or silt is required, the compaction shall be carried out in accordance with the clause 6.6.2 of IS 4701-1995. The materials shall be deposited in horizontal layers. The thickness of each horizontal layer before compaction shall not be more than 25 cm (Loose layer) and the layer shall be of full width of the embankment. Excavating and placing operation shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable density and best impermeability and stability.

If the surface of any compacted layer of earth fill is too dry or too smooth to bond properly with the layer of materials to be placed thereon, it shall be moistened and or scarified in an approved manner to provide a satisfactory bonding surface before the next succeeding layer is placed. All the rollers used on any one layer of fill shall be of the same type and same weight to get uniform compaction.

Prior to and during compaction operations, the embankment materials shall possess optimum moistures contents as required in clause 6.6.4 of IS: 4701-1995. The embankment materials shall have optimum moisture content required for the purpose of compaction and this moisture content shall be fairly uniform throughout the layer. In so far as practicable, the moistening of the material

shall be performed at the site of excavation but such moistening shall be supplemented as required by sprinkling water at the site of compaction, if necessary. If the moisture content is greater than optimum value for compaction, the compaction operations shall be delayed until such time as the materials has dried to the optimum moisture content or to the level directed by Engineer-in-charge. The moisture content of soils shall be determined in accordance with I.S: 2720(Part-III) 1995.

If the moisture content is not within the limit described above, the compaction operation shall not be proceeded except with the specific approval of the Engineer-in-charge, until the materials has been wetted or allowed to dry out, as may be required to obtain optimum moisture content, and no adjustment in price will be made on account of any operations by the contractor in wetting or drying the materials or on account of any delay arises thereby.

When the materials has been conditioned as herein before specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipes and at the joints of bank connections with the structures, they shall be equipped with suitably shaped heads to obtain the required density.

The dry bulk density of the soil portion in compacted embankment materials shall be not less than 98% of the maximum dry bulk density at optimum moisture content obtained in accordance with I.S: 2720 (Part-VI) 1995 (Indian Code of Practice for determination of moisture content, dry density relation using light compaction).

The dry density of soil in field shall be determined in accordance with I.S. 2720 (Part – XXVIII) 1974 (Indian Code of Practice of determination of dry density of soil in place by sand replacement) or by I.S: 2720 (Part – XXIX) 1975 (Indian Code of Practice for determination of dry density of soils in place by the code cutter method).

Moisture content of soil shall be determined in accordance with I.S: 2720 (Part-II) 1973 (Indian Code of Practice for determination of moisture content).

The optimum moisture content is the moisture content that corresponds of the laboratory maximum dry density determined in accordance with I.S: 2720 (Part – VII) 1973.

The above compaction tests will be conducted by contractor in the presence of departmental officers at his cost and the contractor shall ensure compaction, till the Engineer-in-charge or his authorized representative is satisfied that the maximum dry density at optimum moisture content is obtained and permits the laying of next layer.

3.6.6 COMPACTING COHESIONLESS MATERIALS:

Where compaction of cohesion less free draining materials such as sands and gravels is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

As envisaged in clause 6.6.2.1 of IS 4701-1982 the thickness of the horizontal layer shall not exceed 25 cm. (loose layer) before compaction and it should be spread over the full width of the embankment and compaction shall be done by tampers or crawler tractors or vibrating rollers.

As envisaged in clause 6.6.3.2 of I.S: 4701-1982 the relative density of the compacted materials shall not be less than 70% when tested in accordance with I.S. 2720(Part-XIV) k1995 (Indian Code of Practice for determination of density Index (relative density) of cohesion less soils).

3.6.7 COMPACTION OF COHESIONLESS MATERIALS CONTAININGS SOME CLAY AND SILT:

This sub-paragraph applies only to cohesion less materials and not to cohesive materials. Cohesion less materials containing clay and silt may not be free draining. When compaction of cohesion less materials containing clay and silt is required, the materials shall be compacted to a dry density in accordance with either sub-paragraph (i) and (ii) below, using whichever test that result in higher dry density of the compacted materials in the placement.

i) Dry density determined using procedure enunciated in I.S. 2720 (Part-VII) 1995 (Indian Code of Practice for termination of moisture content dry density relation using light compaction). Prior to and during compaction operation the materials shall posses optimum moisture content as determined in accordance with clause 6.6.4.1 of I;.S. 4701-1995 and the moisture content shall be uniform throughout each layer. Provided that the moisture content is ensured as required in clause 6.6.4 of I.S. 4701-1995 the dry density of take soil portion in the compacted materials shall not be less than 95% of the laboratory maximum soil dry density compacted. The field dry density shall be determined in accordance with I.S. 2720(Part-XXVIII) 1995 or IS 2720 (Part XXIX) k1995.

ii) Dry density using the relative density test as described in I.S. 2720 (Part XIV)1995 Indian Code of Practice for determination of density index (relative density) of cohesion less soils. The relative density of the compacted materials obtained shall be not less than 70% determined in accordance with clause 6.6.3.1 of I.S. 4701–1995. The moisture content shall be maintained as per clause 6.6.4 of I.S. 4701 – 1995.

3.6.8 ROLLERS AND OTHER COMPACTING EQUIPMENT:

As shown in Appendix C of IS: 4701 – 1995 the following compacting equipment may be used for compacting the soils shown against them as detailed below.

Major Division	Sub-group	Suitable type of compacting equipments.
Coarse Well Grained Soils	Well Grained Gravel, gravel and little or no fines. Well graded gravel sand mixtures with excellent clay binder Uniform gravel with little or no fines. Poorly graded gravel and gravel sand mixtures little or no fines. Gravel with fines, silty gravel, clayey gravel poorly graded gravel sand clay mixtures.	Smooth wheel roller Diesel road rollers of 8 to 10 tones capacity pneumatic tyred Roller vibrating smooth wheel roller -do- -do- -do- -do-
Coarse Grained soils, Sand & sandy clays.	1. Well graded sand and Gravelly sands, little or no fines. 2. Well graded sand with excellent clay binder. 3. Uniform sand with little or no fines. 4. Sands with fines silty sands, clayey sands, poorly graded sand clay mixtures.	Heavy vibrating plate, Frog rammer, power rammer, power roller. -do- -do- -do-
Fine Grained Soils: Soil having low compressibility	1. Silts (inorganic) and very fine sands rock flour, silty or clayey fine sands, with slight plasticity. 2. Clayey silts (inorganic)	Smoot wheel roller diesel Road Rollers of 8 to 10 tones capacity power rollers pneumatic tyred roller. -do-
Soils having medium compressibility	1. Organic silts of low plasticity 2. Silty and sandy clays (Inorganic of medium plasticity.) 3. Clays (inorganic of medium plasticity) 4. Organic clays of medium plasticity.	Sheep Foot Roller Frog rammer, power rammer -do- -do-
Soils having highe compressibility.	1. Micaccous or diatomaceous fine sandy and silty soils elastic silts. 2. Clay (Inorganic) c. Organic clays of high plasticity.	Smooth wheel roller diesel Road Rollers of 8 to 10 tones capacity pneumatic tyred roller. -do- -do-

The compacting equipment shall confirm to recent edition of relevant India standard specification mentioned below.

1. Smooth wheeled roller should conform to IS 5502-1969
2. Sheep Foot roller should conform to IS 4661-1968
3. Pneumatic tyred roller should conform to IS 5501-1969
4. Vibratory plate compactor should conform to IS 5889-1970
5. Vibratory roller should conform to IS 500-1970

The methods of compaction shall conform to clause 7.2.1, 7.2.2 & 7.2.3 of IS: 4701-1995.

Unless otherwise specified compaction shall be done by mechanical compactors like standard sheep foot roller hauled by dozer or tractor. While specifications below provide that equipment of particular type and size is to be used. The use of improved compaction shall always be encouraged.

Tamping rollers used for compaction of earth fill shall conform to the following requirements.

A. ROLLER DRUMS*:*

Double drum sheep foot vibratory rollers shall be used for compaction. Each drum of a roller shall have an outside diameter not less than 142.25cms and shall not be less than 122cm in length. The space between two adjacent drums, when on level surface, shall not be less than 30cms and not more than 38cms. Each drum shall be free to pivot about an axis parallel to the direction of travel.

B. TAMPING FEET:

The total number of feet per drum shall be 88. At least one tamping foot is to be provided for 867 sq.cm of the drum surface area. The length of each tamping foot from the drum surface shall be

maintained at not less than 18cm. The cross sectional area/bearing surface area of each tamping foot shall not be less than 25.80 sq.cm and not more than 64.50 sq.cm.

C. ROLLER WEIGHT:

The weight of the roller when fully loaded shall not be less than 7091Kg and the ground pressure when fully loaded shall not be less than 40 Kg/Sq.cm. Appropriate equipment for hauling the rollers should be used which can pull the rollers satisfactorily at a speed of 4.00 Km/hour when drums are fully loaded. The space between the tamping feet shall be kept clear of material striking the drum as the same can reduce the effectiveness of the tamping roller.

D. ROLLING:

When each layer of materials has been prepared to have the proper moisture content uniformly distributed throughout the materials, it shall be compacted by passing the tamping roller. The exact number of passes for each layer to obtain specific density shall be designated by Field Laboratory tests and tests conducted on the borrowed material. The layers shall be compacted in strips over lapping not less than 0.6 m. Rolling shall commence at edges and progress towards centre longitudinally. The roller of loaded vehicles shall travel in a direction parallel to the axis of the canal. Turns should be made carefully to ensure uniform compaction. Rollers shall always be pulled.

3.6.9 TAMPING:

Rollers will not be permitted to operate within one meter of concrete and masonry structures in the following locations where compaction of the earth fill materials by means of roller is impracticable or undesirable, the earth fill shall be specially compacted as specified further below.

i. Porticos of the earth fill in embankment adjacent to masonry structures and embankment foundation designated on the drawing as specially compacted earth fill.
ii Earth fill in embankments adjacent to steep abutments.
iii Earth fill at specially designated locations.

Earth fill shall be spread in layers of not more than 10 (ten)cm in thickness when loose and shall be moistened to have the required moisture content as specified. When a layer of earth fill has been conditioned to have the required moisture content, it shall be compacted to the specified density by special rollers, pneumatic/ hand tampers or by other approved methods. The moisture control and compaction shall be equivalent to that obtained in the earth fill actually placed in the embankment in accordance with specifications.

3.6.10 TESTING:

Density tests shall be carried out after rolling to ascertain the state of compaction carried out at regular intervals to account for variations in the borrow area material. Not less than three tests shall be conducted to indicate variations in the standard Procter density attained in the laboratory. Density tests shall be conducted from time to time at site to ascertain whether compaction is attained as specified. For every 1500cum of compacted earth fill, at least one field density test shall be conducted. However, minimum four density tests shall be made per day irrespective of quantity of earth work. In case, the tests show that the specified densities are not attained, suitable action shall be taken either by moisture correction or by additional rolling, so as to obtain the specified density which shall be checked again by taking fresh tests at the same locations. The test locations should be so chosen as to represent the whole layer under test. Each layer should be tested for proper compaction before a fresh layer is allowed over it.

The density to be attained after compaction should be at least 95% of proctor density predetermined by Laboratory tests.

3.6.11 SETTLEMENT ALLOWANCES:

In the mechanically compacted earth fill, settlement allowance of 2% should be provided. In case of earth fill of canal which has not been mechanically compacted, settlement allowance at 12% of height should be provided and necessary adjustment should be made to take care of natural settlement after one full monsoon rains. Accordingly, extra height should be provided. The base width of the embankment shall not be increased to maintain the design slopes indicated in the drawings for additional height as settlement allowance, but the following procedure shall be adopted.

Settlement allowance shall be calculated at various levels and the elevation including settlement allowance shall be derived keeping the embankment width at the designated levels unchanged. The edges of the embankment at the increased elevations (including settlement) when joined with the points where the slope has changed earlier below, shall give the slope to be adopted for construction.

3.6.12 SLOPES DRESSING:

The slopes for particulars reach of the canal embankments which has been completed in the manner described earlier shall be dressed neatly to the designated line and grade. Extra earth works done at sides are to be dressed and reused in the embankment.

3.6.13 MEASUREMENT AND PAYMENT:

a) All works shall be measured and quantity shall be calculated from level sections only.

b) All linear measurements shall be in meters correct to 0.005m and volume shall be worked out in cubic meters corrected to 0.01m^3.

c) The quantities between the levels taken after stripping and after consolidated embankments under OMC conditions within pay lines shall be worked out excluding rip-rap, rock toe and filters etc. It shall be clearly understood that construction of embankments to extra width for compaction and extra height formed for shrinkage allowances will not be included for payment.

d) The measurement of consolidated embankments with the materials obtained from the burrow area shall be the difference between the net quantities of the final compacted embankment section under OMC and net quantities of compacted embankments constructed with the suitable materials from all other excavations as specified in earlier paragraphs.

e) Final measurement and levels shall be taken at the cross sections completed in all respect after slope dressing plus settlement allowances. The final quantity shall not include extra sections provided as mentioned earlier. Payment will be made only on cross section areas up to pay lines of designed sections when embankment section is achieved to its complete shape.

f) The cost of compaction shall be paid separately as in Bill of Quantities of price bid for the compacted volume of earth after being finished to design section. The unit rate of this item shall be for unit volume of earth fill watered and compacted. No extra payment shall be allowed for labours engaged for collecting of samples for testing and rectification during compaction as may be required.

3.6.14 RATE OF PAYMENT:

The rate for embankment fill under the item provides all costs for labour, materials, tools and plants, machinery, token excavation, transportation and incidental operations required for carrying out and completing the item of work in accordance with the specification, drawing and as directed by Engineer-in-charge including (i) site clearance (ii) setting out works (iii) marking out, providing and forming model section, locks spitting, strings and stakes as may be considered necessary to guide in embankment construction (iv) Compacting the original ground including preparation of seat under embankment (v) Scarifying and benching etc. (vi) clearing trees, stumps and bushes, grubbing and stripping of the borrow areas up to required depth.(vii) maintaining borrow area free from vegetation growth, drainage arrangement and moisture control including watering or dewatering, draining etc. (viii) loading, conveyance from designated borrow area, unloading and spreading of suitable fill materials including re-handling (ix) construction and maintenance of approach roads and haul roads (x) cutting and trimming as specified and dressing of slopes (xi) restricted working near sites of structures (xii) settlement allowance (xiii) spreading in thinner layer at required places (xiv) compaction with suitable compactors (xv) removal of unsuitable materials like bushes, roots, sods, other perishable materials and pebbles etc, from the fill materials (xvi) providing labour for testing of samples (xvii) all safety measures for execution of item.

CHAPTER-4
SLOPE PROTECTION

4.1.0 ROUGH STONE DRY PACKING:

GENERAL:

Rough stone dry packing will be provided in bed and slope of the canal where required to protect damage of earth from scour or rain cuts etc. The stones to be used for packing and the surfaces on which stone packing to be taken up, shall be passed by the Engineer-in-charge. The packing shall consist of boulders and blasted rock and it shall be hand placed. The thickness of the packing shall be measured normal to the slope of the embankment.

The contractors shall execute the work to the lines, grade and section as per drawing and in accordance with the specification and relevant clause / clauses of relevant Indian Standard codes unless otherwise specified.

4.1.1 STONE MATERIALS:

The pitching material shall consist of the most durable rock fragments of approved quality selected for the purpose. Stones shall be procured from the approved quarries and if required shall be subjected to inspection and approval by the Engineer-in-charge. The quality of individual stone shall be dense, sound and free from conglomerate, bands and other defects that would tend to increase their susceptibility to destruction by water and weathering action. Stones having thickness less than 50% of their maximum dimension shall not be used for pitching.

4.1.2 QUALITY OF PACKING STONES:

i) Packing stone shall be controlled in quarry for quality, gradation and size.

ii) Stone and spalls obtained from rock excavation shall be checked for quality, gradation and size before lifting.

iii) The stone for packing should be dense, resistant to abrasion and is free from cracks, seams, shale partings, conglomerate bonds and other defects that would tend to increase their susceptibility to destruction by the action of water and weather.

iv) The stone shall be closely packed and the interstices shall be filled with moorum. The finished surface of packing should be reasonably uniform free from loose stones.

4.1.3 TEST FOR STONES:

i) The rock fragments shall be tested for its soundness as per IS-2386-Part-II.

ii) The rock fragments shall be tested for its abrasion as per IS-2386-Part IV.

iii) Water absorption test – As per IS-2386.

iv) Quality of stone should confirm following standards

1 Soundness	Maximum 12 %
2. Abrasion	Maximum 40 %
3. Water absorption	Maximum 5 %

4.1.4 SIZE OF STONES:

No Stone shall be less than 0.03m^3 in size. At least 50% of stones to be used for pitching shall have depth equal to the thickness of pitching. All stones to be used for pitching shall have a minimum depth of 22.5cm. No stones shall have any dimensions less than 20cm.

Smaller size stones required for filling interstices and wedging may be used and such quantity shall be limited to its requirement only.

4.1.5 BASE PREPARATION:

The bed of canal or the slope of compacted embankment, which is to be protected with stone pitching, shall be trimmed to the lines and grades as prescribed on the drawings or as directed by the Engineer-in-charge from time to time. The earth obtained from this trimming shall be laid on top of the embankment if required or as directed by the Engineer-in-Charge.

4.1.6 THICKNESS OF PITCHING:

a) Pitching shall be hand placed either on bed or side slope of the embankment. The thickness of pitching shall be as indicated on the approved drawings. The thickness shall be measured normal to the slope of the embankment.

b) Launching apron shall be hand placed in horizontal layers and its thickness shall be as indicated on the approved drawings.

4.1.7 METHOD OF PLACEMENT:

a) Before laying the pitching or launching apron on level ground or on sides of the slope of canal banks, the receiving surface shall be trimmed to the required slopes and profiles put by means of lines and pegs at regular intervals. Depressions shall be filled up and thoroughly compacted. Pitching on inverted filter, if any shall be started from the end and built in courses upwards. Stones shall be placed by derrick or by hand and so placed that the largest dimensions are perpendicular to the face of the slope. The large stones shall be placed in the bottom course.

b) The stone shall be laid compactly with staggered joints and so matched & interlocked that, they shall be keyed together with minimum of joint space. Then rock fragments and spalls shall be driven by a hammer into interstices to wedge the packing in place.

c) All interstices between adjacent stones shall be filled with spalls of proper sizes and wedged in with hammer to ensure tight packing.

4.2.0 RIP RAP & LAUNCHING APORON:

4.2.1 GENERAL:

The rip rap may be hand placed or dumped by machines. The thickness of the riprap shall be measured normal to the slope of the embankment.

4.2.2 QUALITY OF STONE:

i) Rip Rap and spall material shall be controlled in quarry for quality, gradation and size.

II) Rip Rap and spalls obtained from rock excavation shall be checked for quality, gradation and size before lifting.

iii) The stone for Rip Rap should be dense, resistant to abrasion and is free from cracks, seams, shale partings, conglomerate bonds and other defects that would tend to increase their susceptibility to destruction by the action of water and weather.

iv) The finished Rip Rap should present a reasonably uniform surface free of loose stones.

4.2.3 TEST FOR STONE:

i) Soundness – The rock fragments shall be tested for its soundness as per IS-2386-Part-II.

ii) Abrasion – The rock fragments shall be tested for its abrasion as per IS-2386-Part IV.

iii) Water absorption test – As per IS-2386

4.2.4 THICKNESS OF RIP RAP / LAUNCHING APRON:

In no case the minimum thickness of hand placed Rip Rap / Launching apron and dumped rip rap shall be less than 30 cm.

4.2.5 PLACEMENT OF RIP RAP / LAUNCHING APRON:

(i) HAND PLACED RIP RAP:

The hand placed rip rap shall consist of one man stone (40 to 45 kg) laid on edge starting at the bottom. The stone shall be laid compactly with staggered joints and so matched & interlocked that, they shall be keyed together with minimum of joint space. Then rock fragments and spalls shall be driven by a hammer into interstices to wedge the rip rap in place.

The hand placed rip rap shall preferably be laid in one course and the layer thickness is same at the stone size. If two layers of stones are used the header stone extending through both layer and spaced at about 1.5m shall be used. In two layers placing the tops layer stones shall be larger.

(ii) **DUMPED RIP RAP / LAUNCHING APRON:**

The dumped rip rap / Launching apron shall consist of boulders or blasted rock fragments of armoury H.G stones should weigh not less than 200 kg and should be within 200 kg to 4.00 MT and shall be dumped mechanically

(iii) CRATES:

Crates shall be of size 100cm X 100cm X 100cm made out of galvanized iron wire of 10-SWG and stitching with 20-SWG wire tying together with all sides filled with hard stones of not less than 50kg in weight or, 30 cm size blocky in shape rather than elongated and more nearly cubical.

4.1.8 MEASUREMENT AND PAYMENT:

Measurement for payment will be made on the basis of cubic meter of the finished works for the respective items as mentioned earlier. The unit rate is inclusive of trimming the earth to required profile, slopes and grade and/or preparing level strips at suitable interval as directed to have uniform base and cost, conveyance, royalty and other taxes of all materials, supply of equipments labour etc. complete as per direction of Engineer-in-charge.

CHAPTER-5
INVERTED FILTER

5.0. GENERAL:

Inverted filters satisfying relevant I.S. Specification should be provided in the location as indicated in the approved drawings or as directed by the Engineer-in-charge.

5.1. MATERIAL:

Inverted filter shall be constructed to the specified thickness always measured normal to the slope. Filters shall be placed in at least two different layers. The filter materials shall be clean, sound, well graded sand and gravel or screened rock fragments manufactured by stone crushers.
The filter materials used are required to satisfy the following criteria:

5.1.1 PIPING CRITERIA:

Its void should not allow migration of particles. For this,

$$\frac{\text{D15 of filter material}}{\text{D85 of base material}} \leq 5$$

D15, D85, D50 denote diameter of grain size, at which 15%, 85% and 50% respectively of material is smaller than the particular size, determined from the gradation curve.

5.1.2 PERMEABILITY CRITERIA:

The filter should be sufficiently more pervious than the base material so as to induce a rapid drop in gradient line or have easy drainage. For this,

$$\frac{\text{D15 of filter material}}{\text{D15 of base material}} \geq 5$$

This criterion ensures permeability of the filters to be greater than 25 times of the base material.

5.1.3 GRADATION CRITERIA:

The filter which satisfies the piping and permeability criteria as above may yet fail if it has excess or lack of certain sizes or is not uniformly graded. Hence the filter material should be well graded to satisfy the condition.
Co-efficient of Uniformity (CU)

> 4 (in case of aggregates)
> 6 (in case of coarse sand)

The gradation curve of the filter material should be approximately parallel with that of base material specially in the finer zone. To ensure it,

$$\frac{\text{D50 of filter material}}{\text{D50 of base material}} < 25$$

Filter material should be clean. Percentage passing through 75 micron IS sieve should be less than 5% and fines shall not be cohesive material.

Filters should not have particles large than 75mm. so as to minimize segregation.

The filter material should be controlled at the quarry site and before lifting, certificate shall be obtained from quality control organization of the department. After testing at the quarry before lifting and transporting to the final point for placement, clean equipments should be used to avoid mixing up of clay and other impurities to the filter.

The requirement for grading of the filters shall be established by the field laboratory on the basis of mechanical analysis of adjacent materials. Mechanical analysis shall be performed on samples which have been compacted by method equivalent to compaction by rollers so that the individual particles of the decomposed rock are broken down to their final conditions. No particles of decomposed rock shall be permitted in the filter. No debris, vegetable matters or other deleterious materials shall be permitted.

5.2 PLACEMENT OF FILTER:

Before the filter is placed, the underlined slope or base shall be trimmed neatly as per the approved drawing. The filter material shall be placed so that each is uniform in thickness. Segregation of fine and coarse sizes in each layer shall be avoided and each layer shall be free from pockets of coarse or fine material. Care shall be taken not to mix the materials of one layer with the material of another layer or with the base to be protected. The placed filter should be compacted with few passes of vibratory roller/flat surface roller/crawler tractor as applicable to obtain relative density of minimum 70%.

5.3 MEASUREMENT & PAYMENT:

The payment shall be made per cubic meter of filter materials. The unit rate is deemed to include the cost, transportation, taxes as applicable, as well as labour, testing charges, compaction and any contingencies, like diversion & dewatering, etc. all complete.

CHAPTER – 6
(CEMENT CONCRETE WORKS)

6. 0 CONCRETE:

a) Concrete shall be composed of cement, fine aggregate (natural sand or manufactured sand or both), coarse aggregates (manufactured), admixtures (if required) and water, well mixed in proportion and brought to the proper consistency. The design mix proportion shall be adjusted to produce a durable and workable concrete, suitable for specified conditions of placement and design strength. Use of approved admixture shall be permitted by Engineer-in-Charge only on satisfactory evidence that its use does not adversely affect the properties of concrete.

b) For all items of concrete in any portion of the structure or its associated works, where nothing is specified, controlled concrete shall be used.

c) All concrete, its constituents, methods and procedures of manufacture shall conform to relevant Indian Standard Specification and other publications listed in Chapter-I, unless otherwise specified.

6.1 CONTROL CONCRETE:

For controlled concrete, the design of the mix proportion should be arrived on basis of trial mix after preliminary tests. Prior to and during construction, all necessary precautions should be observed to ensure that the required working strength is attained and maintained. The controlled concrete shall be of their required grade as M-10, M-15, M-20, M-25, M-30 and M-35 with different proportions of cements, fine aggregate, coarse aggregates and admixture, if required, specified by weights.

In designing the concrete mix the letter 'M' refers to the mix and number to the specified characteristic of compressive strength of 15cm cube at 28 days expressed in N/mm^2. The compressive strength requirement for various grades of concrete shall be as in the relevant BIS Codes in their recent editions.

Concreting in Batching & Mixing plant shall conform to IS Code No. 4925-1968. For works in which water tightness is required the specification in IS 3370-1965 (Reaffirmed 1999) Para 1 to 10 shall be adopted.

6.2 MATERIALS COMPOSITION:

6.2.1 CEMENT:

a) Only Ordinary Portland cement (OPC) shall be used for controlled concrete and other RCC construction works. Pozzolana Portland Cement (PPC) may be allowed in mass concrete etc. In case of exigencies, Portland Slag Cement IS: 455 - 1995 may be allowed in all concrete works after obtaining permission from Engineer.

b) The Contractor shall create suitable and adequate infrastructures for procuring, handling, storing and conveying cement to batching plant at site, with advance planning of work to be done during next one month.

c) Immediately upon receipt at the site of the work, cement shall be stored separately in dry, water tight and properly ventilated structures at the cost of the contractor. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification. The contractor shall produce test certificate of the manufacturer for every 500 tons of receipt of cement or as approved by Engineer-in-charge.

d) Sampling & testing shall be done in the Quality Control organization laboratory of the Department. No cement shall be used until clearance has been given by Engineer-in-charge that the test result are satisfactory. Cements older than 90 days shall not be used unless the test results satisfy the minimum strength requirements. For physical and chemical requirements, Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC) and Portland Slag Cement (PSC) will conform to IS: 269-1989, IS: 1489-1991 and IS: 455-1995 respectively. Actual cement level required for the concrete shall be determined by mix-design.

e) Different shipment of bagged cement shall be stored separately so that it may readily be distinguished from other and shall be stored in a dry enclosed area protected from moisture. Storage of materials shall be as described in IS 4082-1996 (IS recommendation on staking and storage of construction materials at site) To prevent under aging of bagged cement after delivery, the contractor shall use bags of cement in the chronological order in which they were delivered to the job site. All storage facilities shall be at contractor's cost and subject to approval of the Engineer-in-charge.

6.2.2 FINE AGGREGATES:

General specification of aggregates shall conform to IS: 383-1997 or its latest version. Sand to be used shall be natural as obtained from the river bed from specified quarries. The contractor shall arrange quarries and may obtain sand from different sources which shall meet requirement of specification.

Fine aggregates will be tested for their gradation, specific gravity, water absorption, fineness modulus, soundness, petrography analysis, deleterious constituents and alkali aggregate reactivity to assess suitability for use.

6.2.2.1 QUALITY:

a) Sand shall consist of hard, dense durable and uncoated siliceous gritty materials. It shall be free from injurious amount of dust, lumps, soft and flaky particles, shale, alkali, organic matter, loam and other deleterious substances. Sand shall be washed if necessary to remove all vegetations and other foreign materials. The cost of washing and screening shall be borne by the Contractor. The amount of deleterious substances in sand shall not exceed maximum permissible limits prescribed in table 1 clause 3.2.1 of IS 383-1997 (Indian Standard Specification for coarse and fine aggregates form natural source for concrete) when tested in accordance with IS 2386-1997.

Material Passing	*Percentage by weight*
75-Micron IS Sieve	3.0
Clay lumps	1.0
Cinders and Clinkers	0.5
Mica	2.0
Total of all deleterious substances Including alkali, mica coated grains, soft and flaky particles, loams etc.	5.0

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

Fine draft sand or sea sand or sand containing saline impurities shall on no account to be used and requires sodium sulphate test. The sand to be used shall pass Sodium or magnesium Sulphate accelerated test as specified in IS 2386(Part-V) 1997.

6.2.2.2 GRADING:

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

IS Sieve	*Percentage of weight passing on Sieves*
4.75 mm	100
2.36 mm	90-100
1.18 mm	70-100
600 micron	40-100
300 micron	5-70
150 micron	0-15

b) A sand whose grading falls outside the specified limits given in table-4 0f IS: 383-1997 due to excess or deficiency of coarse or fine particles may be processed to comply with the standard by

screening through a suitably sized sieve and/or blending with required quantities of suitable sizes of sand particles. Based on test results and in the light of practical experience with the use of local materials, deviation in grading of sand may be considered by the Engineer-in-charge.

6.2.2.3. FINENESS MODULUS:

a) Sand should have a fineness modulus between 2.1 to 3.0 subject to confirmation of the gradation specified in the preceding paragraphs.

b) The fineness modulus shall be computed by adding cumulative percentage of sand retained on the IS Sieves 4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron, 150 micron and dividing the sum by 100. Gradation of sand shall be so controlled that the fineness modulus of at least 9 out of 10 consecutive test samples of finished sand shall not vary by more than 0.10 from the average. Sand having any deviation from the specified range or gradation and fineness modulus shall not be permitted to be used in work without the written permission of the Engineer-in-charge.

6.2.2.4 SPECIFIC GRAVITY:

The sand to be used shall have minimum Specific Gravity of 2.6.

6.2.2.5 BULKAGE:

Bulk age in sand to be used shall be Less than 20%

6.2.2.6 STORAGE:

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

6.2.3 COARSE AGGREGATE:

6.2.3.1 GENERAL:

a) Coarse aggregates for concrete shall consist of clean, dense and durable crusher broken hard granite metal free from vegetable matter. Predominantly flaky aggregates shall not be used. Coarse Aggregates for concrete from designated quarries shall be arranged by the Contractor to its full requirement as in the contract documents. The contractor shall, unless otherwise specified in the tender notice and subsequently on this basis in the contract, be responsible to maintain required formalities of Government (Revenue Department and controlled by the department of Mines and Geology) and to bear all quarry fees etc. for quarry materials.

The contractor shall carefully clear the area of deposit from which the aggregates are to be produced like trees, roots, bushes, sods, solid unsuitable sand and gravel and other objectionable matter. Materials including stripping, removed from deposits owned by the Government and controlled by the Director of Mines and Geology. Government of India and not used in the work covered by these specifications shall be disposed off as directed.

Due to the overall construction programme, it is quite likely that more than one contractor may elect to use of the sources named in the contract document. The contractor shall be responsible for coordinating his work such that it does not interfere with the operations of other contractor who are also using any given source.

Coarse aggregates as delivered to the batching plant shall generally have uniform and stable moisture content. In case of variations, clause 9.2.3 of IS 456-2000 shall govern during batching. The percentage of deleterious substance in coarse aggregate shall not exceed the following values.

Materials passing 150 micron IS Sieve screen	1
Shale	1
Coal	1
Soft fragments	3
Other deleterious substance	1
Clay-lumps	1

The sum of total of all deleterious materials shall not exceed 5 percent by weight.

6.2.3.2 QUALITY:

Coarse aggregates will be tested for their gradation, specific gravity, water absorption, impact and abrasion values, soundness, spectrographic analysis, deleterious constituents, flakiness and elongation indices and alkali aggregate reactively in accordance with IS 2386-1997 (Part I to VIII) and other relevant standards to assess its suitability. Coarse aggregates shall be washed, if necessary to remove all vegetation and other perishable substances and objectionable amounts of foreign materials. The cost of washing and screening shall be borne by the Contractor.

A) LOS ANGLES ABRASION TEST:

The abrasion value of aggregates when tested in accordance with the method specified in IS 2386 (Part IV) using Los Angles machine shall not exceed 30% for Aggregates to be used in concrete for wearing surface and 50% for aggregates to be used in other concrete.

B) AGGREGATE CRUSHING STRENGTH TEST:

Aggregates crushing value, when determined in accordance with IS 2386 (Part IV) 1997 shall not exceed 45% for aggregates used for concrete other than wearing surface and 30% for wearing surfaces. As an alternative to the crushing strength test aggregates impact value shall be found out with the method specified in IS 2386 (Part IV) 1997. The aggregates impact value shall not

exceed 45% by weight for aggregates used for concrete for other than wearing surfaces and 30% by weight for concrete for wearing surface such as runways roads and pavements.

C) SOUNDNESS TEST:

The coarse aggregates to be used for all concrete works shall pass a sodium or magnesium sulphate accelerated soundness test specified IS 2386 (Part V) 1997 and the average loss or weight after 5 cycles shall not exceed the limits specified in clause 3.6 of IS 383 – 1997.

D) SPECIFIC GRAVITY:

Minimum value shall be 2.60.

6.2.3.3 GRADING:

a) Coarse aggregate shall be well graded. When grading falls outside, it may be processed with standard procedures confirming to relevant IS Codes for best result.

b) The gradation shall give a dense concrete of the specified strength and consistently that will work readily into position without segregation and without use of excessive water content.

c) The grading of coarse aggregate shall be in the nominal sizes as mentioned in Table-II & IS: 383-1997 reproduced below.

Table – II of IS: 383-1997

IS Sieve	Percentage passing for graded aggregate of maximum nominal size (by weight)			
Designation	40 mm	20 mm	16 mm	12.5 mm
80 mm	100	----	---	---
63 mm	---	----	---	---
40 mm	95-100	100	---	---
20 mm	30-70	95-100	100	100
16 mm	---	---	90-100	---
12.5 mm	---	---	---	90-100
10 mm	10-35	25-55	30-70	40-85
4.75 mm	0-5	0-10	0-10	0-10
2.36 mm	---	---	---	---

However, the exact gradation required producing a dense concrete of specified strength and desired workability shall be in grade ranging from 40mm to 4.75 mm. Each grade of material shall be stacked separately.

6.2.3.4 STORAGE:

Production of aggregates may include quarrying of the raw material and processing. Viz. transporting, crushing, screening and washing. Water used for washing aggregates shall be clean and free from alkali, salts and other impurities. After washing, the aggregates must be stored in stockpiles with a free draining base for at least 3 days to ensure that sand delivered to the batching plant will have reasonably uniform moisture content. The storage and handling shall be in such a manner as to prevent inter-mingling of various sizes of aggregates required separately for grading purposes. No foreign matter shall be allowed to be mixed up with the aggregates.

a) Aggregate shall be stacked in such a way as to prevent the intrusion of foreign materials such as soil, vegetable matter etc. Heaps of fine and coarse aggregates shall be kept separate. When different sizes of coarse aggregate are procured separately, they shall be stored in separate stock piles, sufficiently away from each other to prevent the materials at the edge of the piles from getting intermixed with each other.

b) The aggregates shall be stock-piles adjacent to the mixer site so as to require minimum re-handling and labour when conveyed to the mixer/ batching plant.

c) The aggregates shall be placed on a dry hard patch of ground. The aggregates shall be kept free of dirt, rubbish, papers, vegetable matters etc. on the stock piles.
To minimize moisture variations the stock piles shall be spread over as large in area as possible but left low and fairly uniform in height preferably 1.25 to 1.50 meter and the lowest layer of about 30 cm height shall be allowed to act as drainage layer and not used till end.

6.2.4. WATER:

a) Water used for mixing of concrete and mortar and to be used for curing shall be free from injurious amounts of deleterious materials. Portable water is generally considered satisfactory for mixing and curing. Samples of water will be tested before use.

b) Where water is found to contain any sugar or an excess of acid, alkali or salt, and not confirm to IS; 456-2000 shall not be permitted for its use. As a guide the following table represents the maximum permissible values in accordance with IS: 3025-1964 (Latest edition).

PERMISSIBLE LIMIT FOR SOLIDS IN WATER

	(*Mg. per lit.)*
Organic	200
Inorganic	300
Sulphate	500
Alkali/ chlorides	i) 100 for R.C.C ii) 200 for plain concrete
PH value	6 to 8
Suspended matter	200

6.2.5. ADMIXTURES:

i) GENERAL:

No materials other than the essential ingredients i.e. cement, aggregate and water shall ordinarily be used in the concrete or mortar. But the Engineer-in-charge may permit the use of approved admixtures for imparting specific characteristic to the concrete, on satisfactory evidence that its use does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement. Cost of such admixtures shall be borne by the contractor and shall be deemed to have been included in the unit rates for relevant items.

Air Entraining Agent (AEA) confirming to requirement of IS 9103-1997 may be used when necessary, only on approval of Engineer-in-charge. The air entraining agent as an admixture may be added to the concrete batch in form of solution. It shall be batched by means of mechanical batches capable of correct measurement and in such a manner as will ensure uniform distribution of the agent throughout the batch during the specified mixing period. The amount of AEA used shall be such as to effect air entrainment from 4 to 6 percent by volume. The resulting modification, if any, to the content or proportion of cement as a consequence there of shall be accounted for in the rate for payment according to general technical specifications for concrete.

Admixture of Pozzolanas, if ordered, shall conform to the requirements specified in IS 9103-1999 (Indian Standard Specification for Admixtures for concrete).

ii) TESTS:

The contractor shall provide satisfactory facilities for easy and quick collection of adequate test samples. All tests for the evaluation and approval of an admixture shall be made at the expense of the contractor.

6.2.6 EPOXY:

Use of Epoxy for bonding fresh concrete for repairs may be permitted on written approval of the Engineer-in-charge. Epoxy shall be applied in accordance with the instructions of the manufacturers. The cost of such repair with all materials shall be borne by the contractor.

6.2.7. STEEL:

Steel may be used for RCC works as per specification under chapter of reinforcement.

6.2.8. TESTING OF MATERIALS BEFORE COLLECTION:

Before collecting materials required for the concrete work, the contractor shall ensure that the samples of materials proposed to be used are supplied to the project laboratory for tests and materials shall be collected only after ascertaining its suitability from results of the tests and after written permission of Engineer-in-charge.

6.3 MIX PROPORTION OF CONCRETE:

a) Concrete mix shall be designed on the basis of preliminary tests. The proportion of ingredients shall be such that concrete has adequate workability for conditions prevailing at work site in question and can be properly compacted, with the means available. All efforts shall be made to obtain concrete having suitable workability, impermeability, density, strength and durability without use of excess cement. The acceptance or rejection of concrete shall be as per the acceptance criteria laid down in clause 16 of IS 456-2000.

b) The water cement ratio exclusive of water absorbed by the aggregate shall be suitably low to provide adequate durability in concrete. The water cement ratio of various grades of concrete shall as determined from Quality Control laboratory tests and ordered by the Engineer-in-charge. Addition of water to compensate for stiffening of the concrete after mixing but before placing will not be permitted.

c) Supply of properly graded aggregates of uniform quality should be maintained till the completion of the work. Grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions as required. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer-in-charge, to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests. In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Water shall either be measured by volume in calibrated tank or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked in presence of field staffs of the Department.

d) It is most important to keep the specified water cement ratio constant. To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineers (Q. C. staffs). The amount of mixing water shall then be adjusted to compensate for any variations noted in the moisture content. For the determination of moisture content in the aggregate, IS 2386-1997 (part-III) shall be referred to. Suitable adjustments shall also be made in the weight of aggregates to allow for variations in weight of aggregates due to variations in their moisture content.

e) In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend upon the nature of work and methods of vibration of concrete shall be as follows:

Sl. No.	Type of Work	Allowable slump for compaction
1	Mass concrete for RCC foundation footings and retaining walls.	10 mm to 25 mm
2	Beams, slabs and columns	25 mm to 40 mm
3	Thin RCC section or sections with congested steel.	40 mm to 50 mm.

f) If the specified slump is exceeded at the placement, the concrete is unacceptable. The Engineer-in-charge may allow for use of lesser slump whenever concrete of such lesser slump can be consolidated readily into place by means of vibration.

6.4. PRODUCTION OF CONCRETE:

The contractor shall furnish his proposed plant layout and methods of concrete production, concrete transportation and concrete placement to the Engineer-in-charge prior to mobilization. He shall ensure that these are adequate and suitable to meet the construction, specifications. He shall submit detailed description of handling and placing machineries and equipments he proposes to use as per requirements. Minimizing segregation and slump loss shall be strictly absorbed by the contractor in all handling and placing operations and any equipment/methodology found incapable of producing acceptable results shall be promptly replaced/ modified.

6.4.1 BATCHING:

a) The contractor shall provide such means and equipments as are required to accurately determine and control the relative amounts of the various materials including water, cement, admixtures, sand and each specified size of coarse aggregate required for the concrete. Such means and the equipments and its operation shall be subject, at all times, to the inspection and approval of the Engineer-in-charge.

b) The measuring and weighing equipment shall operate within the limit of accuracy specified. Standard test weights and other auxiliary equipment required for checking their satisfactory performance shall be provided by the contractor.

c) The equipment shall be capable of controlling the delivery of material for weighing or volumetric measurement so that the combined inaccuracies in feedings and measuring during normal operations do not exceed 1% for water 3% for all aggregates. Periodical tests shall be made at least once in every two weeks in the case of equipment for measuring water, cement and admixtures and at least once in every month in case of equipment measuring sand and coarse aggregate. However, this shall not obviate any surprise checking and testing at any time as desired by the Engineer-in-charge. Repairs, replacement, or adjustment of equipment at the cost of contractor shall be made as necessary, in order to secure satisfactory performance.

d) The prescribed amount of the various materials of concrete including water, cement, admixtures, the groupings of fine aggregates and each individual size of coarse aggregate shall be measured and controlled within the specified limits of accuracy. The amount of water, cement and aggregate shall be determined in accordance with the method prescribed in Appendix-A of IS: 2720 and its subsequent amendments. In case of coarse aggregates, percentage of free water shall be determined by weighing a representative sample, then surface drying each particle individually with a clean piece of cloth and re-weighing.

e) The proportions of various materials shall be changed as directed in order to maintain the desired quality of the concrete.

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

g) Cement and aggregates hauled from stores for each batch shall be protected during transit to prevent from wind loss and to limit the pre-hydration of cement. Separate compartments with suitable covers shall be provided to protect the cements or they shall be completely enfolded in and covered by the aggregates to prevent wind loss. If cement are enfolded in moist aggregates or otherwise expressed to moisture and delays occur between batching and mixing extra cement shall be added to each batch. The extent of such extra cement will be so as to attain the required quality. No separate payment for this addition of extra cement shall be made to contractor.

6.4.2 MIXING:

a) For all works, concrete ingredients shall be thoroughly mixed in mechanical mixer to ensure uniform distribution of all component materials throughout the concrete at the end of the mixing period and shall be as dense as possible, plastic enough to consolidate well. Mixing shall be done as per clause 9.3 of IS: 456-2000. The mixture should comply with IS: 1971-1968 or its subsequent edition.

b) Mixing shall be continued until there is an uniform distribution of the materials and the concrete is uniform in colour and consistency. The time of mixing shall be as shown in Table-I of IS: 457-2000 reproduced below:

Capacity of Mixer	*Minimum time of mixing*	
	Natural Aggregates	*Manufactured Aggregates*
3 m^3 or large	2 minutes	2 $^1/_2$ minutes
2 m^3	1 $^1/_2$ minutes	2 minutes
1 m^3 or smaller	1 $^1/_4$ minutes	1 $^1/_2$ minutes

Mixing shall be controlled with a suitable time device which will indicate the mixing period and assure compliance of the required period of mixing.

c) The concrete as discharged from the mixer shall be uniform in composition and consistency from batch to batch. Workability shall be checked at frequent intervals as per IS: 1199-1999 or its subsequent edition. Mixers will be examined regularly by the Engineer-in-charge for changes in conditions due to accumulations of hardened concrete or mortar or to wear and tear of blades.
Any mixer that at any time produces unsatisfactory mix shall not be used until repaired. If repair attempts are unsuccessful, the defective mixer shall be replaced. Batch size shall be at least 10%, but not in excess of the rated capacity of the mixer.

d) Water shall be admitted prior to and during charging of the mixer with all other concrete ingredients. After all materials are in the mixer, each batch shall be mixed for not less than time specified in table-I of IS: 457-2000. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

e) The minimum mixing time specified is based on average mixer performance. The Engineer-in-charge may adjust the minimum mixing time as required by the observation of the mix delivered from mixer. Excessive mixing which require addition of water to maintain the required concrete consistency will not be permitted.

f) The first concrete batch at the start of continuous mixing operation or after lapse of 30 minutes in continuous mixing operation shall be made richer by the addition of extra cement as directed but no extra payment shall be made for it.

g) For any one batch, the difference between the unit weight of coarse aggregate from concrete samples from the front and end of the mixer or mixer discharge, when determined in accordance with the above mentioned mixer performance test, shall not exceed 10 percent of the mean value.

h) The full contents of the drum shall be discharged quickly to avoid segregation. The batching plant should be equipped with an interlocking mechanism which will prevent concrete batches from entering mixers which are not empty.

i) The minimum mixing periods specified are conditional on the materials being fed into the mixer in a manner which will facilitate efficient mixing and an operation of the mixer at its designed speed. The following sequence of charging the mixer may be adopted.
   i) Five to ten percent of the total quantity of water required of mixing, adequate to wash the drum thoroughly shall be introduced before the other ingredients in order to prevent any caulking of the cement on the blades or sides of the mixer.
   ii) All dry ingredients (cement, fine and coarse aggregate) shall be simultaneously fed into the mixer in such a manner that the period of flow for each ingredient is about the same. Eighty to ninety percent of the total quantity of water required for mixing shall be added uniformly along with the dry ingredients.
   iii) The remaining quantity of water shall be added after all the other ingredients are in the mixer.
   iv) Portion of the coarse aggregate, however, may be added last. This facilitates clearance of the chutes and removes and fine aggregate of cement adhering to the sides.

j) Concrete which has been kept unused for more than initial setting time after the addition of water shall be rejected unless the concrete is in such a condition that it can be subsequently vibrated in place and its use is specifically permitted.

k) When the mixer is stopped, before placing again any ingredients in the mixers, all hardened concrete or mortar shall be removed from the inner surface of the mixer.

l) The re-tempering of partially hardened concrete or mortar requiring renewed mixing with or without the addition of cement, aggregate or water shall not be permitted.

m) A representative of Engineer-in-charge shall supervise all stages of production of concrete, preparation of test specimens and performance of all site tests.

6.4.3 TRANSPORTATION OF CONCRETE:

a) Concrete shall be transported from mixer to the place of final placement as rapidly as possible by methods which will prevent segregation of the ingredients or slump loss in excess of 25mm and or a loss in air content of more than one percent before the concrete in placed in the works. It shall be transported, laid and compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly designed agitators. Wherever the length of haul from the mixing plant to the place of deposit is such that the concrete unduly compacts or segregates suitable agitators or transit mixers shall be used for conveying concrete. Conveying concrete by head load shall not be permitted.

b) The contractor shall be required to deploy mechanized transportation and placement of concrete such as transit mixer, buckets, and cranes etc. Use of belt conveyors is also allowed if segregation and objectionable slump losses are prevented and there is no loss of mortar on the return belt. The belt should be suitably protected from the sun during hot weather. Suitable hoppers and drop chutes shall be used wherever necessary to prevent segregation.

c) If buckets are used for conveying low slump concrete, they shall be capable of prompting discharge in controlled quantities without splashing or segregating and shall be of such capacity that there is no splitting of batches in loading buckets. Buckets shall be of bottom dump type permitting an even controlled flow into the forms or hopper without undue splashing or segregation. Conveying vehicles shall be designed to facilitate uniform delivery rather than quick dumping.

d) Use of chutes may also be allowed subject to the satisfaction of Engineer-in-charge, and fulfillment of the following requirements:

   i) The chute shall be on a slope sufficiently steep to handle concrete of the least slump that can be worked and vibrated and also the chute is to be adequately supported so that the slope would be constant for varying loads.

   ii) Effective end control through suitable drop chutes shall be provided that will produce a vertical drop and prevent separation of the ingredients. The chute plant shall be of such size and design as to ensure practically continuous flow of concrete in a compact mass without separation or loss of ingredients and shall be protected from wind and sun wherever necessary to prevent loss of slump by evaporation, and shall be furnished with a discharge hopper. Free fall or drop of concrete shall be limited to 150 cm. Chute sections shall be made of or lined with metal and all runs shall have approximately the same slopes not flatter than 1 vertical to 2 horizontal. The required consistency of concrete shall not be changed in order to facilitate flow in chute. Where it becomes necessary to change the consistency, the concrete mix shall be completely redesigned with the approval of Engineer-in-charge. Wherever there is a free fall within the conveying system, suitable baffle plates, splash boards or down spouts shall be provided to prevent segregation, splashing or loss of ingredients. Whenever it is necessary to hold the discharge end of a chute more than 3 meters above the level of the fresh concrete a flexible down spout shall be used to break the fall. The lower end of the spout shall be held close to the place of deposit. Wherever depositing is intermittent, a discharge hopper shall be provided. All chutes shall be thoroughly cleaned, before and after each run. All wash after and debris shall be disposed off outside the forms. Slope of chutes shall be so adjusted that the concrete flows without the use of an excessive quantity of water and without any segregation of its ingredients.

e) Use of Pump-Crete may also be allowed, subject to preparation of mix design in accordance to accommodate pump-crete and the satisfaction and approval of the Engineer-in-charge. This will require a slump of 75mm-100mm of the concrete mix and limiting the maximum size of aggregate to 20mm. Super plasticizers, if needed shall be used with the approval of Engineer-in-charge. A constant supply of fresh, plastic, un-separated concrete of medium consistency will be essential for satisfactory operation of the pump. Concrete pump lines shall be suitably shaded by wrapping them with burlap and kept damp.

f) Equipment used for transporting concrete from batching plant to the forms shall be maintained free from the previously deposited concrete and leakage of mortar. Batch containers, transit mixers, agitators, chutes, concrete pumps, pipe-lines and discharge hopper shall be thoroughly cleaned after each batch and wash with water and all the debris shall be disposed off outside the work area.

g) If truck mixer is used, each truck mixer shall be equipped with accurate water meter located between the supply tank and mixers and having a dial or digital indicator and a reliable revolution counter, located near the water meter which can be readily rest to Zero for indicating the total number of revolutions of the drum from each batch. Each mixer shall have affixed there to a metal plate on which the drum are plainly marked.

6.5 TEMPERATURE OF CONCRETE:

The concrete as deposited shall have a temperature not higher than the stipulated value of 15^0 C to 30^0 C (approximately 60^0 F to 90^0 F) with respect to hot and cold weather conditions. Placement of concrete at a higher temperature is liable to impair the quality and durability of concrete. Temperature shall be maintained as per the procedure set in IS: 7861 (Part-I & II) of its latest edition.

The temperature will be determined by placing a thermometer in the concrete immediately after sampling at the site of placement. The temperature of concrete at the batch plant shall be adjusted to assure that the specified concrete temperature is attained at the point of placement.

PRECAUTIONS:

Insulating water-supply lines/tanks; using cold water.

Cooling course aggregate by sprinkling water;

Working only in evenings and nights; (avoiding working during hot hours of the day)

Shading materials and facilities not otherwise protected from the heat.

Concreting operations shall be temporarily suspended during excessively hot weather when the air temperature inside the form exceeds 115^0 F or when conditions are such that the concrete cannot be placed at the required temperature. Wherever necessary, exposed surfaces of fresh or green concrete shall be adequately shaded from the direct sunrays and protected against premature setting or drying by curing under continuous fine spray of water. Curing compound may be applied to exposed faces of piers and similar other structures.

6.6 SURFACE PREPARATION FOR PLACING CONCRETE:

6.6.1 GENERAL REQUIREMENT:

a) Concrete shall not be placed in any part until all form work required is completed, embedded parts, if any, are installed and checked and passed the surfaces by the Q. C. Organization, prepared for placing. No concrete shall be deposited until the foundation has been inspected and approved by Department.

b) All surfaces of forms and embedded materials that have become encrusted with dried, mortar or grout from concrete previously placed shall be cleaned off all such mortar or grout before fresh concrete is placed.

6.6.2 FOUNDATION SURFACES:

a) Immediately before placing concretes all surfaces of foundations upon or against which the concrete is to be placed, shall be free from standing water, mud and debris. All surfaces of rocks upon or against which concrete is to be placed shall in addition to the foregoing requirement be cleaned and free from all lubricants. Objectionable coating and loose semi-detached or unsound fragments are to be removed. The surface of absorptive foundations upon or against which concrete is to removed and surface shall be moistened thoroughly and kept sufficiently wet for at least 24 hours prior to placing concrete so that moisture will not be drawn from the freshly placed concrete. The cleaning and roughening of the surface of rock shall be performed by the use of high velocity air water jets, sand blasting, stiff brooms, picks or by other effective means. The washing and scrubbing process shall be continued until the wash water collected is clean and free from dirt. In the final cleaning process the wash water may have to be removed by sponges. If any drilled holes are left in the foundation surface which are no longer needed the same shall be cleaned with air water jetting and filled up completely with cement slurry.

b) In the case of earth or shale foundations all soft or loose soil and surface debris shall be scraped and removed. The surface shall be moistened to a depth of about 15 cm. (6 inches) to prevent the sub grade from absorbing water from the fresh concrete. Just before placing, the surface of the earth shall be tamped or otherwise consolidated sufficiently to prevent contamination of concrete during placing. If sub-soil water is met with the foundation, it shall be dewatered making a sump outside working area and as directed till the placing and setting of concrete. All concrete shall be placed on clean damp surface free from standing or running water and never upon soft mud, dried porous earth or upon fills that have not been subjected to approve rolling and desired compaction has been obtained.

c) Foundation of porous or free draining material shall be thoroughly compacted by flushing and by subsequent tamping or rolling, if necessary. The finished foundation surface shall then be blanketed with a layer of tar paper or closely woven burlap carefully lapped and fastened down along the seems so as to prevent the loss of mortar from the concrete.

6.6.3 SURFACES OF CONSTRUCTION / LIFT JOINTS:

i) Construction joints are defined as concrete surfaces upon or against which concrete is to be placed and to which new concrete is to adhere but which have become so rigid that the new concrete cannot be incorporated integrally with that previously placed. The provision of construction joint shall conform to clauses 12.4.1 and 12.4.2 of IS 456-2000 and its latest amendments. The positions of construction joints envisaged during construction are subject to the approval of the Engineer. In lift joint, the concrete of the earlier pour shall be chipped to produce a rough surface or green cut with air water jet after the concrete has hardened sufficiently (4 to 6 hours after vibration) as directed by the Engineer.

ii) All the joints shall cleaned by the contractor at his cost to the satisfaction of the Engineer. All intersections of construction joints with concrete faces which will be exposed to view shall be made straight, level and plumb. All exposed construction joints shall confirm to the requirements of aesthetic and their pattern shall be subject to the approval of the Engineer. Surfaces of the construction joints which have been permitted to dry by reason of the succeeding layer not placed within the specified moist curing period shall be kept moist for at least 72 hours prior to placing the succeeding layer.

iii) Disturbance of surface concrete at the joints shall be avoided during the early hardening period. Before placing the succeeding layer the surface of the construction joints shall be thoroughly cleaned, and loose defective of fractured concrete shall be removed satisfactorily.

iv) The surface of construction/contraction joints shall be clean, rough and damp but free from standing pools of water when receiving the next lift. Clean up shall comprise removal of all laitance, loose or defective concrete, coating sand, sealing compounds, if used, and other foreign materials if necessary by scrapping, chipping or other suitable means.

v) The surface of construction/lift joints shall be cleaned by green cutting to remove laitance if the next lift is planned to be placed within 3 to 4 days of the completion of the previous lift. Green cutting shall be done within 4 to 6 hours of lying concrete depending upon temperature; the surface shall be cleaned by wet sand blasting/high pressure water jetting just prior to placing next lifts. For effective green cutting, the compressed air pressure should not be allowed to fall below 6.33 kg/cm^2. The water pressure should be sufficient to bring the water in to effective influence of the air pressure. As an approximate estimate, the quantity of compressed air required by the green-cutting gun is 2m^3/min. and the quantity of water 273 liters/minute.

vi) The methods used in disposing of waste water employed in cutting, washing and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor or affect exposed surfaces of the structures. Methods of disposal of waste water shall be subject to approval.

6.6.4 PLACING AND COMPACTING CONCRETE:

6.6.4.1 GENERAL:

a) All surfaces upon or against which concrete is to be laid shall be prepared in accordance with the drawings.

b) No concrete shall be placed in any part of the structure, until all the form work, installation of parts to be embedded, if any, have been embedded and approved by the Engineer. The contractor shall notify the Engineer-in-charge at least 24 hours before batching begins for placement concrete. Placement shall not begin until all preparations are completed and correct placement checkout card has been signed by the contractor or his authorized representative and the authorized representative of the Engineer-in-charge satisfying the completion of preparation of surfaces upon or against which concrete is to be laid.

c) If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again.

d) The concrete shall be deposited as nearly as possible in its final position and compacted before setting commences and should not be subsequently disturbed. Methods of placing should be such as to avoid segregation. Care should be taken to avoid displacement of reinforcement of movement of form work.
All concrete which has set before placement shall be rejected and immediately removed from site of work.

e) Treatment of Cold Joint
In concrete placement, delay may occur resulting in cold joints within a lift. When placement is resumed while concrete is still green and not fully hardened (and therefore capable of ready bonding), all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes with a hand pick. Care shall be taken to avoid dislodgement of any particles of coarse aggregate. The surfaces shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of the concrete to be placed on this surface shall not exceed 160mm in thickness and shall be well compacted, with proper attention to corners.

f) In placing concrete in a lift successive batching of concrete shall be placed in a systematic arrangement in order to avoid long exposure of parts of the live surface of a concrete layer.

g) If, for any cause, the working surface is left exposed until it has hardened to a considerable extent, it shall be left to set and cured for not less than 56 hours or longer. If for any reason, concreting is discontinued the initial setting time of already laid concrete is over, the surface thus interrupted shall be roughened and given a thoroughly clean up, thoroughly wetted and covered with a 13 mm thick layer of mortar composed of cement and sand with same ratio as in the concrete mix itself. This 13 mm layer of mortar shall be freshly mixed and placed immediately before placing a new concrete.

h) In placing concrete the exposed area of fresh concrete shall be maintained at the practical minimum by first building up the concrete in approximately horizontal layers to the full width of the block and to full height of the lift over a restricted area at the down-stream end of the block and then continuing upstream in similar progressive stages to the full area. The slope formed by the

unconfined upstream edge of the successive layers of concrete shall be kept as steep as practicable in order to keep its area minimum. Concrete along these edges shall not be vibrated until adjacent concrete in the layer is placed, except, that it shall be vibrated immediately when weather conditions are such that the concrete will hardened to an extent that later vibration may not fully consolidate and integrate if with the concrete to be placed later.

i) Re-tampering of concrete shall not be permitted. Any concrete which has become so stiff that proper placing without re-tampering cannot be ensured shall be wasted.

j) If concrete is placed monolithically around openings having vertical dimension greater than 60cm or if concrete in deck, floor slabs or other similar parts of structures is placed monolithically with supporting concrete, the following requirements shall be strictly observed.

k) Concrete shall be placed up to top of the formed opening at which point further placement will be delayed to accommodate settlement of fresh concrete. If bevels are specified beneath nearly horizontal structural members such as decks, floor slabs, beams and girders, such bevels being between the nearly horizontal members and the vertical supporting concrete below, the concrete shall be placed to the bottom of the bevels before commence of placement.

l) The last 60 cm or more of concrete placed below horizontal members or bevels shall be placed with a 50mm or less slump and shall be thoroughly compacted.

m) All form work and reinforcement contained in it shall be cleaned and made free from standing water and dust immediately before placing the concrete.

n) Except where otherwise agreed to by the Engineer-in-charge, concrete shall be placed in approximately horizontal layers to compacted depth of not more than 45cm. Where internal vibrators are used after getting the approval from the Engineer-in-charge, lesser depths of layers of concrete may be placed where concrete cannot otherwise be placed and consolidated in accordance with the requirements of these specifications.

o) Forms shall be constantly monitored and their position adjusted as necessary during concrete placement.

p) A cold joint is an unplanned joint resulting when a concrete surface hardens before the next batch in placed against it. Cold joints will be allowed only in the event of equipment breakdown prolonged or heavy rainfall or other unavoidable prolonged interruption in continuous placement of concrete.

Care shall be taken to prevent cold joints while placing concrete in any part of the work. The concrete placing rate shall be such that while previously placed adjacent concrete is plastic, later concrete can be made monolithic by normal use of vibrators.

s) Concrete shall not be placed in rain sufficiently prolonged to wash mortar from concrete.

6.6.4.2 COMPACTION:

Concrete shall be thoroughly compacted during the operation of placing and thoroughly worked around the reinforcement, around embedded fixtures and into corners of form work. Wherever possible, vibrators of the surface form or immersion type shall be used. Over vibration and under vibration shall be avoided.

a) All concrete shall be compacted to produce a dense homogenous mass with the assistance of vibrators in such a manner that it is free from pockets of coarse aggregate and is in intimate contact with surface of forms and embedded materials. Unless otherwise permitted, concrete shall be compacted by mechanical vibrator. The vibration of the concrete shall be adequate and efficiently performed for which sufficient number of vibrators of required capacities in serviceable condition shall be kept at site before start of the concrete work, so that spare equipment is always available in the event of break downs.

b) Compaction of concrete shall whenever practicable, be carried out by use of immersion type vibrators. Vibrators having heads of 100mm or more in diameter shall be operated at speed of at least 6000 vibrations per minute when immersed in the concrete.

Vibrators having vibrating heads less than 100mm. in diameter shall be operated at a speed on at least 7000 vibrations per minute.

6.7 REPAIR OF CONCRETE:

i) It will be the obligation of the contractor to repair imperfections in the work expeditiously and of the necessary standards of workmanship through deployment of capable crew. Repair should be completed within 24 hours after the forms have been removed. Before repairs are commenced, the methodology of repairs and material to be used shall be got approved from the Engineer-in-charge. The proven methods of repair of concrete are outlined in the USBR Concrete Manual (Eighth Edition – Revised, 1988), which include: Dry-Pack Mortar; Replacement Concrete; Replacement Mortar; replaced aggregate concrete; & Epoxy concrete etc.

ii) Surface of concrete finished against forms shall be smooth, free from projections. Immediately upon the removal of forms within 4 hours thereof wherever practicable, all unsightly ridges of fins shall be removed and any local bulges on exposed surfaces shall be remedied by tooling and rubbing. All holes left by the removal of fasteners from the tie rods, after being removed with a toothed hammer shall be neatly filled with requisite dry patching mortar.

iii) All honey combed, porous, fractured or otherwise in the opinion of the Engineer-in-charge, additions are required to bring it to the prescribed lines, shall be removed by chipping concrete. The chipped opening shall be sharp edges and keyed and shall be filled to the required lines with fresh concrete or as found suitable.

iv) Concrete replacement shall be used when holes extend 0.05 sq meters in area and deeper than the reinforcement steel in reinforced concrete and in un-reinforced concrete where the holes are 0.1 sq. meter in area and 100 millimeters or more in depth.

v) Where concrete is used for filling as mentioned above, the defective concrete shall be removed and good concrete exposed but in no case less than 100 millimeters in depth and the concrete will be reinforced if necessary and as directed by the Engineer-in-charge.

vi) Dry packing mortar shall consist of one part of cement to two parts sand by volume and just enough water so that the mortar as used will stick together on being module into ball by slight pressure of the hands and will not exclude free water when so pressed but will leave the hands damp. The mortar shall be fresh and shall be placed within 30 minutes after preparation.

vii) The mortar shall be placed in layers not more than 25 millimeter in thickness after being compacted and each layer shall be thoroughly tamped to the satisfaction of the Engineer-in-charge. Each layer except the last shall be roughened thoroughly to provide an effective bond with the succeeding layers. The last or finishing layer shall be smoothened to form a surface continuous with surrounding concrete. Dry packing mortar shall be used for filling behind reinforcement or for filling holes that extend completely through a concrete section. Guniting shall be used for holes too wide for dry patch mortar filling and too shallow for concrete filling.

viii) All patches shall be bonded thoroughly to the surface of the chipped openings and shall be sound and free from shrinkage crack.

ix) All procedures for the replacement of concrete, mortar replacement, use of epoxies and curing of repairs shall be according to the provisions laid down in Chapter – V "Repairs & Maintenance of Concrete—Concrete Manual, United State Bureau of Reclamation, Eighth Edition, Revised 1981 vide Paras 130(b), (c), (e) 133, 134 & 136 of the concrete manual as may be applicable to these repairs.

6.8. CURING AND PROTECTING:

6.8.1. All concrete shall be protected against injury until final acceptance. Exposed finished surfaces of concrete shall be protected from the direct rays of the sun for at least 72 hours after placement. Fresh exposed concrete shall also be protected from the action of the rains and mechanical injury. No fire shall be permitted in direct contact with concrete at any time. Concrete in which standard Portland cement is used shall be kept continuously moist for not less than 14 days for normal concrete by covering with saturated materials like burlap/hessian cloth etc. or a system or perforated pipes, mechanical sprinklers or hose or by one other methods approved by the Engineer-in-charge.

6.8.2. All openings formed through the concrete, should be closed during the entire curing period and as long thereafter as practicable to prevent circulation of air and prevent the resultant cracking.

6.8.3. Construction joints shall be cured in the same way as the other concrete and shall also be kept moist for at least 72 hours prior to the placing of additional concrete upon the joints. The time of applying damp sand shall be specified by the Engineer-in-Charge before which curing will be carried out by other methods approved by the Engineer-in-charge.

6.8.4 The water and other methods of curing shall be handled as not to stain concrete surfaces which shall be exposed.

6.8.5 The actual method of curing adopted shall be subject to the approval of the Engineer-in-charge. The contractor shall have on hand, and ready to install before actual concrete placement is started, all equipments needed for adequate curing and protection at all location of concrete placement.

6.8.6 Finished concrete surfaces shall be protected from stains and/or abrasion surfaces or edges likely to be injured during the construction period shall be kept properly protected by leaving forms in place or erecting protective covering satisfactory to the Engineer-in-charge.

6.8.7 In case the curing operations are inadequate or unsatisfactory, the Engineer-in-charge shall be entitled to take such steps as he may deem necessary to make good the deficiencies and defects, at the contractor's risk and cost.

Curing and protection should confirm to para 4-14 of I.S. 457-1991 or with the latest amendments.

6.9. MEMBRANE CURING:

Curing compound may be applied to the concrete surfaces, which will be permanently exposed to air, by spraying first coat to provide a continuous uniform membrane over all area with the coverage per liter as prescribed by the manufacturer according to the roughness of the surface to be covered. It may be necessary to cover the surface adequately; a second coat of curing compound shall be applied by spraying at right angles to the direction at which the first coat is applied.

6.10. EXPANSION JOINTS IN CONCRETE:

Expansion joints shall be provides as shown on the drawing or as directed. Performed bituminous fiber type expansion joint filter materials or readymade bituminous boards shall be placed in the expansion joints. Open joints or false joints shall be constructed as shown in the drawing or as directed by the Engineer-in-Charge. For details of performed bituminous filler refer relevant IS Codes.

6.11. CONCRETE IN BLOCK OUTS:

a) All concrete required to be placed in block outs to permit the installation and adjustment of mechanical and other embedded parts shall be included in the respective concreting work of the component. The concrete surface with block outs shall be chipped and roughened as described and the dowel bars shall be made ready hereinafter before the concrete is placed in block-outs.

b) Exceptional care shall be taken in placing the concrete in block-outs in order to ensure satisfactory bond with the concrete previously placed and to secure complete contact with all metal work in the block-outs.

c) The roughening of the concrete surface of the block-outs shall be performed by chipping and or sand blasting as directed by the Engineer-in-charge and in such a manner as not to loosen, crack or disintegrate any part of the concrete beyond the roughened surface. After roughening the surface, old concrete shall be cleaned thoroughly of loose fragments, dirt and other objectionable substances and shall be sound and hard to ensure good mechanical bond between the existing and new concrete. All concrete which is not hard, dense and durable shall be removed to the depth required to the satisfaction of the Engineer-in-charge.

6.12. EMBEDMENT IN CONCRETE:

In some location of the structures, embedment for 2nd stage concrete of gate guides electrical conduit lines, piezometers and other fixtures or openings have to be provided in concrete work as shown on relevant drawings or as directed by Engineer-in-charge. Construction of the surface for either placement of concrete shall have to be suitably carried out so as to provide such embedment/fixtures/openings. Grouting of concrete behind the gate guides, where ever necessary shall have to be done. No extra payment shall be made for the operations as this shall be deemed to have been included in the price bid in schedule of quantities for the respective item of work.

6.13. TESTS AND STANDARDS OF ACCEPTANCE:

6.13.1. GENERAL:

The contractor shall supply samples of all ingredients of concrete used in the work free of cost for the tests to be conducted through the Engineer-in-charge or any officer nominated by him. Testing of concrete shall be carried out by the Quality Control Organization of the Department in their laboratories at the cost of the contractor. The tests shall be conducted with the representative samples in accordance with relevant Indian Standard Specifications.

6.13.2. SAMPLING PROCEDURE AND FREQUENCY:

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

b) The minimum frequency of sampling of concrete of each grade shall be in accordance with the following as per I.S. 456-2000.

Quantity of concrete m^3	*Number of samples*
1 to 5	1
6 to 15	2
16 to 30	3
31 to 50	4
51 to above	4 plus one additional sample for each additional 50m^3 or part hereof.

(Note: At least one sample shall be taken during each shift.)

6.13.3. TEST SPECIMEN:

a) Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes, such as to determine the strength of concrete at 7 days or at the time of striking from work, or to determine the duration of curing or to check the testing cubes by accelerated methods as described in IS: 9013-1999. The specimen shall be tested as described in IS: 516-1999.

b) For controlled concrete preliminary tests shall consists of three sets of separate tests and in each set, tests shall be conducted on six specimens. Not more than one set of six specimens, shall be made on any particular day. Of the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests at 7 days are intended only to indicate the strength likely to be attained at 28 days.

6.13.4. TEST STRENGTH OF SAMPLES

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

b) Contractor shall provide necessary unskilled labour and facilities for collection of samples, curing in vats; transportation of cubes etc. and his authorized representative shall remain present at the

time when the samples, cores etc. are collected. Testing shall be carried out at the testing laboratories set up close to the site or at any other laboratory that the Engineer-in-charge may decide upon and the results given thereby shall be considered as correct and authentic and acceptable to the contractor. The contractor shall be given access to all operations and tests that may be carried out as aforesaid.

6.13.5. ACCEPTANCE CRITERIA:

a) The average strength of the group of cubes cast for each day shall not be less than the specified cube strength for the work. About 20 percent of the cubes cast for each day may have values less than the specified strength provided the lowest value is not less than 85% of the specified strength.

b) In case the concrete does not conform to the accepted criteria for strength as specified above, the Engineer-in-charge reserves the right to reject the work or accept the same at a reduced rate derived from tendered rate or as approved by him provided that the strength does not affect integrity of the structure. Whenever necessary for the purpose of obtaining economy, workability, density, impermeability, durability strength or on account of variation in the quality and gradation of aggregates or other materials, the Engineer-in-charge, in consultation with quality control organization shall, after testing make necessary changes. Contractor shall have to effect these changes and will not be entitled to any compensation on account of such changes.

6.14. TOLERANCES:

i) Allowable deviation in concrete works from plumb, level, alignment, profile, grade and dimensions shown on the approved drawing is defined as tolerance. All concrete structures shall be built to the exact line, grades and dimensions established. However, variations from the line, grades and dimension, which occur despite all reasonable precautions taken, will be permitted to the extent set forth in these paragraphs without any further additional cost to the contractor.

ii) The Govt. reserves the right to diminish the tolerances set forth therein if such tolerances impair the structural action operational function or architectural appearance of a structure or position thereof.

iii) Concrete shall be within all stated tolerances, even though more than one tolerance may be specified for a particular concrete structure. Provided that the specified variation for one element of the structure shall not apply when it will permit another element of the structure to exceed its alterable variation. Where tolerances are not specified for particular structure, tolerances shall be those specified for a similar work. The contractor shall be responsible for finishing the concrete forms within the limit necessary to insure that the completed work will be within the tolerance limit specified. The defective work where the tolerance limit is exceeded shall be remedied in his own cost as directed by the Engineer-in-charge.

iv) Permissible surface irregularities for the various classes of concrete surface finished are to be distinguished from the tolerances described herein. The intent of this paragraph is to establish tolerance that are consistent with modern construction practice, yet governed by its effect, upon the structural action, appearance or operational function of the structure. Where tolerances are not stated in the specification or drawings for any individual structure or feature thereof, permissible deviations will be interpreted conformably to the provisions of this paragraph.

a) **ALL MAJOR STRUCTURES**:

i) Variation of the constructed linear outline from established position in plan.

In 5 meters …. 10 millimeters
In 10 meters …. 20 millimeters.

ii) Variation of dimensions of individual structural features from established position.

In 25 meters or more …. 30 millimeters

iii) Variations from the plumb, from the specified batter or from the curved surfaces of all structures including the lines and surfaces of walls, piers, vertical joint grooves and visible aisles.

In 2.5 meters …. 10 millimeters
In 5 meters …. 20 millimeters
In 10 meters … 30 millimeters

iv) Variation in cross sectional dimensions of piers and small members.

Minus …. 5 millimeters
Plus …. 10 millimeters

v) Variation in thickness of walls and similar members.

Minus …. 5 millimeters
Plus …. 10 millimeters

vi) Seals and side walls for gates and similar water tight joints. Variation from the plumb level not greater than a rate of 5 millimeter in 5 meters.

b) TOLERANCE FOR PLACING REINFORCEMENT STEEL:

i) Variation for protective covering
With 50 millimeter cover 10 millimeter
With 75 millimeter cover 12 millimeter

ii) Variation from indicated spacing – 25 millimeter

c) TOLERANCE FOR CANAL STRUCTURES:

1	Deviations from specified dimensions of cros section of columns, beams, piers and slabs	(-)6 mm to (+) 12mm
2	Deviations from dimensions of footing.	
	Dimensions in plan	(-) 12mm to (+) 50 mm
	Eccentricity	(±) 0.02 times width of footing in the direction of deviation but not more than 50mm
	Thickness	(±) 0.05 times the specified thickness.]

Note: *Tolerance applies to concrete dimensions only but not for positioning of vertical reinforcing bars or dowels.*

6.15. MEASUREMENT AND PAYMENT FOR CONCRETE:

Measurement and payment for cement concrete items shall be made on the basis of the actual volume of the concrete laid for finished items. No deductions shall be made for the space occupied by reinforcement rods, embedded metal parts, piezometers, electrical conduit lines etc. The quantity of concrete for the grooves for stop logs and crest gates in abutments, and piers shall however be deducted from the total quantity to arrive at the concrete work under respective items. The volumes of openings, fixtures, pipes and metal works each of which is larger than $0.10m^2$ in cross section will be deducted. The reinforcement steel shall be separately paid at the rates under items of Bill of Quantities. The rate of concrete should include the cost of all labour and materials, machineries, T&P, royalty and taxes etc. and for fabrication of shuttering plates, clearing, planting fixing in position with staging, centering nuts and bolts, tie etc. and removing after specified period from date of lying of concrete and curing. All labour, material, plant etc. involved in providing cement, slurry and mortar or concrete and construction joints and cost of cleaning surfaces shall be deemed to be included in the unit rates. No payment shall however be made for providing grooves for crest gates & stop log gates, fixing pipes and installing other fixtures, electrical conduits. The cost of fitting & fixing shall be deemed to be included in the rates. The rate shall include all incidental operations like dewatering etc.

CHAPTER – 7

7.0. FORM WORK:

7.1 PROCEDURE:

7.1.1. All staging works/ centering and shuttering works (Form work) shall be constructed temporarily according to the approved drawings and specification to provide actual shape, size, level, grade and dimension to the concrete/ reinforced cement concrete. The Form work shall be of rigid and smooth to give aesthetic view to the structure.

7.1.2. As soon as practicable, after the acceptance of tender, the contractor shall submit a scheme showing the procedure and method of form works by which he proposed to carry out the work, together with such details as are necessary to demonstrate the adequacy, stability and safety of the methods.

7.1.3. The approval to the general scheme of centering & shuttering as well as design criteria and loading shall be obtained in good time to facilitate all preparatory works. Any delay on this account shall be the responsibility of the contractor.

7.1.4. After approval of the general scheme, the contractor shall prepare detailed design and drawings for execution of the form work, centering and temporary work. These shall be forwarded to the Engineer-in-charge for approval. If the method is not accepted by the Department, it may be modified suitably. No work shall be carried out without prior approval of the Engineer-in-charge.

7.1.5. Not withstanding the approval given in accordance to the design criteria and loading and the general scheme furnished by the Agency, for Form work, the entire responsibility for the satisfactory execution of centering/shuttering and all temporary works for withstanding concreting and removal of form work after stipulated interval, shall rest with the contractor. The Contractor shall be liable to pay all claims and compensation arising from any loss or damage to life and property due to any deficiency, or due to failure or fault malfunctioning of the Form works.

7.1.6. The contractor is responsible to set the forms to line and grade and in plumb and to achieve tightness and braced sufficiently to stay in alignment and strong enough to hold the concrete. There should be no loss of mortar causing any honey-combing.

Stability is a very important consideration in form work. Contractor shall ensure that the forms do not suffer from inadequate cross-bracing, inadequate horizontal bracing.

Immediately before concrete is placed, the forms should be properly treated with suitable form oil or other suitable coating material to prevent sticking of the concrete.

Joints between the form work and existing concrete structures shall also be grout tight. Form work shall be arranged to facilitate removal of the various parts in correct sequence, without jarring or damaging the concrete. Fixing blocks, bolts or similar devices may be embedded in the concrete, provided they do not reduce the strength or effective cover of any part of the structure below the required standard but the use of through bolts shall be avoided as far as possible. Temporary opening shall be provided at all points necessary in the forms to facilitate cleaning and inspection immediately before placing of the concrete.

7.1.7. Forms shall overlap the hardened concrete in the lift previously placed by not more than 75 mm and shall be tightened smoothly against the hardened concrete in the lift previously. Particular attention shall be paid in setting and tightening the forms for construction joints so as to get a smooth joint-free or sharp deviations or projection. No jute bags or other such materials be allowed to be used to make the joints of shuttering plates for leak proof.

7.1.8. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall be maintained rigidly in position. The contractor shall continuously monitor plumb, line and grade of form works and correct immediately the deficiencies. If a type of from does not consistently perform in an acceptable manner, as determined by the Engineer-in-charge, the type or form shall be changed and method of erection shall be modified by the contractor without any extra cost.

7.1.9. Chamfer strips shall be placed to produce beveled edges on permanently exposed concrete surfaces. Interior angle of inter setting concrete surfaces and edges of construction joints shall not be beveled except where indicated on the drawings.

7.1.10 Suitable struts or stiffeners or ties shall be used for the staging work wherever necessary. All supports shall be braced and cross braced into two directions. All splices and braces shall be secured by bolting unless specially intended otherwise. All struts shall be firmly supported against settlement and slipping, by suitable means as directed. All supports shall be cut square at both ends and firmly supported against settlement and slipping. When the form work is supported on soil, sleepers etc. shall be used to properly disperse the loads. In case the supports rest on already completed beam or slab suitable props shall be provided under the latter.

7.1.11 In case of using form works for columns, retaining walls or deep vertical component the height of the column shall facilitate placement and compaction of concrete and suitable arrangement may be made for securing the forms to the already poured concrete for placing the subsequent lifts. No steel tie or wires used for securing this form work shall be left exposed of the face of the finished work.

7.1.12 Suitable inserts for block outs for gate grooves or electrical and other service fixtures where necessary shall be provided in the required locations as specified.

7.2. REMOVAL OF FORMS:

7.2.1. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any form. Forms shall be removed as soon as the concrete has hardened sufficiently, thus facilitating satisfactory curing and earliest practicable repair of surface imperfections.

7.2.2. Forms on sloping surfaces of concrete, such as forms on the water sides shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any repair or treatment required on such sloping surface shall be performed at once and followed immediately by the specified curing.

7.2.3. Forms shall be removed with care so as to avoid damage to the concrete. Damaged concrete surfaces, during form removal shall be repaired in accordance with the specification for Repair of Concrete.

7.2.4. The contractor shall be liable for damage or any injury caused by removing forms before the concrete has gained sufficient strength. To avoid incessant appearance in concrete that might result from swelling of forms, wood forms for wall openings shall be loosened as soon as the loosening can be accomplished without damages to the concrete. Forms for the opening shall be constructed to facilitate such loosening. Forms shall be removed with care so as to avoid injury to concrete and any concrete so damaged shall be repaired in accordance with paragraph 6.2.21 by the contractor at his cost.

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

7.2.6. The following minimum time intervals of form stripping as per specifications in IS-456-2000 will generally be followed while using ordinary Portland cement.

(i)	Walls, columns and vertical faces.	24 to 48 hours or as may be decided by Engineer.
(ii)	Slabs (Prop left under)	3 days
(iii)	Beam Soffits (Prop left under)	7 days

(iv)	Removal of props under slabs Spanning up to 4.5 m.	7 days
	Slabs spanning over 4.5 m.	14 days
(v)	Removal of props under beam and arches	
	spanning up to 6 m	14 days
	Spanning over 6 m.	21 days

Note: For other cement, the stripping time recommended for Ordinary Portland Cement may be suitably modified.

7.3. CLEANING OF FORMS:

7.3.1. All rubbish, shall be removed from the interior of the forms. The form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with an approved composition. Care shall be taken that such approved composition is kept out of contact with the reinforcement. Before concrete is placed, the surfaces of forms designated to produce F-1 & F-2 finished shall be oiled with commercial form oil that will effectively prevent sticking and will not stain the concrete surface. For timber forms, oil shall consist of pure refined, pale, paraffin mineral oil or approved form oil. For steel forms, form oil shall be mineral oil suitably compounded with one or more ingredients which are appropriate for the purpose. Care shall be taken to keep form oil out of contact with reinforcement.

7.3.2. Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms and request him to inspect and accept the form work as to their strength, alignment and general fitness, but such inspection shall not relieve the contractor of his entire responsibility of form work to withstand concreting and for safety of men, machinery and materials.

7.4. RE-USE OF FORMS:

Forms required to be used more than once shall be maintained in serviceable condition and shall be thoroughly cleaned and repaired before reuse. Where metal sheets are used, the sheets shall be placed and maintained in the forms without lumps or other imperfections. All forms shall be checked for shape and strength before reuse.

7.5 FINISH OF FORMED SURFACES:

7.5.1. The classes of finish and requirements for finishing of concrete surface shall be as shown in the drawing or as hereinafter specified. In the event of finishing not being definitely specified herein or on the drawings, the finishes to be followed shall be as directed by the Engineer-in-charge. Finishing of concrete surface shall be performed only by skilled workmen.

7.5.2. Completed concrete surfaces will be tested where necessary to determine whether surface irregularities are within the limits herein specified.

7.5.3. Surface irregularities are classified as either 'abrupt' or 'gradual'. Offsets caused by displaced form sheathing, or lining or form sections or by loose knots or otherwise such defect will be considered as abrupt, other irregularities shall be considered as gradual irregularities and will be tested by use of template, consisting of a straight edge or the equivalent there of for curved surfaces. The length of the template shall be 150 cm for testing of formed surfaces and 300 cm for testing unformed surfaces.

7.5.4. TABLE FOR FINISH OF FORM WORK:

Sl. No.	F-1 finish		F-2 finish
1	Surfaces of the concrete remaining below N.S.L	1	Deck of the Bridge
2	Block Joints	2	Piers
3	Key for Intermediate Construction	3	Abutment & wall (river side)
4	Faces which are not exposed fo public viewing.	4	Exposed surface of the profile of the structure.

7.6. COST:

The cost of furnishing all materials and performing all works for constructing forms including any necessary treatment or coating of forms is indicated in the respective items of the bill of quantities of the agreement.

CHAPTER – 8

REINFORCEMENT

8.0. GENERAL:

Unless shown otherwise in the drawings, the reinforcement bars shall be of High Yield Strength Deformed (HYSD) bars of grade Fe-500 conforming to IS: 1786-1985 or its subsequent editions for HYSD steel bars and wires for R.C.C. work. The steel reinforcement bars shall be placed in position including cost, carriage, royalty and other taxes of all materials with all leads and lifts, labour for straightening, cutting, bending, binding, welding as required, placing in position in grills as per approved design & drawings, and specification tying the grills with 18 to 20 gauge binding wire, placing in position with ties, chairs, supports and spacers etc. complete to the satisfaction of Engineer-in-charge. This also will be applicable for anchoring rock with concrete through HYSD steel reinforcement bars as in approved design & drawings.

8.1. PROCUREMENT OF STEEL:

Steel required for reinforcement should be procured sufficiently ahead of its use in the work subject to the observance of the following points. The contractor shall make his own arrangement for procurement of steel of required specification of reputed manufacturing units, preferably reinforcement bars manufactured by Steel Authority of India Limited (SAIL) or Rastriya Ispat Nigam limited (RINL) or TISCO.

i) The procurement schedule of steel required for the work should be submitted for approval of the Engineer-in-charge prior to its procurement.

ii) Unless otherwise specified elsewhere, general requirements relating to the use and procurement or materials, inspection and testing shall confirm to IS: 1387-1959 with its latest amendment.

iii) No steel material shall be dispatched/received from the manufacturer's or suppliers' premises prior to its being certified by the contractor or his authorized representatives and due permission of the Engineer-in-charge as having fulfilled the test and requirements laid down in this standard (IS-1387-1959 with its amendments) except where the bundle or coil containing the bars is marked with the ISI certification marks.

iv) The contractor should make an arrangement with the manufactures or suppliers so that the Engineer-in-charge or his representative shall be at liberty to inspect and verify the steel manufacturer's certificate regarding physical & chemical analysis at the premises of the manufacturer or supplier. When the Engineer-in-charge requires an actual analysis of finished materials, the contractor must ensure that the manufactures or suppliers carry this analysis at a place as agreed by the Engineer-in-charge.

v) Manufacturers' Certificate

In case of bars which have not been inspected at the manufacturer's works, the manufacturer or supplier, as the case may be, shall supply the contractor with the certificate stating the process of manufacture and also test sheet signed by the manufacturer giving the results of each mechanical tests applicable to the material purchases, and the chemical composition, if required. Each test sheet shall indicate the number or the identification mark to be found on the material. All these documents should be handed over to the Engineer-in-charge before material is used in the work.

vi) Identification and marking.

The contractor must ensure that the manufacturer or supplier shall have ingots, billets and bars or bundles of bars marked in such a way that all finished bars can be traced to the cast from which they were made. Every facility should be extended to Engineer-in-charge or his authorized representative for tracing the bars to the cast from which they were made.

vii) Tests.

Engineer-in-charge may collect the samples from lot to be tested either in the quality control laboratory of the department or in any approved and recognized laboratory. The cost of the test processes including transportation from the stock yard to laboratory etc. should be borne by the contractor.

a) Unless otherwise specified, selection and preparation of test samples should be as per IS-226-1962 with its latest amendments.

b) All test pieces of bars shall be selected by the Engineer or his authorized representative either.

   i) From the cutting of bars, or

   ii) From any bar or the coil, after it has been cut to the required or specified length and the test piece taken from any part of it.

c) All the test samples should be tested as required by the Engineer-in-charge as per the relevant Indian Standard procedures and the lot will be accepted for use after it satisfies successfully all requirements of the tests.

d) Re-tests

Should any one of the test pieces first selected fail to pass any of the tests, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of that particular test. Should the test piece from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with the required standard and hence the representing lot will be rejected.

8.2. STEEL REINFORCING BARS:

a) Steel reinforcing bars and anchor rods shall be placed in concrete where shown on the drawings or as directed by the Engineer-in-charge. The specification drawings issued with the tender document do not show the position of reinforcement. Working drawings shall be issued by the Engineer-in-charge during the course of the contract for details of reinforcement. Generally, the quantity of consumption of steel will be as in the approved construction drawings i.e. working drawings.

b) At least 30 days prior to placement of reinforcement, the contractor shall submit to the Engineer-in-charge three prints and reproducible tracing of each of reinforcement details (Bar Bending Schedule) compatible to working drawings for approval. The Contractor's reinforcement detailed drawings shall be prepared in accordance with IS: 456-2000 "Code of practice for Plain and Reinforced Concrete", IS: 2502-1999 "Code of practice for bending and fixing of Bars for concrete Reinforcement" and IS: 5525-1999 "Recommendation for detailing of Reinforcement in RCC work". The contractor's drawings shall show necessary details for checking the bars during placement. Reinforcement bars shall conform to requirements shown on the drawings or as directed by the Engineer-in-charge. The approval of the Engineer-in-charge to the Contactor's reinforcement detailed drawings shall not absolve the contractor's responsibility for the correctness of details or for conformance with the requirements of those specifications.

c) As far as possible, high yield strength deformed bars, conforming to IS: 1786-1999 or as asked in the drawing shall be procured to be used as reinforcement by the contractor. However, in case of non-availability of such bars other steel bars conforming to IS: 432-1995 and/or IS: 1139-1995 shall be procured by Contractor after approval of Engineer-in-charge in writing for use as substitute. The same rate stipulated in schedule will be applicable for all type of steel reinforcement bars.

d) Steel reinforcement bars shall be clean and free from rust, at the time of fixing in position and subsequent concreting.

e) The steel reinforcement bars shall be stored in such a way as to avoid distortion and to prevent deterioration by corrosion.

f) The weight of steel per meter supplied by contractor shall be as per standard steel tables of Indian Standards.

8.3. CUTTING, BENDING, BINDING AND PLACING OF BARS:

a) The contractor shall be responsible for the accuracy of the cutting, bending as per the drawing and bar bending schedule and placing of the reinforcement. Unless otherwise prescribed, placement dimensions shall be to the center line of the bars. Reinforcement shall be inspected for compliance with the requirements as to grade, size, shape, length, splicing and locations after it has been placed. No concerting shall be started unless the reinforcement placed in the work is finally checked and accepted by the Engineer-in-charge.

b) Before the reinforcement is placed, the surface of the bars and surfaces of any metal bar supports shall be cleaned of the rust, loose scale, dirt, grease and other objectionable foreign substances. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in the concrete.

c) Reinforcing bars shall be accurately placed and secured in position in accordance with the procedure specified in IS: 2502–1990 (code of practice for bending and fixing of bars for concrete reinforcement). Placing of bars will be such that there will be minimum required gaps between the bars and any adjacent embedded metal work and the bars and fabric shall not be displaced during the placing of concrete. The contractor shall also ensure that there is no disturbance of the reinforcing bars in concrete that has already been placed.

d) Wire for binding reinforcement shall be of soft and annealed mild steel and shall conform to IS: 280-1978 (or Latest Edition). Binding wire shall have tensile strength of not less than 56kg/mm^2. The wire shall have minimum diameter of 1mm. Chairs, hangers, spacers and other supports for reinforcement may be of steel or other approved material. Where portions of such supports will be exposed, the exposed portion of support shall be galvanized or coated with other corrosion resistant material without which the concreting will not be permitted. Such supports shall not be ordinarily exposed on surfaces without specific instructions given on the relevant drawings. The minimum allowable clearance between parallel steel bars shall not be less than 1.5 times the diameter of the larger bars or 1.5 times the maximum size of aggregate whichever is greater. All the points of bars crossing each other, where required, shall be secured by binding wire in such manner that they do not slip over each other at the time of fixing and concreting. Wire used for binding reinforcement shall not be measured for payment.

e) Bars shall be bent cold to the specified shapes and dimensions as in approved drawings. Bars shall not be bent or straightened in a manner that will injure the material or reduce the strength of bar. Bars bent during the transport or handlings shall be straightened before being used on work.

f) Welding of bars having diameter more than 40mm shall be done as directed by the Engineer-in-charge and in conformity with the requirements of clause 11.4 of IS 456-2000. Concrete cover shall be as shown on the drawings.

g) As specified in clause 11.3 of IS 456-2000 unless otherwise specified by the Engineer-in-charge, reinforcement shall be placed with the following tolerances.
   i) For effective depth 200 mm or less ± 10 mm
   ii) For effective depth more than 200 mm ± 15 mm

   The cover in no case shall be reduced by more than one third of specified cover or 5 mm whichever is less.

h) Dowels shall be of same HYSD bars of grade Fe-500 confirming to IS: 1786 – 1990 used for reinforcement. Supplying, cutting, bending, binding, shaping, cleaning and placing the dowels in position shall be as in approved drawings or as directed by Engineer-in-charge. The dowels shall be accurately and firmly placed in the concrete in accordance with approved drawings or as directed by the Engineer-in-charge. Payment for dowels on finished item shall be made at the unit price bid in bill of quantity of reinforcement bars.

i) Unless otherwise specified, 'U'-Type hook at the end of each bars shall invariably be provided if plain MS round bars if used as per approved drawings. The radius of the bend shall not be less than twice the diameter of round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the round bar. The hook shall be suitably encased to prevent any splitting of the concrete.

8.4. SPLICING:

a) Where it is necessary to splice reinforcement, the splices shall be made by lapping, by welding or by mechanical means.

b) Joints or splices in reinforcing bars shall generally be made at the locations where neither shear nor bending moment is maximum. But the contractor would be permitted to make joints or splices at other positions provided that such positions are mentioned in approved drawings or approved by the Engineer-in-charge. Joints and splices in the reinforcing bars should be staggered. Approval of such additional splices will generally be restricted to splices not closer than 8m in horizontal bars or 4m in vertical bars measured between midpoints of laps.

c) If the Contractor proposes to use welded splices in higher diameter reinforcing bars, the equipment, the materials and all welding and testing procedures shall be subject to the approval of the Engineer-in-charge. The contractor shall also carry out tests to all welds at his own cost as required by Engineer-in-charge.

d) Welded splices for reinforcing bars shall conform to IS: 1786-1990. Welding shall be done in accordance with IS 9417-1999. For reinforcing bars conforming to IS: 432 (Part-I) 1995, welding shall be done in accordance with IS: 2751-1999. Electrodes for manual metal arc welding shall conform to IS: 814-(Part-I)-1974 and IS: 814-(Part-II) -1974. Mild steel file rods for only acetylene welding shall conform to IS: 1278-1972 having a minimum butt weld tensile strength of 41 kg/mm^2.

e) Deformed bars shall not be lap welded at splices except where lap welding is shown on the drawings or otherwise specifically approved.

f) The ends of the bars to be butt welded by gas-pressure or flash-pressure welding shall be squared off by an abrasive disc cutter. Any accumulation of dirt of oxide film formed after the cutting operation shall be removed by sand blasting or buffing prior to welding. Ends of bars to be joined by flash pressure welding shall be cleaned of all rust and imperfections on the end faces and for distance of about 15cm. from the ends, if necessary, to prevent arching. Care shall be taken in aligning and separating the ends of the bars which shall be matched accurately and held firmly in position during the welding operations. For pressure welding the bars shall be accurately held in position with the prescribed pressure applied prior to heating and during heating welding.

g) Where bars are to be joined by electric arc welding, the weld metal shall be deposited in successive layers and each layer shall be thoroughly cleaned before the subsequent layer is deposited.

h) All structural welds shall have complete fusion and freed from imperfections. Defective pressure welded joints shall be separated by flame cutting and re-welded. Defective arcs welds shall be chipped to sound metal and resulting cavities shall be filled in the same manner as the original grooves were filled or the bars shall be flame cut and re-welded.

i) Arc welding of reinforcement bars for fixing bars in place or for preparation of mats shall be carried out by competent operators using approved techniques. The work shall be so performed that there are no sharp discontinuities or loss of cross section in the jointed bars at or adjacent to the weld.

j) Only operators skilled in the type of welding procedures used for the welding of reinforcement bars shall be used for work. Before being permitted to weld bars on the job, each operator shall make four satisfactory test welds of the bars using the same bar material, end preparation, pressure, heating and upsetting as will be used for the actual reinforcement. The test bars shall not be less than 45cm. long before welding. The bars when tested shall show a breaking strength of the metal in the bars. For the welding process and the operator to qualify all test welds must meet this requirement. The operator may be permitted to weld an additional set of bars and if these meet the requirements the process and the operator will be qualified.

k) Welding materials and welding procedures and the workmanship of welding operators will be subject to inspection and approval at all times during the progress of work. The position and

dimension of lapped splices will normally be shown on the reinforcement drawings. Where splices are required for the work, the following minimum overlap of spliced bars shall be used for the various sizes and grades shown. Hooks will not normally be prescribed for splices in structural grade deformed bars.

l) If the Contractor proposes to use mechanical coupling for reinforcing bars, he shall submit samples of the proposed coupling to the Engineer-in-charge for approval not less than 60 days prior to their proposed use.

LAPPED SPLICES

Diameter of Bars in mm.	Grade of Bar.	Minimum length of overlap in cm for M-15 concrete	Length of splices for M-20 concrete
(1).	(2)	(3)	(4)
8.	Deformed ribbed bars.	44 cm.	33 cm.
10.	Deformed ribbed bars.	55 cm.	44 cm.
12.	Deformed ribbed bars.	66 cm.	49 cm.
16.	Deformed ribbed bars.	88 cm.	65 cm.
20.	Deformed ribbed bars.	110 cm.	82 cm.
22.	Deformed ribbed bars.	110 cm.	83 cm.
25.	Deformed ribbed bars.	125 cm.	94 cm.
32.	Deformed ribbed bars.	160 cm.	120 cm.
36.	Deformed ribbed bars.	180 cm.	135 cm.
40.	Deformed ribbed bars.	200 cm.	150 cm.

8.5. CARE OF PLACING REINFORCEMENT AND CONCRETE:

Where reinforcement bars are bent aside at construction joints or required for providing dowels and afterwards bent into their original position, care shall be taken to ensure that at no time the radius of the bend is less than 6 times diameter for deformed bars and 4 times diameter for plain mild steel bars. Care shall also be taken when bending such bars, to ensure that the concrete around the bars is not damaged.

8.6 MEASUREMENT AND PAYMENT:

Measurement for payment, for supplying, straitening, bending, binding, making grills and placing reinforcing bars and structural steel in position will be made only on the calculated weight of the material placed, or fixed in auxiliary structure in accordance with the approved construction drawings or as directed by the Engineer-in-charge. The calculated weight of reinforcing bars and structural steel shall be determined as follows.

The weight per unit length of reinforcing bars and structural steel used shall be based on the standard weights as per Bureau of Indian Standards (Table 1 and Para 5.3.1 of IS: 1786-1990) of that size of rod.. The calculated weight of reinforcing bar for payment will be the weight per unit length of the bars multiplied by corresponding lengths of bars placed in concrete, which will be measured and should in no case, be more than the length provided in the drawing, unless the Engineer-in-charge specifically approves. Splices shall not be measured for payment. Wastage of rods, Chairs, ties, hangers, space bars etc. will not be measured. The binding wires also shall not be measured as these are all deemed to have included in the unit cost of the item in Bill of Quantity.

Payment for supplying and placing reinforcement bars shall be made at rate tendered thereof in the schedule. The rates shall include the cost of preparing reinforcement as per detailed approved drawings including bar placing drawings, bar bending diagrams, submitting the drawing to the department, preparing all necessary bar bending and cutting lines, cost of steel binding wire, binding and welding at site of work including all taxes, furnishing and attaching wire ties and supplying, cutting, bending, cleaning, placing and maintaining in position all reinforcing bars, cost of jointing as per approved method, etc. all complete and finished to as shown on the approved drawings or as directed by the Engineer-in-charge. The unit rate shall also include cost of all splices, chairs, ties, hangers, space bars, wastages of bars due to cutting, incidental operations necessary to complete the work as per specification.

CHAPTER-9

CEMENT CONCRETE LINING

CONTRACTOR **EXECUTIVE ENGINEER**

9.1 GENERAL:

9.1.1 Canal lining shall be done with concrete paving and finishing machines, which will place, compact and finish the cast in situ concrete lining in bed and slopes. Plain cement concrete of M-15 grade, with the maximum size of aggregate of 20mm shall be laid on the bed and slopes of the canal sections as shown on relevant approved drawings. The thickness of lining shall be as in the approved drawings, both in bed and slopes of the canal or as per written order of Engineer-in-charge. If during construction it is found necessary to alter the canal sections and side slopes without altering the thickness of lining, the contractor shall be informed in writing well ahead of such changes.

9.1.2 Each concrete paving machine and associated support equipments utilized under this contract shall place canal lining at an average sustained rate of advancement of not less than 10.00 meters or more per hour. The minimum rate shall be obtained for paving operations on the side slopes and on the bottom of the canal while also meeting the requirements for lapsed time following trimming, consolidation of concrete, finishes, joints and other requirements specified therein.

9.1.3 The equipments and operation for foundation trimming, sub-grade preparation, concrete production, concrete delivery, production of curing compound & its application and other associated activities supporting the placement of the canal lining shall be matched with the lining equipment capability so as not to impede the specified placement rate of lining operation. The overall equipment deployment shall be such as to ensure the completion of canal lining within the scheduled period specified in the contract document.

9.1.4 The contractor can effectively deploy longitudinally operating self aligning slip form paver with built in vibrator attached to the mould/forms so as to effectively compact and finish the concrete of uniform thickness in slopes and bed independently.

9.1.5 During the preparation of sub-grade for canal lining the proud earth shall be excavated and trimmed by machines for better progress and to achieve the designed profile of the sub-grade. This excavation for trimming for base preparation of lining shall be carried out immediately prior to lying of the lining but in no case the time interval should exceed 3 days in case of normal weather condition and 2 days in case of adverse weather conditions.

9.1.6 The scope of work also includes the following –

i. Dewatering the canal sections for preparing the base for lining and laying concrete lining till final setting.
ii. Providing necessary under drainage arrangements consisting of filter blanket of graded aggregates and pressure relief valves as per drawings.
iii. Providing filter materials of approved quality and grade as per approved design and drawings.
iv. Providing and fixing P.V.C or any other expansion/contraction or construction joints to stop leakage of water.
v. Providing and fixing contraction joints filled with sealing compound of approved quality (confirming to relevant IS Codes) in bed and slopes.
vi. Providing steel safety ladders at required intervals or as directed.

9.2. CLEARANCE OF SITE:

Area proposed for lining the canal as a whole shall have to be cleared of all objectionable materials, stumps, roots, bushes, and rubbish. Such materials, from clearing operation shall be disposed off away from the working area as per the direction of the Engineer-in-charge.

9.3. TRIMMING THE CANAL SECTIONs AND PREPARATION OF SUB-GRADE:

9.3.1. Provision of this paragraph shall apply to the preparation of sub-grade on which concrete lining is to be placed.

The work of trimming the canal section up to the bottom of concrete lining/bottom of filter materials/CNS materials to be provided as the case may be and preparing sub-grade for concrete lining includes removal of proud from the slope and bed of the canal. The trimming operations is to be carried out manually or by machines (Trimmer) of adequate capacity immediately prior to laying of the lining but in no case the time interval between trimming and laying should exceed 3 days in normal weather and 2 days in adverse weather conditions. Wherever rock is over excavated the item of trimming and preparation of sub-grade includes filling the over excavated portion with suitable semi pervious materials, watering and compacting and trimming up to bottom level of the concrete lining. All along the canal alignment the rain cuts on inner slope of the banks shall be filed up with approved excavated materials and shall be compacted adequately to required line and grade and level. The material required for filing the over excavation in rock and rain cuts, if not available during excavation in soils to be done under this item, shall be hauled from stock piles or borrow area to be arranged by the contractor and placed in position.

9.3.2 If at any point materials have been excavated beyond the pay line required to receive the concrete lining the excess excavation shall be refilled on horizontal layer with selected materials moistened. If required and compacted using rollers and slope compactors where placing and compacting bedding material is on a sloping foundation the layers may be placed parallel to the surface of the

foundation. If at any point the foundation materials disturbed or loosened during the excavation process or otherwise it shall be moistened, if required and thoroughly compacted by tamping, rolling or by other approved methods to form firm foundations for placing the concrete lining.

9.3.3 If at any place, placement of bedding material below the concrete lining is required due care shall be taken by the contractor to wet the surfaces of excavation and embankment to a depth of 15 cm. or to depth up to impermeable layer below whichever is less as per direction of the Engineer-in-charge.

9.3.4 In the canal section requiring bedding material below the concrete lining due care shall be taken by the contractor to place the bedding materials on scientifically approved surface adequately wet as described above in layers not exceeding 15 cm. in depth in a single operation and compacted till the bedding material attains a height where it can be trimmed to form a true and even surface upon which the concrete for lining is to be placed. Each layer of bedding material shall be moistened and thoroughly compacted.

9.3.5 All loose materials likely to be present at the end panel of existing lining adjacent of which lining is to be placed under these specifications shall be removed and all voids beneath the existing lining shall be refilled and compacted thoroughly. No extra payment shall be made to the contractor on this account.

9.3.6 Suitable materials trimmed from the canal shall be judiciously utilized in canal embankment, road embankments or in back filling of the structures or used as a bed material as per direction of the Engineer-in-charge. The trimmed materials which cannot be utilized in proper place during one continuous operation shall be stock piled at designated dumping yard or as directed by the Engineer-in-charge.

9.3.7 The preparation of sub grade for concrete lining shall confirm to clauses 4.1, 4.2, 4.3, 4.4 and 4.5 of IS: 3873-1993 (Indian code of Practice for laying cement concrete lining on canals)

9.4. TOLEARANCE IN PREPARATION OF SUB-GRADE:

Excavated profile provides the final base for lining and tolerance departure from lines shown on the drawings shall be as indicated here below.

± 20 mm on straight sections.
± 50 mm on tangents and
± 100 mm on curves.

Departure from levels shown on the drawings ± 20 mm

The above tolerance shall be negotiated gradually through smooth transition in a length of 50 m.

No over run in concrete quantity shall be paid to the contractor.

9.5. SELECTED BEDDING MATERIALS:

The selected bedding material in the case of bed and sides of canal profile in normal soils shall be graded filter material compatible with sub grade materials and thoroughly compacted. In case of expensive soils cohesive non swelling (CNS) soil will be used for bedding. The thickness of CNS layer shall be designed according to swelling pressure of soil or as directed by the Engineer-in-charge. The thickness of cohesive non-swelling material shall be provided in canal sections whose carrying capacity is less than 2.0cumecs and 2.0cumecs and more as in Table 1A & Table 1B respectively of IS: 9451-1999.

9.5.1 CNS PROPERTIES:

Several soils containing non-expanding type clay minerals exhibit CNS properties. The following range of properties broadly helps in locating them.

(a) GRADATION:

1. Clay (less than 2 microns) 15 to 20 %
2. Silt (0.06 mm - 0.002 mm) 30 to 40 %
3. Sand (2mm - 0.06mm) 30 to 40 %
4. Gravel (greater than 2mm) 0 to 10 %

(b) INDEX PROPERTIES:

Liquid limit Less than 50% but greater than 30 %

Plasticity Index Less than 30% but greater than 15%

9.5.2 THICKNESS OF CNS LAYERS:

The thickness of CNS layer given in table 1A and 1B of IS 9451-1999 for the canals having carrying capacity less than 2.00cumecs and for canals having carrying capacity 2.00cumecs or more respectively shall apply in general with respect to different swelling pressures. However, optimum thickness of CNS layer shall be obtained from actual experiments conducted in both field and laboratory tests. Thickness of CNS layer for canals having discharge $2m^3$/sec and more mentioned here for guidance.

TABLE – 1B OF IS: 9451)

Swelling pressure of soil (In KN/m^2)	Thickness of CNS materials (In mm.)

50 to 150	750
150 to 300	850
300 to 500	1000

The loading handling transportation and placing of the selected bedding material shall be subjected to approval and shall be such as will result in a uniform mixture of the material being placed without separation or segregation. Selected bedding materials shall be obtained from required excavation in area where materials in excess of that required to construct the adjacent embankments is available or available or from borrow pits approved by the Engineer-in-charge.

9.6. UNDER DRAINAGE:

For a lined canal where the ground water level is higher or likely to be higher than the water level inside the canal so as to cause damage by differential pressures on the lining or where the sub-grade is sufficiently impermeable to prevent free drainage of the underside of lining in case of rapid draw down condition, required under drainage facilities shall be provided with suitable pressure relief arrangements as indicated in the drawings or directed by the Engineer-in-charge.

9.6.1 FILTER DRAINS:

Wherever necessary longitudinal and / or transverse filter drains shall be laid below the concrete lining true to the canal lines and grade as shown in the approved drawings or as directed by the Engineer-in-charge. The number of layers comprising the filter thickness of each layer and the materials to be used shall be as shown in the approved drawings. The filter material shall be clean round well graded sand or coarse aggregate. The requirements of grading of such materials shall be established in the field laboratory on the basis of a mechanical analysis of adjacent material. Particles of decomposed rock debris rock, vegetable matter or the deleterious materials shall not be permitted in the filter. Before placing the filler, the bed shall be prepared as specified in earlier paragraph.

The longitudinal drains shall be laid to the line and grade of the canal while the transverse drains in bed shall have a slope towards the centre of the canal bed from the edges as shown in the drawing

Payment of filter drains described above shall be made at the unit price as provided in the bill of quantities whose unit price should include the cost of all above operations as well as defined in the nomenclature of the item.

9.6.2 LOCAL FILTER:

In addition to the above filter drains, local filters of the size and type as shown in the approved drawing shall be provided. The cost of these local filters shall be included in the unit price bid for filter drains or pressure relief arrangements.

9.7. PRESSURE RELIEF ARRANGEMENTS:

Wherever necessary pressure relief arrangements, consisting of flap valves shall be provided in the bed and sides of canal slopes as shown in the approved drawings or as directed by the Engineer-in-charge.

9.7.1. FLAP VALVES:

Flap valves consisting of required dimensions fixed with polyvinyl chloride (P.V.C) pipe and P.V.C. flange and rubber flap shall be fabricated with all accessories as shown in the approved drawings. The flap valve shall be designed as to open automatically at differential head of not more than 100 mm of water. The contractor shall arrange for performance tests of all the flap valves and those that do not confirm to the specified functioning shall be rejected. Installation of flap valves shall not be permitted without the acceptance of test report of the same.

The flap valves shall be installed in position in the filter drains in the bed and normal to the canal slopes in the side at the location shown in the drawings or as directed by the Engineer-in-charge.

The tendered unit price bid for this item shall be inclusive of the cost of manufacture, transportation, handling, testing and installation in position complete and shall be inclusive of all those operations as well as those defined in the nomenclature of the item including all taxes and other incidental charges.

9.7.2 POROUS PLUGS:

Wherever shown in the approved drawings, porous concrete precast cylinders of required diameter and of specified lengths shall be provided for free drainage. The porous concrete shall be composed of one part of cement with four parts of uniformly graded course aggregate not more than 20mm size by volume. While placing porous concrete for casting pipes, care shall be taken to ensure that no more over tamping so as to reduce the porosity.

As soon as the porous concrete hardens i.e. after final setting, it should be sprinkled and kept moist for at least 14 days. The compressive strength of porous concrete at seven days on 15cm diameter & 30cm height cylinder should not be less than 70kg/cm^2 and porosity at seven days shall be such that water will pass through the slab of concrete of 30cm thick @ of minimum of 500liters/minute/m^2 with a constant head of 100cm depth of water on the slab.

The porous plugs shall be so inserted into the lining that their porosity is not lost or reduced when the lining concrete is vibrated for compaction.

The tendered unit price of the item shall be inclusive of supply, manufacture, handling and installation in position as well as other incidental charges required to finish.

9.7.3 POROUS CONCRETE PANELS:

In the slope of the canal lining wherever required, porous concrete panels composed of one part cement with four part well graded 20mm downgraded hard granite chips shall be provided at intervals shown in the approved drawings or as directed by Engineer-in-charge. The quantity of fines in the aggregate shall be limited to 10% of the total weight of the aggregate.

9.8. MEASUREMENT AND PAYMENT:

Measurement and payment for the pressure relief valves (PRVs) shall be made on the basis of numbers at the unit rate in schedule of quantity. The rate shall include the cost of providing and fixing PRVs, including cost, carriage, royalty, taxes of materials & testing as per the specifications and as directed by the Engineer-in-charge. Measurement and payment on porous concrete includes supply, manufacture, handling and installation in position and other incidental charges if required.

9.9. MATERIALS FOR LINING:

All materials including cement, fine aggregate and coarse aggregate, water, admixture and steel has been specified in relevant Sections. Any ancillary material like joint seals, copper plates etc required for construction of Canal / Structures will be supplied by the contractor at his own arrangements.

9.10. CAST IN SITU CONCRETE LINING:

9.10.1. GENERAL.

The work shall generally conform to IS 3873-1993. All concrete for lining shall be governed by IS 456-2000.The concrete shall be of controlled grade with suitable admixtures of approved air entraining agents using well graded aggregates with maximum size of as 20 mm. Ordinary Portland cement or Portland Pozzolana Cement shall be used and cement level will be as per the approved Mix Design determined by the Departmental Quality Control Laboratory.

9.10.2 BATCHING AND MIXING OF CONCRETE:

The batching and mixing of concrete shall be done as per Para-6.4.1 & 6.4.2 respectively mentioned concrete chapter.

9.10.3 TRANSPORTATION OF CNCRETE:

Transportation shall be handled from the place of mixing to the place of final deposition as rapidly as practicable by use of equipments such as transit mixers which shall prevent initial setting, segregation and loss of any of the ingredients. It shall be transported and compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly designed agitators operating continuously where this time shall be within initial setting time from the addition of cement to the mix and within 30 minutes of its discharge from the agitator.

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

9.10.4 PLACING AND COMPACTION:

Concrete shall be placed only in the presence of a duly authorized representative of the Engineer-in-charge and shall be compacted before initial setting time and shall not be subsequently disturbed.

Placing of concrete shall not be started until all form works are completed, installation of parts to be embedded if any, and preparation of surface upon which concrete is to be laid have been completely inspected by the Engineer-in-charge. All absorptive surfaces against which concrete is to be laid shall be moistened adequately so that moisture shall not be withdrawn from freshly placed concrete. The surfaces, however, shall be free from standing water and mud.

Concrete shall be deposited in all cases as neatly as practicable directly from mechanized pavers in its final position and shall not be caused to flow in a manner to permit segregation. Excessive separation of the coarse aggregate caused by allowing the concrete to fall freely from too great a height or at too great an angle from the vertical shall not be permitted and where such separation would otherwise occurs the work will be stopped and the contractor shall provide suitable means to convey the concrete without allowing such separation to continue with the work.

9.10.5 MECHANICAL PLACING:

For efficient placing and finishing of the concrete lining on slopes and in bed, concrete lining machines such as slip form pavers or concrete pavers finisher of approved quality and design shall be used. Each lining machine and associated support equipment utilized under this contract shall place canal lining at an average sustained rate of advancement of not less than 10 meters per hour. This minimum rate shall be obtained for paving operation on the side slopes and on the bottom of the canal, while also meeting the requirements for lapse time following trimming, consolidation of concrete to required thickness with limitation to its tolerances, finishes, preparation of joints and other requirements specified herein.

The equipment of operations for foundation trimming, sub grade preparation, concrete production, concrete delivery, joints production, curing compound placement and other associated activities supporting the placement of the canal lining shall be matched with the lining equipment capability so as not to impede the specified placement rate of each lining operation. The overall equipment development shall be such as to ensure in the completion of canal lining within scheduled period specified in the contract.

Concrete lining shall be done in the canal prism as shown in the drawing. Mixing of concrete is to be done in a stationery or mobile weight batching plant of capacity of one cubic meter to 3.5 cubic meter a time installed at suitable places and concrete is to be conveyed to work spot in transit mixers to be moved on canal banks and unloaded at site in the hopper of the paver. The concrete in bed and side is to be placed with mechanized paver finisher ISI 456 CP 650 or any other paver of similar capacity. The concrete from transit mixer is to be unloaded into hopper and conveyed to other bank, through side discharge conveyor then placed with paver in bed and side and vibrated, with plate joints which will be done with Groove cutter attached to the paver Panels shall be as per drawing or as directed by the Engineer-in-charge. The above mechanized procedure is to be followed for side lining where slant length is 2.70 M. and above. In case where canal bed width is less than 2.00 M and where bed lining is not possible to be tackled with the above mechanized paver, concrete shall be laid by conventional method i.e. mixing by concrete mixtures and laying the concrete manually in alternative panels of 3 m. width and 3 m length as per drawing or as directed by Engineer-in-charge duly using steel form work to the required thickness of concrete and vibrated with mechanical pan vibrators. The concrete for side lining where the slant length is less than2.70m shall be laid by using appropriate equipment with steel guided form work and vibrated by mechanical vibrator fitted to gantry. If the concrete is laid manually on slopes compaction by suitable method as approved by Engineer-in-charge shall be adopted. Concrete shall be mixed is stationery or mobile batching plant and conveyed through transit mixers included for manual placement. Whenever necessary for the purpose of obtaining economy, workability density, impermeability, durability, strength, mode of vibration and gradation of aggregates or other materials, the Engineer-in-charge of quality control shall after testing make necessary changes in the proportion of the mix.

Concrete when deposited shall unless otherwise specified have placement temperature of not less than 4.5° C and not more than 32 ° C.

Concrete shall be so laid as to facilitate placing, vibrating, finishing and curing operations. The side lining concrete shall be screed up on the slope while the concrete is being vibrated ahead of the screed. Concrete required for key as shown on the drawings shall be laid integrally along with the side slope lining.

Alternatively, the contractor can select to use longitudinally operating self alignment, slip form machine with built in vibrators attached to the slip forms, so as to effectively compact and finish the slope and bed concrete lining.

9.10.6 FINISHING:

a. All exposed concrete surfaces shall be cleared of impurities, lumps of mortar or grout and unsightly strains. The finished surface shall be even smooth and free from pockets and equivalent to that obtainable by effective use of long handle steel trowel. Where the surface produced by lining machine meet the specified requirements no further finishing operation shall be required. Surface irregularities, when tested with a straight edge of 1.5 meter length shall not exceed 6 mm in canal bed for bottom slab and 12mm on side slopes.

b. The surface of concrete finished against form shall be smooth and be free from projections, honey combing and other objectionable effects. Immediately on removal of forms, all ridges or lips shall be removed and undesirable local bulging on exposed surfaces shall be remedied by tooling and rubbing.

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

9.11. CURING:

9.11.1 GENERAL:

The concrete lining on slopes including curvatures portion at junction of slope and bed lining shall be cured with specifications given in Para 6.9 of chapter cement concrete. The concrete lining in canal bed shall be cured with water in accordance with the specifications given in Para 6.8 of chapter cement concrete. If water curing of lining in the canal bed is not carried out to the satisfaction of the Engineer-in-charge as per specifications the contractor shall be directed to switch over to liquid membrane curing compound for the purpose.

Water curing of concrete is to follow strictly in accordance to the procedures and specifications as in clause 5.8 of IS 3873 of 1993.

All equipment material etc. needed for curing and protection of concrete shall be at site and ready for installing before actual concreting begins. Detailed plans methods and procedures of curing and protection of concrete lining shall be got approved in writing from the Engineer-in-charge

sufficiently in advance of the actual concreting in order to avoid interruption or damage to the work of other agencies.

9.11.2 MEMBRANE CURING:

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

b. Concrete of canal lining on slopes including key at the top and curved portion at the bottom of the slope of canal shall be cured with liquid membrane forming white pigmented curing compound which shall form water retaining surface to achieve the desired effect of water curing at 28 days. The curing compound shall be white pigmented of approved qualify conforming to ASTM-C-309-81 Type-2.

c. White pigmented compound (Type-2) shall consist of finely divided white pigments and particle solids, ready mixed for immediate use without alteration. The compound shall present a uniform white appearance when applied uniformly to a fresh concrete surface at a specified rate of application. It shall be of such consistency that it can be readily applied by spraying to provide uniform coating at temperatures above 4 degree Centigrade. Two coats are to be applied in perpendicular direction at an interval of approximately one hour. They shall adhere to freshly placed concrete that has stiffened or sufficient to resist marking during the application and to damp hardened concert and shall form a continuous film when applied at the specified rate of application when dry the covering shall be continuous flexible and without visible breaks or pin holes and shall remain as unbroken film for at least 28 days after application. It shall not react and should not have deleterious effect on concrete.

d. The compound shall meet with the requirement of water retention test as per ASTM designation C-150-80 .The loss of water in this test shall be restricted to not more than 0.55 Kg. m^2 of solution of exposed surface in 72 hours.

e. The white pigmented compound (Type – 2) when tested as specified in accordance with method E- 97 of ASTM shall exhibit a day light reflectance of not less than 60% of that of magnesium oxide.

f. It shall fulfill the requirement of drying time when tested in accordance with ASTM C 309-81. The compound applied shall be dry to touch in not more than 4 hours. After 12 hours it shall not be tacky or track off (peel off) concrete where walked upon nor it shall impart a slippery surface.

g. TESTING:

i. The liquid membrane forming curing compound to be brought in the manufacture's original clear containers. Such container shall be legibly marked with the name of the manufactures the trade name of the compound the type of compound and class of vehicle/solids the nominal percentage of volatile material and batch or lot number. The lot number will be assigned to the quantity of compound mixed sampled and tested as single product. The manufacturer shall exercise the care in filling the container so that all are equally representative of the compound produced.

ii. Curing compound to be used on site shall be got tested at least 14 days in advance so that the result of water retention tests reflectance test, drying etc. are available before it can be permitted for use. All of the filled containers represented by the approved sample shall then be

sealed to prevent leakage substitution or dilution. The Engineer-in-charge or authorized representative should mark each container represented by the samples with a suitable identification mark for later identification and correlation and shall be kept in store with double lock arrangements. One key shall be kept with the contractor and the other with Engineer-in-charge. Random samples shall be collected from every batch of the compound. Frequency of random sampling shall be done as directed by the Engineer-in-charge. The contractor shall provide samples and labour for collecting samples free of cost. Testing shall be carried out by the department.

h. METHOD OF APPLICATION:

The compound shall be sprayed using mechanical sprayer of approved design to ensure uniform and continuous membrane on the concrete surface. The coverage shall be at the rate specified by the manufacture or at the rate of 4 to 5 m. per liters. Field trials shall be conducted to decide effective coverage rate which depends upon surface finish. With a view to ensure through and complete coverage approximately on half of the compound for a given area should be applied by moving the spray gun back and forth in one direction and the remaining half at right angles to this direction. In case the application is still not found uniform the contractor shall have to apply another coat as and where directed by the Engineer-in-charge. If next coat is to be applied it should be applied approximately after an interval of one hour. The curing compound shall be applied on lining concrete as soon as the bleeding water or shine disappears, leaving dull appearance. Equipment for spraying curing compound shall be of pressure tank type (5 to 7 kg/cm2) with provision of continuous agitation. A curing jumbo with multiple traveling spray guns shall be provided for

effective spray. Spraying on concrete lining shall be done in such a way that the green concrete is not disturbed or damaged or any foot impressions left. Necessary schemes on spraying by mechanized means shall be got approved from the Engineer-in-charge. However, in emergency for very small areas (Patches) it can be applied with wire or bristled brush. Such compounds shall be used on the work only after production of test results and approval of the schematic plan on spraying curing compounds. Adequate care shall be taken to prevent any movements on cured surface up to 28 days after application of curing compound. Under unavoidable circumstance created by non availability or short supply of specified curing compound the contractor shall be allowed to resort to water curing of concrete lining on slopes after obtaining prior approval of the Engineer-in-charge in writing. Such water curing shall be carried out in accordance with the following specification.

9.11.3 WATER CURING:

The surface of invert of the canal shall be kept continuously moist by covering it completely with wet burlap as soon as the concrete has hardened sufficiently. The burlap shall be kept continuously wet by spraying water for at least 12 hours. Thereafter curing by ponding shall be resorted to. The concrete to be cured with water shall be kept wet by ponding for at least 14 days. Water lost by evaporation shall be replenished periodically to keep the surfaces continuously submerged under water. The period of 14 days specified above shall be increased to 21 days when Pozzolana has been used in the concrete as part replacement of cement.

When the curing of concrete in the canal bed is not found satisfactory the Engineer-in-charge may ask the contractor to resort to membrane curing.

9.12. TESTING OF CONCRETE AND ACCEPTANCE OF WORK:

9.12.1 GENERAL:

Required Tests of concrete shall be carried out in department laboratories at the cost of the contractor on samples taken at the site for laying concrete in accordance with relevant clauses of IS: 1199-1999.The samples shall be provided and arrangement of transportation shall be made by the contractor at his cost.

9.12.2. SAMPLING PROCEDURE AND FREQUENCY:

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

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

Quantity of concrete m^3	Number of samples.
1 to 5	1
6 to 15	2
16 to 30	3
31 to 50	4
51 to above	4 plus one additional sample for reach additional 50 m^3 or part thereof

Note: At least one sample shall be taken during each shift.

9.12.3. TEST SPECIMEN:

Three test specimens shall be made from each sample for testing at 28 days strength. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking form work or to determine the duration of curing or to check the testing cubes cured by accelerated methods as described in IS 901-1978. The specimen shall be tested as described in IS 516-1999.

9.12.4 TEST STRENGTH OF SAMPLES:

a. The test strength of the sample shall be the average of three specimens. Individual variation shall not be more than 15%percent of the average.

b. Contractor shall provide necessary unskilled labour and facilities for collection of samples cores etc. and shall remain present at the time when the samples cores etc. are taken. Testing shall be carried out at the testing laboratories set up at the site or at any other laboratory that the Engineer-in-charge may decide upon and the results given thereby shall be considered as correct and authentic and acceptable to the contractor. All testing charges will be borne by the contractor.

9.12.5 ACCEPTANCE CRITERIA:

A. The average strength of the group of cubes cast for each day shall not be less than the specified cube strength for the work. About 20 percent of the cubes cast for each day may have values less than the specified strength provided the lowest value is not less than 85% of the specified strength.

B. In case the concrete does not confirm to the accepted criteria for strength as specified above the Engineer-in-charge reserves the right to reject the work or accept the same at a reduced rate derived from the tendered rate and as approved by him. Whenever necessary for the purpose of obtaining economy, workability, density, impermeability, durability and strength or on account of

variation in the quality and gradation of aggregates or other materials, the Engineer-in-charge in consultation with Quality Control Division shall after testing make necessary changes in the proportion of mix. Contractor shall have to effect these change immediately.

9.13. INSERTION OF PVC CRACKS INDUCING JOINTS:

9.13.1. (a) The transverse and longitudinal PVC (Polyvinyl Chloride) strips shall be provided with the shapes confirming to dimensions shown on the drawing. The finished PVC strips inducing joints shall be extruded from virgin Pigmented, Plasticized Polyvinyl chloride (PVC). The PVC strips inducing joints shall be dense homogeneous free from holes and other imperfections. The cross section of the PVC strips inducing joints shall be uniform along its length and thickness shall be symmetrical transversely. Tolerance for dimensions in overall length and width shall be 5% and thickness 10%. The finished PVC strips inducing joints shall meet the following requirements.

Sl. No	Characteristics	Unit	Values
1	Tensile strength	Kg/Cm2	116 Minimum
2.	Tear Resistance	Kg/Cm2	49 Minimum
3.	Stiffness in Flexure	Kg/Cm2	24.6 Minimum
4.	Accelerated extraction		
	a) Tensile Strength	Kg/Cm2	105 Minimum
	b) Ultimate elongation	Kg/Cm2	250 Minimum
5.	Effect of alkali (7 days)		
	a) Weight measure	%	0.25 Maximum
	b) Weight deceased	%	0.10 Maximum
	c) Hardness change	Point	1.50
	Effective of alkali (28 days)		
	a) Weight increase	%	0.4 Maximum
	b) Weight decrease	%	0.3 Maximum
	c) Dimension change	%	1.1

Weight of the PVC strip shall be a minimum of 460 gm/meter for the longitudinal strip and a minimum of 420 gm/meter for the transverse strip.

b) The above determination shall be made in accordance with the specification of C.W.C. in vogue. The surface finish of PVC strips shall be mat finish and of white colour.

c) Contractor shall arrange for getting the finished PVC strips inducing joint tested in recognized Test Laboratories by the Government. The manufacturers shall furnish test sample of PVC strips inducting joints in 30 cm. length reel, free of cost. Each sample shall be marked with the number of the reel from which sample is obtained and with certificate that the samples are from the reels to be furnished.

d) It is mandatory for the manufacturer of the PVC strips from whom the contractors shall procure PVC strips to have a full-fledged testing laboratory in the factory to enable pre-dispatch testing of the products. Test reports from Government test laboratory shall also be binding on the manufacturer based on samples drawn by the Engineer-in-charge from consignments received at site. The contractor shall get the sample of PVC strip approved by the Engineer-in-charge. He shall furnish the name of manufacturer the details of the in-house testing arrangements with the manufacturer and shall also furnish a test report from the in-house testing facilities along with the sample.

9.13.2 (a) The PVC strips inducing joints shall be inserted in the concrete lining when concrete is plastic. The longitudinal PVC strips inducing joints shall be inserted before the transverse PVC strips inducing joints is inserted. The PVC strips inducing joints at edges shall be plastered in position fixed with longitudinal channels by clips or such other arrangement prior to lying of concrete. The PVC strips inducing joints shall be inserted in position in concrete lining as shown in drawings. The insertion of the longitudinal and or transverse PVC strips inducing joints at the predetermined locations of joints requires special attention to ensure proper location (depth is especially important) plumb installation and consolidated concrete around the PVC strips inducing joints. The longitudinal PVC strips inducing joint includes a cellular upper fin. The inspection of fin shown on the drawings shall be comparatively thin and shall remain above the top surface of lining. It is important that top of the upper fin be at or near the concrete surface. The manner of installation shall include mechanical vibration that produces through consolidation of the concrete around the crack inducing joint and provides a continuous contact between the concrete and all surfaces of the crack inducing joints. The longitudinal crack inducing joint shall be fed into the fresh concrete from reels mounted in front of the pavers through guides and tension rollers so placed as to ensure proper depth and orientation of the crack inducing joints. Installation of transverse crack inducing joint shall be made by suitable joint inserted contrivance capable to insert into freshly placed concrete lining.

b) At intersection of longitudinal and transverse joints containing PVC strips inducing joints the top vertical members of the longitudinal crack inducing joints shall be removed for 10 to 15 cm. in width without pulling the crack inducing joint from the concrete lining and transverse crack inducing joint shall be placed within the notch so formed. Depression of the longitudinal cracks inducing joint below the specified positions in the concrete shall be permitted at intersection only to the extent necessary to place the transverse crack inducing joint to the specified depth. However, tolerances and concrete consolidation requirements of the preceding paragraph shall apply at intersections.

c) The manner of making the intersections shall produce transverse and longitudinal crack inducing joints and provide a neatly continuous weak end and in plan normal to the lining surface in both directions through the intersections.

9.13.3. JOINTS:

In RCC lining construction joints shall be provided to accommodate expansion and contraction of the concrete or to provide continuity between the breaks in construction work. Joints shall be provided as shown on the drawings or as directed by Engineer-in-charge. The depth of joints to be cut in the bed of the canal as well as on slope shall be as specified in the drawings. The joints are not to be filled with sealants but only to be cut at specified intervals. The sealants shall be filled in joints later but before functioning of canal. The tools to be used by the contractor for providing joints shall be got approved from Engineer-in-charge.

9.14. TOLERANCE:

a) The interest of this paragraph is to establish tolerances that are consistent with modern construction practice and yet be governed by the effect that permissible deviations shall have upon the structural action or operational function of the structure. Deviations from the established lines, grades and dimensions shall be permitted to the extent set forth herein provided that the department reserves the right to diminish the tolerance set forth herein if such tolerance imparts the structural action or operational function of the lining.

b) Tolerance for lining shall be permitted within the following limits.

i) Departure from established alignment ± 20 mm on straight reaches.
± 50 mm on tangents.
± 100 mm on curves.

ii) Departure from established grade ± 20 mm on straight reaches.

iii) Variation in concrete lining thickness ± 10 mm of lining thickness provided average thickness is not less than as specified.

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

9.15. DEWATERING:

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

9.16. MEASUREMENT AND PAYMENT:

9.16.1 PLAIN CEMENT CONCRETE LINING*:*

Measurement shall be on the basis of lining area (square meter) and / or lining concrete volume (cum) of concrete as designated in bill of quantities and payment shall be made at the unit rate of bid for lining concreting works. Payment for lining shall be made for the thickness shown on the drawings and on square meter and / or cum basis of the area/volume including key on both sides. The thickness of lining shall be determined by setting of paver machine in relation to final level of sub grade on which lining is to be laid. The thickness shall be cross checked by (i) volume of concrete placed and area covered (ii) use of probe when concrete is being placed and (iii) coring if required. Any overrun in quantity of concrete in lining shall not be paid to the contractor.

The unit rate for lining shall include providing and fixing joints to specified depth in panels as directed by the Engineer-in-charge, costs, carriage, royalty and taxes of all materials with all leads, lifts, mixing, form work, conveying, placing, compacting, finishing, curing and also dewatering during placing of concrete lining as required.

The unit rate of lining shall also include the cost of producing samples, approval of Engineer-in-charge and cost of all incidental works needed to make the joints, cost of all operation of equipments, labours, T&P etc. required for carrying out this work.

9.16.2 RCC LINING:

The quantity of reinforced cement concrete lining shall be measured on square meter and / or cum basis on the same lines as of plain concrete lining mentioned above. Payment of RCC lining shall be made at the unit rate as provided in the bill of quantities. Reinforcement shall be paid separately as per item rate in bill of quantities. The rate for RCC lining is inclusive of costs and

carriage of all other materials (except reinforcement and binding wires), transport with all leads, lifts, cutting of grooves, mixing, conveying, placing, vibrating, compacting, smooth finishing curing etc. and also dewatering during the placing of reinforcement and concrete for lining as required.

9.17. SAFETY LADDERS:

9.17.1 GENERAL:

Safety ladders should be constructed in canal lining as provided in the approved drawings or as directed by the Engineer-In-Charge.

Safety ladders consisting of ladder rungs should be constructed in canal lining about 30 m upstream of the point where the canal enters some underground structure. In other reaches safety ladders may be provided at a spacing of about 300 m, the ladders being provided alternatively on either side.

Ladder rungs should be smooth, round and made of mild steel bars, galvanized or coated with coal tar after installation.

Typical details of safety ladders are illustrated in the approved drawing.

9.17.2 MEASUREMENT AND PAYMENT:

Safety ladders shall be measured by weight of M.S. bar. Payment therefore shall be made at the unit rate in schedule of quantities. The rate shall include the cost, carriage, taxes of providing and fixing the ladders as indicated on the drawings.

CHAPTER – 10
EXPANSION JOINTS/CONSTRUCTION JOINTS (EJ/CJ).

10.0 DESCRIPTION OF ITEMS:

The construction joints should be left in concrete in required places as per approved drawings and design. Embedded parts if any will have to be provided prior to casting of concrete. Old surface of the concrete joints should be made clean free of dirt, grease, protrusions or any objectionable materials as per the direction of the Engineer-in-charge. The face of the joints should be made straight. The surface of joints should be painted with bitumen /coal tar and fitted with the approved filler/ sealing materials like bituminous filler boards, etc. The adjacent concreting then only can be constructed.

In the case of P.V.C. water stop the pieces should be jointed together at the site by vulcanizing thoroughly to make it water tight having sufficient strength to withstand the designed water pressure exerted on it

Location and embedment of the P.V.C./Copper water stops shall be as shown on the approved drawings. Approximately one half of the width of water stops embedded in the concrete on each side of the joints. In order to eliminate faulty installation that may result leakage, care shall be taken that the water stops shall be installed so as to form continuous water tight diaphragm in the joints unless otherwise shown. Adequate provision shall be made to completely protect the water stops during the progress of the work.

Additional vibrations over and above that used for adjacent concrete placement shall be carried out to assure complete embedment of the water stops in the concrete. Larger pieces of aggregate near the water stops shall be removed by hand during embedment to assure complete contact between the water stop and surrounding concrete.

10.1 FILLER MATERIALS:

Filler materials are provided at the expansion joints to allow expansion and contraction of the adjoining concrete block. The filler material and its fixation should be as per IS 1838 (Part-I) 1983 with its latest amendments.

The standard of the filler material should be as per the specification shown in the relevant drawing or as per the instruction of the Engineer-in-charge. However the criteria for accepting the filler materials to be procured and used, if there is nothing specific in the drawings, will be as per the table below.

10.2. PHYSICAL REQUIREMENTS OF BITUMEN IMPREGNATED FIBRE FILLERS:

Sl No.	*Characteristics*	*Requirement*	*Method of test (Ref. to Indian Standard)*
1	**2**	**3**	**4**
i)	Resistance to handling	Strips shall not be deformed or broken by twisting, bending or other types of ordinary handling when exposed to atmospheric conditions (See Note)	--
ii)	Recovery	Shall recover at least 70 percent of its thickness before the test	IS: 10566-1983*

iii)	Compression	a) Load required to compress the specimen to 50 percent of its original thickness before the test shall be 7 Kgf/cm^2, Min (0.7 N/m m^2) and 53 Kgf/c m^2 (5.3 N/m m^2) Max. b. Loss in bitumen 3 percent Max.	IS: 10566-1983*
iv)	Extrusion	Amount of extrusion of the free edge shall not exceed 6.5 mm.	IS: 10566-1983*
v)	Water absorption	20 percent, Max.	IS: 10566-1983*
vi)	Density	300 Kg/ m^2, Min	IS: 10566-1983*
vii)	Bitumen content	35 percent, Min	IS: 10566-1983*
viii)	Weathering	a) Shall show no sign of disintegration delemination or separation of fibres after the test b) Shall satisfy the requirement of recovery compression and extrusion after the test	IS: 10566-1983*
ix)	Penetration of recovered bitumen.	Shall be between 25 to 100 at 250 C	IS: 10566-1983*

Note: Pieces of the joint filler that have been damaged shall be rejected
*Methods of test of preformed fillers for expansion joints in concrete paving and structural construction (Reaffirmed – 1995).

10.3. TESTS:

Contractor should arrange for test of the material at his own cost

10.3.1 NUMBER OF SAMPLES:

One representative sample shall be selected from each lot of 100 m^2 of the material having same thickness. The sampling shall be done at random.

10.3.2. SIZE OF SAMPLES:

Each test sample shall consist of sufficient material so that five test pieces measuring 100 x 100 cm. could be obtained.

10.3.3. TESTS:

All the test pieces as selected above shall be subjected to dimensional and physical requirement. The lot shall be accepted if all the five test pieces meet the physical and dimensional requirements, failing which the lot will be rejected.

10.4. MODE OF MEASUREMENT:

The unit of measurement of the item is square meter. The rate is deemed to include cost of materials, transportation, taxes as applicable, fitting and fixing in position including any other contingencies and all incidental charges.

10.5. P.V.C SEALS:

10.5.1 The joints of the structures are to be sealed by the P.V.C (Poly Vinyl chloride) strips as shown in the relevant approved drawings to make the structure water tight. These shall be provided with the shapes confirming to the dimensions shown in the relevant drawings and IS Specification. The finished P.V.C seals should be extruded from virgin, pigmented, plasticized poly vinyl chloride. The P.V.C. seals shall be dense, homogeneous free from holes and other imperfection. The cross section of the P.V.C shall be uniform along its length and thickness shall be symmetrical transversely. Tolerance for dimension in overall length and width shall be 5% and in thickness 10%. The finished P.V.C sealed joints should meet the following requirements:

10.5.2. PHYSICAL CHARACTERISTICS:

Sl No.	***Characteristics***	***Unit***	***Value***
1	**2**	**3**	**4**
1)	Tensile strength	N/mm2	11.6 minimum
2)	Ultimate elongation	Percent	300 minimum
3)	Tear Resistance	N/mm2	4.9 minimum
4)	Stiffness in flexure	N/mm2	2.46 minimum
5)	Accelerated extraction		
a)	Tensile strength	N/mm2	10.5 minimum
b)	Ultimate elongation	Percent	250 minimum

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6)	Effect of alkails	7 days	
a)	Weight increase	Percent	0.10 Max.
b)	Weight decrease	Percent	0.10 Max.
7)	Effect of alkails	28 days	
a)	Weight increase	Percent	0.40 Max.
b)	Weight decrease	Percent	0.30 Max.
c)	Dimensions.	Percent	+/-1

10.5.3. It is mandatory for the manufacturer of the P.V.C strips, from whom the contractor will procure, to have a full-fledged testing laboratory in the factory to enable pre-dispatch testing of the products. The contractor will furnish the name of the manufacturer, the details of the in-house testing arrangements with the manufacturer and will also furnish a test report from the in-house testing facilities along with the samples. The said samples drawn from consignment received at site by the Engineer-in-charge shall be sent for testing in Government testing laboratory. The contractor will bear all the cost involved in testing of such samples. Test reports from Government test houses shall be binding on the manufacture. Then the contractor will procure P.V.C strip water stop (Seal) after approval of the Engineer-in-charge.

10.5.4 COPPER SEAL:

In case of copper seal, the thickness of the copper sheet should be of 16 gauge (1.63 mm) and minimum of 0.6m wide with 'V', 'U' or 'Z' groove of size 2.5 cm. at its longitudinal axis. The groove should be perfectly straight and uniform. Adjacent copper sheet should be perfectly brazed together on both sides for the whole width by butting the two sheets against each other. If lapping between adjacent sheet are given, the maximum lapping should be 5cm and should be held together tight. Brazing should be done on both sides for the whole width. The joints should be brazed, water tight and should be capable of withstanding the hydraulic pressure exerted on it. M.S. anchor rods of 6 mm to 8mm diameter and 30cm long with hook on outer side and should be brazed with the copper sheet @ 50cm centre to centre approximately on both sides of copper sheet preferably staggered. The minimum length of the rod to be brazed is about 5cm and brazing should be done on both side of the rod.

The edges of the copper sheet should also be given a link at about 0.5m interval to have a better grip with concrete. The brazing should be done as per relevant IS specification.

10.6. MEASUREMENT AND PAYMENT:

Measurement for payment, for furnishing and placing P.V.C water-stops/ copper seal will be made at the applicable unit price for linear meter measured along the center line of the water stop tendered therefore (in the schedule of quantities) with no allowance for lap at splices and intersection. The unit price shall include the cost of making splices and intersections and of furnishing all labour, equipment and materials, all taxes required for installing the water stops and protecting the water stops from damage during the progress of the work. The unit rate shall also include the cost of preparing and submitting the drawing, producing samples for approval of the Engineer-in-charge and costs of all incidentals work including tests etc. needed to complete the work as per the design and specification.

CHAPTER - 11
FINE DRESSING AND TURFING

11. 1. DESCRIPTION :

This work shall consist of supplying and laying live sods on the slope and other locations as ordered by the Engineer in accordance with the following specifications.

11.2. MATERIALS :

The sods shall consists of a dense well rooted growth of permanent and desirable grasses. Indigenous to the general locality where it is to be used, and shall be practically free from weeds or undesirable grasses. At the time the sods is out. The grass on the sod shall have a length of approximately 2 inches (if longer, the grass shall be cut to approximately this length and the sod shall have been raked from debris.

The sod shall be cut in uniform strips cot larger than it is convenient for handling and transport. The thickness of the sod shall be as uniform as possible approximately ¾ inch or more depending on the nature of the sod, so that practically all of the dense root system of the grasses will be retained but exposed in the sod strip and so that the sod can be handled without undue tearing or breading.

In the event the sod which is to be cut is in a dry condition, so as to cause crumbling or braking during cutting operations, the contractor at his own expense, shall at least 12 hours before cutting the sod, apply water to the same in sufficient quantity to provide a well moistened condition of the sod to the depth to which it is to be cut.

Top soil of the area to be turffed shall consist of soil of the area to be turffed shall consist of soils adopted to the sustenance's of plant life.

11.3. CONSTRUCTION METHOD:

Preparation of the earth bed :

All areas desired to be covered with sod shall be fine dressed to required contour, to an extent such that the finished work after laying sod with necessary top soil incorporated in the bed will be in accordance with required lines, grades, slopes and cross section.

The area to sodded shall be free from stones, roots or other undesirable foreign materials.

The soil of the area to be sodded shall be loosened to a depth of approximately not less than and top soil shall be spread evenly over the prepared bed to a depth of 2 inches and the clods and lumps shall be broken down to provide a uniform texture to the soil.

11.4. PLACING THE SOD:

The earth bed upon which the sod to be placed shall be moistened to the depth, manipulated, if naturally not sufficiently moist, and the sod after the same has been cut and shall be properly protected and sprinkled with water until placed be laid in horizontal strips beginning at the bottom of the slopes and working onwards, when placing sods the length to the strips shall be laid at right angles to the direction of flow of water. Sods shall be laid so that the joints caused by abutting ends of sods strips were not continuous, each sod strip shall be so laid to about against the strip previously laid.

As the sod is being laid shall be firmly and lightly tamped with suitable wooden or metal tampers to press the sod into the underlying soil. After tamping, the sod shall present a smooth even surface free from bumps or depressions, at such point. Where water will start flowing over a sodded area the upper edge of the sod strip shall be turned into the soil and layer of earth placed over this, which earth shall be thoroughly compacted to conduct the surface water over the upper edge of the sod. No sods shall be laid during the dry months of March to July.

11. 5. WATERING:

The sod shall be thoroughly watered immediately after placing and shall be kept thoroughly wet for a period of at least seven days after laying and shall be maintained in a satisfactory condition.

11.6. METHOD OF MEASUREMENT AND PAYMENT:

Measurement of turffing shall be made after full and satisfactory growth of the turffing. The unit and price shall contain all the specification as mentioned in the tender schedule.

Sod shall be measured by units of 100 square meters and will be paid for at the contract unit price of 100 square meter of sod in place which shall be full compensation for preparing the earth bed, for furnishing, placing, top dressing and watering the sod and for all labour, equipment, tools and incidentals necessary to complete the work in accordance with contract.

CHAPTER-12

Road Work

12.1.0 GRANULAR SUB BASE (GSB):

This work shall consist of laying and compacting well-graded material on prepared sub grade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers is sub-base or lower sub-base and upper sub-base (termed as sub-base hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer. It functions as a drainage layer for the pavement.

12.1.1 Materials:

It shall be natural sand, Moorum gravel Crushed Stone Crushed Slag, brick metal, Kankar, or combination there of depending on grading requirement.

12.1.2 Grading for Granular Sub-base Materials (MORD Clause 401.2.1):

IS Sieve Designation	Percent by weight passing the IS Sieve		
	Grading I	Grading II	Grading III
75 mm	100	-	-
53mm	-	100	-
26.5mm	55-75	50-80	100
9.5mm	-	-	-
4.75mm	10-30	15-35	25-45
2.36mm	-	-	-
0.425mm	-	-	-
0.075mm	<10	<10	<10

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Notes: The material passing 425 Micron (0.425mm) Sieve for all the three gradings when tested according to IS 2720 (Part-5) shall have liquid limit (LL) and plasticity index (PI) not more then 25 and 6 percent receptively.

(a) On clayey sub grades, the percent passing IS Sieve 0.075 mm shall not exceed 5.
(b) The wet aggregate is used as GSB material.

12.1.3 Strength of Sub base material mix (MORDclause401.3): the sub base material (mix) shall have a minimum soaked CBR value of 20 when materials are not available within economical leads, the mix with soaked CBR value up to 15 may be allowed.

12.1.4 The GSB mix is not be decided which can satisfy gradation, PL value, CBR requirements and economy.

12.1.5 Compaction of GSB (MORD Clause 401.4.2):

Sl. No.	Thickness of compacted layer	Equipment for compaction
i.	Upto 100mm	Smooth wheeled roller of 80 to 100 KN (i.e. 8 to 10 ton) Capacity
ii.	Upto 225mm	Vibratory roller of 80 to 100KN (i.e. 8 to 10 ton) Static weight.

12.1.6 Compaction requirement of GSB:

The sub-base material of grading specified in the contract shall be spread on the prepared sub grade with the help of a motor grader of adequate capacity, its blade having hydraulic control suitable for initial adjustment and for maintaining the required slope and grade during the operation or other means as approved by the Engineer.

When the sub-base material consists of combination of materials mixing shall be done Manual mixing shall be permitted only where the width of laying is not adequate for mechanical operations, as in small – size jobs. The equipment used for mix – in – place construction shall be a rotavator or similar approved equipment capable of mixing the material to the desired degree. If so desired by the Engineer, trial mechanically by the mix in place method. runs with the equipment shall be carried out to establish its suitability for the work.

(i) the moisture content of mix at time of rolling can be within a range of 1% above or 2% less than the Optimum Moisture Content (OMC) determined for the mix in the laboratory as per IS 2720 (Part-7).
(ii) Rolling is to continue till 100% density is achieved at site when compared with Laboratory MDD determined for the GSB Mix as per IS 2720 (Part-7).

12.1.7 Following Laboratory tests are to be carried out for GSB mix before commencement of work (with sand, moorum admixture) and the mix design is to be finalised.

(i) Gradation of materials of GSB Mix.
(ii) Determination of Atterberg's limits of the GSB Mix to Determine liquid limit (LL), Plastic limit (PL) and Plasticity index (PI) of material of mix passing 425 micro (0.425mm) sieve.
(III) CBR of mix.
MDD (Maximum dry density) and OMC (optimum moisture content) of the final GSB mix are to be determined for adoption at site.

12.1.8 Field Quality Control tests for GSB (as per table 1800.2 under MORD Clause 1803.2)

Sl. No.	Type of test	Frequency of Tests
(i)	Gradation of Material of the GSB mix. (IS 2720, Part 4)	2 tests/500 Cum Subject to a minimum of 2 tests per day.
(ii)	Plasticity tests (Atterberg's Limits) i.e tests for Liquid Limit (LL) Plastic Limit (PL) and Plasticity Index (PI) (IS 2720, part 5)	2 tests/ 500 Cum Subject to a minimum of two tests per day.
(III)	Placement Moisture Content of mix laid at site.	2 tests/ 500 Cum Subject to a minimum of two tests per day.

	(IS 2720, part 2)	
(iv)	Degree of Compaction of GSB layer laid at site by sand replacement method (IS 2720, part 28)	One set of tests per 2000 sqm comprising 5 to 6 measurements.
(v)	CBR of GSB mix used at site (IS 2720, part 16)	1 in 1000 Cum

12.1.9 Surface regularity of finished GSB layer (MORD Clause 1802.4):
The maximum permissible undulation measured with 3m straight edge for GSB shall be as indicated below.
(a) Along longitudinal profile-12mm.
(b) Along Cross profile-10mm.

12.2.0 WATER BOUND MACADAM (WBM):
WBM is laid over GSB as the base course. It is the metaling layer for the road.

12.2.1 Physical requirements of coarse aggregates for Water Bound Macadam (table 400.7 of MORD).

Sl. No.	Test	Test Method	Requirement		
			Sub base (WBM-I)	Base (WBM-II,III)	Surfacing (WBM-III)
A	Aggregate Impact Test	IS: 2386 part 4 (or IS:5640)	Less than 50	Less than 40	Less than 30
B	Flakiness Index Test	IS 2386 part 1	Less than 30	Less than 25	Less than 20
C	Soundness Test	IS: 2386 part 1			
(i)	Loss with Sodium Sulphate		Less than 12%	Less than 12%	Less than 12%
(ii)	Loss with Magnesium Sulphate		Less than 18%	Less than 18%	Less than 18%

12.2.2 The grading requirements of coarse aggregates for use in WBM are as follows (MORD table 400.8):

Grading No.	Size Range	IS Sieve Designation	Percent by Weight Passing
I (For Sub base only) Compacted layer thickness=100mm	90mm to 45mm	125mm 90mm 63mm 45mm 22.4mm	100 90-100 25-60 0-15 0-5
II (For base as WBM-II) compacted layer thickness=75mm	63mm to 45mm	90mm 63mm 53mm 45mm 22.4mm	100 90-100 25-75 0-15 0-5
III (For top layer of Base as WBM-III) compacted layer thickness=75mm	53mm to 22.4mm	63mm 53mm 45mm 22.4mm 11.2mm	100 95-100 65-90 0-10 0-5

12.2.3 physical properties of screening Material for use in WBM to fill voids in coarse aggregates (MORD Clause 405.2.8): The screening material can be crushable type (Sand, Moorum

admixture) or non crushable type (stone screening). The physical property of the screening material mix shall be as given below.

(a) Liquid limit-Less than 20.
(b) Plasticity Index-Less than 6.
(c) Fraction passing 75 micron sieve shall not exceed 10%.

12.2.4 Grading requirement of Screening material (MORD) table 400.9):

Grading Classification of Screening	Size of Screenings	IS Sieve Designation	Percent by weight passing the IS Sieve
A	13.2mm	13.2mm 11.2mm 5.6mm 180micron	100 95-100 15-35 0-10
B	11.2mm	11.2mm 5.6mm 180 micron	100 90-100 15-35

12.2.5 Binding Material: Binding material is to be used in WBM as filler materials for preventing. It shall have PI value less 6 for WBM Sub base/ Base Coarse and 4 to 10 for WBM surfacing careening used is of crushable type (i.e. sand, moorum admixture).

12.2.6 Approximate Quantities of Coarse Aggregates & Screenings

Required for 75mm Compacted thickness of Water Bound Macadam (WBM) BASE COURSE for 10m^2 Area (MORD table 400.10).

Classification of WBM	Size Range mm	Compacted thickness mm	Loose Quantity Cum	Stone Screenings		Crushable Screening such as moorum or gravel	
				Gradings classification & size	For WBM Base course (Loose Quantity) cum	Loose Quantity cum	Properties
GR-II	63 to 45	75	0.91 to 1.07	Type A 13.2	0.12 to 0.15	0.22 to 0.24	LL<20 P.I<6 passing 75 micron sieve<10
GR-II	63 to 45	75	0.91 to 1.07	Type A 11.2	0.12 to 0.15	1.22 to 0.24	LL<20 P.I<6 passing 75 micron sieve<10
GR-II	53 to 22.4	75	0.91 to 1.07	Type B 11.2	0.18 to 0.21	0.22 to 0.24	LL<20 P.I<6 passing 75 micron sieve<10

12.2.7 **The approximate weight of compacted WBM mix** (in WBM II or WBM II) with crushable screening (sand, moorum admixture) shall be:

(i) in the range of 3265kg/m^3 to3800kg/m^3 with moorum (60%) and sand (40%) admixture as screening.
(ii) In the range of 3272kg/m^2 to 3807kg/m^3 with moorum (70%) and sand (30%) admixture as screening.

(Note: Bulk densities assumed sand=1500 kg/m^3, Moorum=1700 kg/m^3, Stones=2300kg/m^3)

12.2.8 **Laboratory tests for individual WBM materials** are to be conducted to check quality of material before use in work.

12.2.9 **Frequency of field tests for WBM at worksite** (MORD table 1800.2):

Sl. No.	Test Designation	Frequency of Tests as per MORD
1	Aggregate impact value (IS 2386, part 4)	1 in 250 Cu .M or, Source
2	Grading of Aggregates & Screenings (IS 2386 part 1)	2 tests per 250 Cu.M or, per day
3	Flakiness Index (IS: 2386 part-I)	1 in 250 Cu. M or, per day
4	Atterberg's Limits of binding Material (IS: 2720 part-5)	1 to 50 Cu.M or, per day
5	Water Absorption (IS: 2386 part-3)	1 test per Source

12.2.10 **Surface regularity of WBM work:** The maximum permissible undulation measured with a 3m straight edge shall be 12mm along longitudinal profile and 8mm along the cross profile (for WBM-II and III)

12.3.0 PRIME COAT: the wok shall consist of application of a single coat of low viscosity liquid bituminous material to a porous granular surface preparatory to the super imposition of bituminous treatment or mix.

12.3.1 **Primer Material:** The primer to be applied on the WBM surface before laying BT shall be slow setting bitumen emulsion Grade SS-1 complying with IS 8887.

12.3.2 **Requirement of Viscosity and Quantity of Liquid bituminous material for priming** (MORD table 500.1).

Porosity and type of Surface	Kinematic viscosity of primer at 60^0 C (Centistokes)	Sybolt Furol Viscosity at 60^0 C (Seconds)	Qty. Per $10M^2$ (kg)
Low (WBM/WMM)	30-60	14-28	7-10
Medium (Stabilized base)	70-140	33-66	9-12
High (Gravel Base)	250-500	177-234	12-15

12.3.3 **Application of primer:** the range of spraying temperature for primer shall be 20^0 C to 60^0 C. It shall not be applied when Weather is foggy, rainy, windy, temperature in shade is less than 10^0 C or when there is standing water on Surface of WBM.

12.3.4 **Curing of Primer:** the primer shall be allowed to cure under natural conditions for 24 hours or such period to allow all volatiles to evaporate.

12.4.0 **TACK COAT:** this work shall consist of the application of a single coat of low Viscosity liquid bituminous material to an existing bituminous road surface preparatory to another bituminous construction. Tack coat is to be applied over primed WBM surface immediately before taking up PMC.

12.4.1 **Tack coat Material:** The binder for tack coat shall be Rapid setting Bitumen emulsion grade RS-1 complying with IS-8887. The use of cut back bitumen (medium curing grade) as per IS-217 shall be restricted only for sites at sub-zero temperature or for emergency application.

12.4.2 **Application of Tack Coat:** The normal range of spraying temperature for emulsion shall be 20^0 C to 60^0C and for the cut back 50^0 to 80^0C Bituminous material should not be applied, when the surface is wet, during a dust storm , when the weather is foggy, rainy or windy and when the temperature is less than 10^0 C. If the tack coat consists of emulsion, the surface shall be slightly damp but not wet where the tack coat is of cut back bitumen, the surface shall be dry.

12.4.3 Rate of application of tack coat:

Sl. No.	Type of Surface	Qnty. Of Bituminous Emulsion in kg per sqm area
1	Normal bituminous surfaces	0.2 to 0.25
2	Dry & hungry bituminous surfaces	0.25 to 0.30

3	Granular surfaces treated with primer	0.25 to 0.30
4	Cement Concrete pavement	0.30.to 0.35

12.4.4 **Curing of tack coat:** the tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plants or vehicles shall be allowed on the tack coat.

12.4.5 **Frequency of tests for primer Coat or Tack Coat** (MORD table 1803.3) :

Sl. No.	Test	Test Method	Frequency
1	Quality of binder	Viscosity, Residue on 600 micron sieve and storage stability tests for emulsion (IS-8887). Viscosity and Flash Point tests for cut backs (IS-217) Note: Viscosity requirements are stated at Sl. 5.2	One test per lot or per 10 tonnes
2	Temperature of binder for cutback when used	Appendix-10.6 of IRC-SP-20	One test per 500 sqm. not less than 2 tests per only day.

12.5.0 **20mmTHICK PRIMIX CARPET (PMC):**

The work shall consist preparation, laying and compaction of open graded premix surfacing of 20mm thickness using penetration grated bitumen on previously prepared base to serve as wearing course (MORD clause 508.1)

PMC is to be laid over primed EBM surface after application of tack coat.

12.5.1 **Bituminous binder:** The binder shall be preparation grade bitumen of grade s-65/90 (i.e. grade 60/70 or 80/100) satisfying requirement of IS 73.

12.5.2 **Aggregates:** The aggregates shall conform to be requirement as specified in the table bellow (MORD clause 508.1.2.2.and 504 2.2.)

Property	Test	Specification	Ref. To IS Specification
Particle Shape	Flakiness index	Max 25%	IS 2386 part-I
Strength	Aggregate impact Value	Max 30%	IS2386 part-4
Durability	Soundness:- Loss with (i) Sodium Sulphate (ii) Magnesium Sulphate	 Max 12% Max18%	IS 2386 part-5
Water absorption	Water absorption	Max 1%	IS 2386 part-3
Stripping	Coating & Stripping of bitumen aggregate mixture	Minimum retained coating 95%	IS: 6241

12.5.3 **Proportioning of Materials:** Quantities of materials required for $10m^2$ of Road surface for 20mm thick premix carpet using penetration grade Bitumen (MORD table 500.13):

(i) **Aggregate:**

Size	Quantity
(a) Nominal stone size 13.2mm (passing 22.4mm Sieve and retained on 11.2mm sieve)	$0.18m^3$
(b) Nominal stone size 11.2mm (passing 13.2mm Sieve and retained on 15.6mm sieve)	$0.09m^3$

Total Aggregate	0.27m^3

(ii)

Work	Quantity
(a) For 0.18m^3 of 13.2mm nominal size stone at 52 kg bitumen per m^3	9.5 kg
(b) For 0.09m^3 of 1 1.2 mm nominal size at 56 kg bitumen per m^3	5.1 kg
Total Bitumen	14.6 kg

12.5.4 **Preparation of surface for laying PMC:**

(i) The underlying WBM surface on which the PMC is to be laid shall be primed with primer coat when necessary (MORD Clause 502).

(ii) A tack Coat shall be applied over the base surface before laying PMC (MORD Clause 503).

12.5.5 Preparation of premix (with penetration grade Bitumen):

Temperature of the binder at the time of mixing - 150^{0}C to 163^{0}C.

Temperature of the aggregate-155^{0}C to 163^{0}C

Difference in temperature between the binder and aggregate at no time exceeds 14^{0}C.

Discharge temperature of the Mix shall be between130^{0}C to 160^0 C.

12.5.6 Rolling: Rolling shall be done with 80 to 100 KN (8 to 10 ton) Static Roller and should be completed before the temperature of the mix falls below 100^{0}C.

12.5.7 Laying of Seal Coat over PMC: A Seal Coat over PMCA Seal coat (as per MORD Clause 510) shall be applied to surface of PMC immediately.

12.5.8 Opening to traffic: traffic shall be allowed on the road only after the seal coat is laid.

12.5.9 Laboratory tests to be conducted before Commencement of PMC work at site:

(i) For Binder: Tests to ensure quality of binder (Penetration grade Bitumen)

(ii) For Aggregates: Tests for impact value, Flakiness index, Stripping value, water absorption, grading and soundness of aggregates.

12.5.10 Field tests for PMC Work (with penetration Grade Bitumen) (MORD table 1800.7):

Sl. No.	Test and Test Method	Frequency
i	Quality of Binder : penetration, softening point and ductility tests for paving Bitumen (IS 73)	1 test per Lot of 10 Tonnes
ii	Aggregate Impact Value (IS 2386, part 4)	1 test per 250 Cum. Per source
Iii	Flakiness Index (IS 2386, part-I) of Aggregates	1 test per 250 Cum. Per source
Iv	Stripping of aggregate (IS 6241-1971)	1 set of 3 representative specimens for each source
V	Water Absorption of Aggregates (IS 2386, part 3)	1 set of 3 representative specimens for each source
Vi	Grading of Aggregates (IS 2386, part I)	1 test per 50 Cum or per day
Vii	Soundness of Aggregates (with Magnesium and Sodium Sulphate) as per IS 2386, part 5	1 test per source
Viii	Temperature of Bitumen at application (Appendix 10.6 of IRC SP-20)	Regularly
Ix	Bitumen Content (Appendix 10.8 of IRC SP-20)	1 test per 500 Cum or per day
X	Thickness	Regularly

12.5.11 Surface regularity 20mm thick PMC (MORD Clause 1802.4):

Maximum permissible undulation measured with 3m long straight edge on Completed PMC shall be 8mm along longitudinal profile and Cross profile.

12.6.0 SEAL COAT

This work shall consist of the application of a seal coat for sealing the voids in the P.M.C surface laid to the specified levels grades and cross falls (Camber). The seal coat shall be any of the 3 types, i.e. type A, type B, type C.

12.6.1 Binder for Seal Coat (MORD Clause 501.2.1): The binder for Seal coat shall be penetration grade bitumen of suitable grade S-65/90 (i.e. 60/70 or 80/100) as per IS-73 or Bitumen Emulsion as per IS 8887 (RS grade for Type A, and SS grade for type B and Type C).

12.6.2 Required Quantities of binder per 10m^2 area:

Type of Seal Coat	Bitumen (Kg)	Emulsion (Kg)
Type A: Liquid Seal coat	9.8	12 to 14
Type B: premix Seal Coat with sand grit	6.8	10 to 12
Type C: Premix Seal Coat with stone chips	4.5% by weight of total mixture	9 to 11

12.6.3 Aggregate for Seal Coat (MORD Clause 510.2.):

(i) Type A Seal Coat (Liquid seal coat):

Nominal size of chips	Sieve size	% passing	Quantity required
6.7mm	11.2mm	100%	0.09cum per 10sqm.
	2.36mm	Retained	

(ii) Type B Seal Coat (premix seal coat):

Type of material	Sieve size	% passing	Quantity required
Sand or grit	2.36mm	100%	0.06cum per 10sqm.
	180 micron	Retained	

(iii) Type C Seal coat (premix seal coat):

Nominal size of chips	Sieve size	% passing	Quantity required
6.7mm	9.5mm	100%	0.09cum per 10sqm.
	2.36mm	Retained	

12.6.4 Temperature Control during Construction of Seal Coat with Penetration grade Bitumen:

(i) Type A seal coat: Bitumen is to be heated to 150^{0}C to 163^{0}C as appropriate for the grade and sprayed.

(ii) Type B seal coat: Bitumen is to be heated to temperature appropriate for the grade. Aggregates are to be heated to temperature between 150^{0}C to 165^{0}C.

(iii) Type C seal coat: Temperature of Bitumen shall be in the temperature of 150^{0}C to 163^{0}C and temperature of aggregate is to remain in range of 155^{0}C to 1630C Difference in temperature between the binder and Aggregates shall not exceed 14^0 C.

12.6.5 Opening to traffic:

(i) Traffic shall not be allowed on type A seal coat till next day.

(ii) Traffic can be allowed on type B and type C Seal coat after the premix material has cooled down.

12.6.6 Quality of Aggregates:

(MORD Table 500.3): The Aggregates shall conform to specifications listed at serial 7.2.

12.6.7 Field tests to be conducted during work: All tests listed at serial 8.10 for surface dressing are to be conducted.

12.7.0 Bituminous Macadam Scope :

The work consists of construction in a single course having 50mm to 100 mm thickness or in multiple course of compacted crushed hard granite aggregate premixed with a bituminous binder on a previously prepared base to the requirement of this specification as laid down in Built up Spray Grout (BUSG).

12.7.1 Bitumen:

The bitumen shall be pavers bitumen of penetration grade 35 to 90 complying to IS-73.

12.7.1 Coarse aggregates:

The aggregates shall consist of crushed hard granite rock retained on the 2.36mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter. Where contractor's selected source of aggregates have poor affinity

for bitumen, as a condition for approval of that sources, the bitumen shall be treated with approved anti-striping agents, as per manufacture's recommendations, without additional payment. Before approval of the sources, the aggregate shall be tested for stripping. The aggregates shall satisfy the following physical requirements.

Sl. No.	Property	Quality Control Test	Specification	Frequency of testing.
1.	Cleanliness	Grain size analysis (IS.2386 Part-I)	Maximum 5% passing 0.075 mm sieve.	One test/100m^3
2.	Particle shape	Flakiness and elongation (Combined) IS.2386 part-I)	Maximum 30%	One test/20m^3
3.	Strength	Los Angeles abrasion value or Aggregate Impact Value (IS.386. Part-IV)	Maximum 40% Maximum 30%	One test/200m^3 One test/200m^3
4.	Durability	Soundness (IS.2386. Part-5) Sodium Sulphate Magnesium Sulphate.	Maximum 12% Maximum 18%	One test for each source of supply
5.	Water absorption	Water absorption (IS.2386. Part-3)	Maximum 2%	One set of 3 representative specimens.
6.	Stripping	Coating and stripping of Bitumen Aggregate Mixtures (IS.6241)	Minimum retained coating 95%	One set of 3 representative specimens.

12.7.2 Fine aggregates:

Fine aggregates shall consist of naturally occurring material passing 2.36mm sieve and retained on 75 micron sieve. They shall be clean, hard, durable, dry and free from dust and soft or friable matter, organic or other deleterious matter.

12.7.3 Aggregate grading and binder content:

When tested in accordance with IS-2386 Part-1 (wet sieving method), the combined aggregate grading for particular mixture shall fall within the limits shown in the table below.

Mix designation Nominal Aggregate Size Layer thickness IS Sieve (mm)	Grading 1 40mm 80-100mm	Grading 2 19mm 50-75 mm
45	100	-
37.5	90-100	-
26.5	75-100	100
19	-	90-100
13.2	35-61	56-88
4.75	13-22	16-36
2.36	4-19	4-19
0.3	2-10	2-10
0.075	0-8	0-8
Bitumen Content & by weight of total mixture Bitumen grade	3.1-3.4	3.3-3.5
Bitumen grade	35 to 90	35 to 90

12.7.4 Proportioning of material:

The aggregates shall be proportioned and blended to produce a uniform mixture complying with the requirement of the table furnished above. The binder content shall be within a tolerance of ± 0.3% by weight of total mixture when individual specimens are taken for quality control tests in accordance with the quality control provisions.

12.7.5 Construction Operation:

The base of the bituminous macadam shall be shaped and compacted to the required profile. The surface over which bituminous macadam shall be laid shall be firm and clean and shall be treated with prime coat or tack coat as per the necessity and as directed by the Engineer.

12.7.6 Preparation and transportation of mixture:

Premixed bituminous macadam shall be prepared in a hot mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with thoroughly coated aggregates. Approximate mixing temperature shall conform to the following table. The difference in temperature between the binder and aggregate should in no time exceed 14^0 C. In order to ensure uniform quality of the mix and better coating of aggregates, the hot mix plant shall be calibrated from time to time.

12.7.7 Spreading:

Except in areas where a mechanical pavers can not access, bituminous materials shall be spread, leveled and tamped by an approved self propelled paving machine. As soon as possible after arrival at site, the materials shall be supplied continuously to the pavers and laid without delay.

In areas with restricted space where a mechanical pavers can not be used, the material shall be spread, racked and leveled with suitable hand tools by experienced staff and compacted to the satisfaction of the Engineer.

The manufacturing and rolling temperatures shall conform to the following table.

Bitumen Penetration	Bitumen Mixing (^{0}C)	Aggregate Mixing (^{0}C)	Mixed Material (^{0}C)	Rolling (^{0}C)	Laying (^{0}C)
35	160-170	160-170	170 maximum	100 minimum	130 minimum
65	150-165	150-170	165 maximum	90 minimum	125 minimum
90	140-160	140-165	155 maximum	80 minimum	115 minimum

12.7.8 Rolling:

Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface, level, regularly requirements and compaction to be achieved.

Compaction of Bituminous materials shall commence as soon as possible after laying Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of this specification. Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this, rolling shall commence at the edges and progress towards the center longitudinally except that on super elevated and unidirectional cambered portions, it shall progress from the lower to upper edge parallel to the center line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver, before initial rolling is recommended. The initial or breakdown rolling shall be done with 8-10 tones dead weight or vibratory roller or with a pneumatic tire roller of 8 to 10 tones weight having nine wheels, with a tire pressure of at least 5.6 kg/cm^2. The finish rolling shall be done with 6-8 tones smooth wheeled tandem rollers.

Where compaction is to be determined by density of cores the requirements to prove the performance of rollers shall apply in order to demonstrate that the specified density can be achieved. In such cases the contractor nominates the plant and the methods by which he intends to achieve the minimum specified rolling temperature. Laying trials shall then demonstrate the acceptability of the plant and methods used.

12.7.9 Protection of the layer:

The Bitumen macadam shall be covered with either the next pavement course or wearing course, as the case may be, within a maximum of 48 hours. If there is to be any delay, the course shall be covered by a seal coat before opening to any traffic. The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

12.7.10 Quality Control:

Quality Control tests and frequencies shall conform to the table furnished earlier in the chapter under aggregates. Besides these tests following tests should be carried out.

Sl. No.	Test	Frequency
1.	Quality of binder	As per IS-73
2.	Binder content and aggregate grading	Periodic subject to minimum of 2 tests per day per plant.
3.	Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	At regular close intervals.
4.	Rate of spread of mixed material	Regular Control through checks of layer thickness.
5.	Density of compacted layer	One test per 250m^2 of area.

12.7.11 Measurement for payment:

Bituminous macadam shall be measured as finished work in cubic meters.

12.8.0 Semi-dense Bituminous Concrete (SDBC):

Scope :

This work shall consist of construction in a single or multiple layer of semi-dense bituminous concrete on a previously prepared bituminous bound surface. A single layer shall be 25mm to 100 mm in thickness.

12.8.1 Bitumen :

The bitumen shall be paving bitumen of penetration grade complying with IS-73 of penetration grade 80/100 penetration grade may be used in exceptional cases on approval of the Engineer.

12.8.2 Coarse aggregate :

The coarse aggregates shall consist of crushed granite material retained on 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious substance. Where contractors selected sources of aggregates have proof affinity for bitumen, the bitumen shall be treated with an approved anti-striping agent, as per the manufacture's recommendations, without additional payment. Before approval of the source, the aggregates shall be tested for stripping. The aggregates shall satisfy the physical requirements of the following table.

Sl. No.	Property	Test	Specification	Frequency of testing.
1.	Cleanliness (Dust)	Grain size analysis (IS.2386 Part-I)	Maximum 5% passing 0.075 mm sieve.	One test/100m^3
2.	Particle shape	Flakiness and elongation (Combined) IS.2386 part-I)	Maximum 30%	One test/20m^3
3.	Strength	Los Angeles abrasion value or Aggregate Impact Value (IS.386. Part-IV)	Maximum 40% Maximum 30%	One test/200m^3 One test/200m^3
4.	Durability	Soundness (IS.2386. Part-5) Sodium Sulphate Magnesium Sulphate.	Maximum 12% Maximum 18%	One test for each source of supply
5.	Water absorption	Water absorption (IS.2386. Part-3)	Maximum 2%	One set of 3 representative specimens.
6.	Stripping	Coating and stripping of Bitumen Aggregate Mixtures (IS.6241)	Minimum retained coating 95%	One set of 3 representative specimens.

12.8.3 Fine aggregates:

The fine aggregates shall consist of naturally occurring material passing 2.36mm sieve and retained on 75 micron sieve. They shall be clean, hard, durable, dry and free from dust and soft or friable matter. The fine aggregate shall have a send equivalent value of not less than 50 when tested in accordance with the requirement of IS-2720 (Part 37). The plasticity index of the fraction passing 0.425 mm sieve shall not exceed 4, when tested in accordance with IS-2720 (Part-5).

12.8.4 Filler :

Filler shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement as approved by the Engineer. The grading requirement of filler shall per the following table.

IS sieve (mm)	Cumulative percent by weight of total Aggregate passing
0.6	100
0.3	95-100
0.075	85-100

The filler shall be free from organic impurities and have a plastically index not greater than 4. The plasticity index shall not apply if the filler is cement or lime.

12.8.5 Aggregate grading and binder content:

When tested in accordance with IS-2386-Part-I (wet sieving method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in the following test for grading 1 or 2.

Grading	1	2
Nominal aggregate size	13 mm	10 mm
Layer thickness	35-40	25-30 mm
IS sieve (mm)	Cumulative Percentage by Weight to total aggregate passing	
1.9	100	-
13.2	90-100	100
9.5	70-90	90-100
4.75	35-51	35-51
2.36	24-39	24-39
1.18	15-30	15-30
0.3	9-19	9-19

0.075	3-8	3-8
Bitumen content % by mass of total mix determined by marshall method	Minimum 4.5	Minimum 5.0

12.8.6 Mixture Design.

Apart from conformity with the grading and quality requirements for individual ingredients the mixture shall meet the requirement for the following table.

Minimum stability (kN at 60^0 C)	8.2
Minimum flow (mm)	2
Maximum flow (mm)	4
Compaction level (Number of blows)	75 blows on each of the two faces of the specimen
Percent air voids	3-6
Percent voids filled with bitumen	65-75

The minimum percent voids in mineral aggregate (VMA) shall be as per the following table.

Nominal Maximum particle size (mm)	**Minimum VMA, percent related to design air voids, percent**		
	3.0	4.0	5.0
9.5	14.0	15.0	16.0
12.5	13.0	14.0	15.0
19.0	12.0	13.0	14.0
25.0	11.0	12.0	13.0
37.5	10.0	11.0	12.0

The nominal maximum particle size in the above table is defined as one size larger than the first sieve to retain more than 10% VMA for design air voids values between those listed above are to be interpolated.

12.8.7 Binder Content:

The binder content shall be optimized to achieve the requirements of the mixture mentioned in mixture design paragraph of this specification. The marshal method for determining the optimum binder content shall be adopted replacing the aggregates retained on the 26.5 mm sieve and retained on 22.4 mm sieve, where approved by the Engineer.

12.8.8 Job Mix Formula:

The Contractor shall inform the Engineer in writing, at least 20 days before the start of the work of the job mix formula proposed for us in the works, and shall give the following details.

(i) Source and location of all materials
(ii) Protections of all materials expressed as follows where each is applicable
a) Binder type and Percentage by weight of total mixture.
b) Coarse aggregate / Fine aggregate / Mineral filler as Percentage by weight of total aggregate including mineral filler.
(iii) A single definite Percentage passing each sieve for the mixed aggregate
(iv) The individual grading of the individual aggregate fractions, and the proportion of each n the combined grading.
(v) The results of tests enumerated to satisfy requirements detailed in mixture design chapter of this specification.
(vi) Whether the mixer is a batch mixer, the individual weights of each type of aggregate and binder per batch.
(vii) Test results of physical characteristics of aggregates to be used.
(viii) Mixing temperature / Computing temperature.

Plant trials – Permissible variation in job mix formula

Once the laboratory job mix formula is approved, the contractor shall carry out plant trials at the mixer to establish that the plant can be set up to produce a uniform mix conforming to the approved job mix formula. The permissible variations of the individual Percentages of the various ingredients in the actual mix from the job mix formula to be used shall be within the limits prescribed in the following table. These variations are intended to apply to individual specimens taken for quality control tests.

Description	**Permissible Variation**	
	Base/Binder Course	**Wearing Course**
Aggregates passing 19mm sieve or higher	± 8%	± 7%
Aggregates pasing 13.2mm 9.5 mm	± 7%	± 6%
Aggregates passing 4.75 mm	± 6%	± 5%
Aggregates passing 2.36 mm 1.18 mm, on 0.6mm	± 5%	± 4%

Aggregates passing 0.3mm, 0.15 mm	± 4%	± 3%
Aggregates passing 0.075 mm	± 2%	± 1.5%
Binder content	± 0.3%	± 0.3%
Mixing temperature	± 10^0 C	± 10^0 C

Once the plant trails have demonstrated the capability of the plant and the trails are approved, the laying operation may commence. Over the period of the first month of production for laying of the works, the Engineer shall require additional testing of the product to establish the reliability and consistently of the plant.

12.8.9 Laying trails.

Once the plant trials have been successfully completed approved, the contractor shall carry out laying trials, to demonstrate that the proposed mix can be successfully laid and compacted. The laying trial shall be carried out on suitable area which is not to form part of the works, unless specifically approved in writing by the Engineer. The area of the laying trials shall be a minimum of 100 m^3 of construction similar to that the project road, and it shall be in all respects, particularly compaction, the same as the project construction on which the bituminous materials is to be laid.

The contractor shall previously inform the Engineer of the proposed method for laying and compacting the material. The plant trials shall then establish if the proposed methodology is capable of producing satisfactory results. The density of the furnished paving layer shall be determined by taking cores, no sooner than 24 hours after laying or by other approved method.

Once the laying trial has been approved, the same plant and methodology shall be applied to the laying of the material on the project and no variation of either shall be acceptable, unless approved in writing by the Engineer, who may at his discretion require further laying trails.

12.8.10 Construction Operations:

Preparation of surface : the surface on which SDBC is to be laid shall be firm and clean and shall be treated with prime coat or tack coat as per requirement and as directed by the Engineer. The surface shall be thoroughly swept clean by mechanical broom and dust removed by compressed air. In locations where a mechanical broom can not be access, other approved methods shall be used as directed by the Engineer.

12.8.11 Mixing and transportation of the mixture. (As per Bituminous macadam)

12.8.12 Spreading: (As per Bituminous macadam)

12.8.13 Rolling: (As per Bituminous macadam)

12.8.0 Operating to traffic : The newly laid surface shall not be opened to traffic for at least 24 hours after laying and the completion of compaction, without the express approval of the Engineer writing.

12.8.14 Quality Control:

The physical properties of the coarse aggregate shall satisfy the requirements as laid down in the specification for bituminous macadam. The quality of the aggregate and binder are detailed in the table below.

Sl. No.	Test	Frequency
1.	Sand equivalent test	As required
2.	Plasticity index	As required
3.	Mix grading	One set of tests on individual constituents and mixed aggregate from the dryer for each 400 tonnes of mix subject ot a minimum of 2 tests per plant per day.
4.	Stability of mix	For each 400 tonnes of mix produced, a set of 3 marshall specimens to be prepared and tested for stability, flow value, density and void content subject to a minimum of two sets being tested per plant per day.
5.	Swell test on mix	As required for the bituminous concrete.
6.	Control of binder content and grading of the mix	One test for each 400 tonnes of mix subject to a minimum of two sets per day per plant.

12.8.15 Measurement for payment:

SDBC shall be measured as finished work in m^3

CHAPTER – 13
PRECAST REINFORCED CEMENT CONCRETE PIPES

13.0.0 SUPPLY OF PIPES:

Providing and fixing R.C.C. NP_2/NP_3/NP_4class pipes as per drawings and conforming to IS 458-1988 or its recent editions.

Pipes shall be specified diameter non pressure type conforming to IS 458-1988. Maximum length of the pipe shall not be less than 2.5m or otherwise directed by the Engineer-in-charge. The contractor shall order the pipes required for the work on the basis of the construction drawings supplied to him by the Engineer-in-charge. Pipe marked with the following information on each type shall only be accepted for the work.

A. Class Pipe
B. Date of Manufacture
C. Name of Manufacturers or his trade mark or both
D. IS Specification mark.

13.1. HANDLING ANDLAYING OF PIPES.

Work shall be done as per IS 783-1988 or its latest edition. Reasonable care shall be exercised in loading, transporting and unloading of concrete pipes. Handling shall be such as to avoid impact. All pipes shall be inspected thoroughly before being laid. Broken or defective pipes shall not be used. Trench shall be of sufficient width to provide for free working space in minimum 30cm on either side of the pipe. Pipes shall be lowered into the trenches by use of standard appliance. Pipe shall be laid true to line and as specified on the construction drawings. Lying of pipes shall be along proposed grade of the slopes. The socket ends of pipe shall face upstream. The connections of the pipes shall be joined together in such a manner that these shall produce perfect even surface along the inside of the pipe and there will be no leakage through joints. In no case pipes shall be laid directly on rock or other hard materials.

13.2. JOINING PIPES:

Semi flexible type spigot and joint as per IS 783-1988 and as shown in the construction drawing shall be provided.

13.3. BACK FILLING TRENCHES:

A. Trenches shall be kept free from water until the materials in the joints have hardened. Walking or working on the completed pipe shall not be permitted until the trench has been back filled to a height of at least 45cm over the pipe except as may necessary for back filling and compaction.

B. Trenches shall be back filled after pipe has been laid subject to the condition that jointing has hardened. Only selected materials shall be used for backfilling. Filling of the trenches shall be carried out simultaneously on both sides of pipe in such manner that unequal pressure does not occur.

13.4. MEASUREMENT AND PAYMENT:

Measurement for payment shall be on running meter basis on the pipe line laid. The rate in bill of quantities shall include the cost of pipes including loading, unloading, handling, storing, laying in position, royalty, taxes, curing & all other operations to complete the work as per the specification.

CHAPTER -14
OTHER ITEMS

14. 1. WEEP HOLES: Providing weep holes and placing in position 10 cm dia Asbestos Cement pipes with non-corroding jalli as per design and drawings.

GENERAL:

(a) Weep holes of the size as shown on the drawings shall be provided and they shall extend through the full width of the masonry with a slope of about 1 vertical to 20 horizontal towards the draining face to drain moisture from the backfilling, the spacing of holes shall be as per the drawings in either direction staggered. The sides and bottom of weep holes in the interior shall be made up in the stones/ concrete having fairly plain surface as channel so formed slabbed over with stones/ concrete lintels not less than 150mm and each side including centering and shuttering. In stone masonry, generally the height of weep holes shall be the same as the height of the course in which they are formed. Filters behind weep holes with jally shall be provided to the dimensions and grades as shown on the drawings with inverted backing of approved quality filter materials in back filling side.

(b) In case the length of the pipe falls short of the standard length of the pipe, it shall be joined with necessary collars in cement mortar 1:3 of as per the instruction of the Engineer to form continuous hole in the body of wall. Defective pipes or defective work shall not be measured and paid. These shall be removed and replaced by the contractor. The interior of all pipes shall be free from sand, mortar or dirt and other foreign matter. Care shall be taken to prevent entrance of any foreign matter into the pipes during
progress of work.

14.2 SHEET PILE:

The sheet piles to be used for the works should be of 'Z' type conforming to weight approximately 112 Kg/Sq. 130 Kg/Sq meter

The top and bottom levels of sheet piles should be as per the approved construction drawing to be made available by the department. These levels vary according to the position at which the sheet piles are to be driven.

The sheet piles shall be driven true to plumb and along the line of cut off or along the line as indicated in the relevant drawing. In case it is not possible to follows the line cut off as indicated in the drawing due to on any unavoidable circumstances, the sheet pile lining may be diverted at right angles with the line as per the drawing. This however depends upon the discretion of the Engineer-in-Charge. As the effectiveness of the cut off depends upon the vertically and consequent interlocking of sheet piles special care shall be taken to drive piles vertically and more deviation from the true plumb will be allowed. In case any pile goes out of plumb the same has to be pulled out and another pile driven in its place after making sure that the preceding piles are not disturbed from their vertically. No separate payment will be made for such withdrawal and re-driving of the sheet piles. It is preferable to adopt the method of vibro-sinking or manually moving the sheet piles. The contractor shall however indicate while tendering for the work the method proposed for driving the sheet piles.

MODE OF MEASUREMENT AND PAYMENT:

The length of each pile to be driven shall be measured and shall be entered in the measurement book prior to the commencement of driving. After driving the bottom levels of piles must conform to the levels indicated in the relevant drawing. Payment will be made according to the depth, i.e. difference between the top and bottom level of piles indicated the relevant drawings. The unit of payment for this item of sheet pile driving will be per square meter which shall be obtained by multiplying the depth of pile (top level – bottom level) driven as defined above by the projected length measured along the surface of the sheet pile driven but the projection of the pile.

The rate quoted shall include fabrication of junction piles and taper piles approved by the Engineer. The rate quoted should also include coffer dam dewatering and protection works etc. complete.

SECTION-6
DRAWINGS

DRAWING CAN BE SEEN IN THE OFFICE OF THE EXECUTIVE ENGINEER,
KEONJHAR IRRIGATION DIVISION,KENDUJHAR, ODISHA
DURING THE OFFICE HOURS FROM. 29.10.2026 TO 05.11.2026.

CONTRACTOR **EXECUTIVE ENGINEER**

SECTION-7
FORMS

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – A

NO RELATION CERTIFICATE

Certified that I / We am / are not related to any officer of Water Resources Department of the rank of Assistant Engineer and above or any officer of the rank of Under Secretary and above.

CONTRACTOR

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – B

STRUCTURE AND ORGANISATION

1. Name of Tenderer ……..

2. Nationality of Tenderer ……..

3. Office Address ……..

4. Telegraphic Address ……

Telephone/ Fax No ……

Mobile No ……

Telex Number/ e-mail ID ……

5. Location of establishment ……

And from date

6. The tenderer is

a. An individual

b. A proprietary firm.

c. A limited company or limited corporation

d. A member of a group of companies (If yes, give names, address and present description of other companies.)

e. A subsidiary of large organization

(If yes, give names, address of the present organization)

f. If the company is subsidiary, state what involvement if any, will the parent company have in the project.

Attach the organization chart showing the structure of the organization including the names of the Directors position of officer.

7. Number of year of experience

a. As a prime contractor
   I. In own country
   II. Other country (specify country)
b. In a Joint venture
   I. In own country
   II Other country (specify country)

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8. Name & the address of any associates that the tenderer has in India, who are knowledgeable in the procedure of customs, immigration etc. and other information necessary to do work.

9. How many years has your organization been in business under your present name? Add what were your fields were initially and when you established your organization. When did you add new field (if any)?

10. Have you ever required for suspending construction for a period of more than six months continuously after you started? If so, give the names of project and reason for suspension or failure.

11. Have you ever not completed any work awarded to you? If so give name of project and reasons for not completing the work.

12 In how many projects you have been imposed with penalties for delay? Please give name of the projects and detail reasons.

13. In which fields of Civil Engineering construction do you claim specialization and interest.

14. Give details of your experience in modern concreting / Earth work and quality control.

15 Give details of your material testing laboratory.

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM-C

FINANCIAL STATEMENT

(Must be given separately for each partner in case of joint venture)

1. Name of Firm/ Contractor.

2 Name of partner /Directors

3 Capital

a. Authorized

b. Issued and paid-up

4 a. Details of the work completed and tenderer's performance record for last three years.

(Vide Annexure-A)

b. Details of work on hand and tenderer's performance record for last five years.

(Vide Annexure-B)

5. Furnish Balance sheet and profit & loss statement with auditor's reports for the

Last five years, it should include the following information.

i Working capital

ii Foreign investment.

iii

a. Turnover for 2020-2021

b. Turnover for 2021-2022

c. Turnover for 2022-2023

d. Turnover for 2023-2024

e. Turnover for 2024-2025

f. Turnover for 2025-2026

iv Gross income

a. Turnover for 2020-2021

b. Turnover for 2021-2022

c. Turnover for 2022-2023

d. Turnover for 2023-2024

e. Turnover for 2024-2025

f. Turnover for 2025-2026

CONTRACTOR **EXECUTIVE ENGINEER**

V Total liabilities

Current ratio

a. Current assets to current liabilities

b. Total liabilities to net worth.

6 What is the maximum annual value of work that you can handle?

7 Have you ever been denied tendering facilities by any Government Department/ Public sector undertaking? (Give details)

8 List your sources of finance

a. Own resources

b. Bank credit.

c. Other sources-specify, if any?

9 Certificate of financial soundness by Bank (To be signed by the Senior Manager of a Nationalized Bank)

10 Name and address of Bank from whom reference can be obtained.

Name:

Address :

Telephone No:

Fax No :

11 Have you ever been declared bankrupt?

(If yes, please give details)

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM-D

RESOURCES PERSONNEL

Details of key Technical and Administrative personnel, who could be assigned with the work, are to be mentioned in the following proforma.

A. Details of the Board of Directors.

1. Name of the Director.

2. Organization

3. Address

4. Remarks

B. Key Technical and Administrative personnel

1. Individual Name

2 Qualification

3. Present position of Office

4. Professional experience and details of works

5. Years with the tenderer

6. Languages known

7. Remarks

Signature of Contractor

FORM – E

RESOURCES PLANT AND EQUIPMENT

1. Details of the plants and equipments owned by the tenderer which may be used for this work.

(Proof of ownership to be attached)

(*Separate sheet for each type of equipment)*

I. Name of Equipment_____

II. Number of units_____

III. Kind and make_____

IV. Capacity_____

V. Normal life specified by the manufacturer_____

VI. Number of actual working hour put in by the machine_____

VII. Present location_____

VIII. Remarks

2. Give details, how the additional plants and equipments, which may be required by the tenderer for the work, would be obtained.

(*Separate sheet for each type of equipment)*

Particulars of Machinery	(a) To procure in India	(b) To hire in India	(c) Owned
I. Name of Equipment			
II. Number of units			
III. Kind and make			
IV. Country			
V. Capacity			
VI. Approximate cost in rupees			
VII. Remarks			

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – F

EXPERIENCE; GEOGRAPHICAL

Give summary of experience in INDIA in similar work (Add pages if necessary)

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – G

ADDITIONAL INFORMATION

1. Please add any further information which the tenderer considers relevant in regard to his capabilities .

2. Please give a brief note including why the tenderer considers himself eligible for technical bid for the work (For details please see information and instruction to tenderers.)

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – H

FORMAT FOR PERFORMANCE RECORD OF CONTRACTORS

1. Name of the Contractor :
2. Registration No. and Date :
3. Class of Contractor :
4. Licensing Authority :
5. License valid up to :
6. Details of works executed :

Sl. No.	Jobs executed	Agreement amount	Date of Commencement	Stipulated Date of Completion/ Actual date of completion	Whether work is executed as per the programme?	Reasons for delay , if any
1	2	3	4	5	6	7

7. Whether the Contractor has requisite machineries & personnel deployed in the work (Details of machinery and personnel deployed) :
8. Whether the quality of construction is satisfactory :
9. Whether he has capability to make good the loss in time :
10. Whether the Contractor has abandoned any work in the past three years, if yes, the details thereof.
11. Whether the Contractor has entered in to any litigation in the past, if yes, the details thereof.

Name of the Certifying Officer
With official seal

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – I

Details of the works in hand and performance for last five years as on the date of submission of this document in the following proforma.

(Separate sheet for each work)

1. Name of work_____
2. Place and Country_____
3. Total tendered cost of work _____
4. Brief description of works including principal features and quantities of main items._____

   _____
5. Details of works in hand
   i. Percentage of physical completion and amount billed for the work completed.
   ii. Cost of work remaining to be executed.
   iii. Stipulated date of completion.
   iv. Anticipated date of completion.
6. Explain for non-completion of work within stipulated time limit if so.
7. Were there any penalties /fines / stop notice / compensation /liquidated damages imposed?

   Yes or No.

   If yes, give amount and explanations
8. Were there any fines, claims or stop notice filed by the employer?

   (Yes or No.)

   (If yes, give amount and explanation)

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – J

AFFIDAVIT

I, Sri…….Aged..... years,

Son/ Daughter/ Wife of Sri ..... at present residing

At……. P.O……..P.S……..Dist……

Pin……. (State & Country) do here by solemnly affirm as follows.

i) That, I / We possess a valid license for execution of works contract issued by *…….. belongs to ……Class & is valid up to **…… .

I am submitting tenders before the Executive Engineer, Keonjhar Irrigation Division, Kendujhar, At/Po – Kendujhar,, Dist – Kendujhar, Odisha for the work "

I am the authorized signatory on behalf of the contractor for the tender for the work mentioned above.

ii) I am swearing this affidavit that all tender documents and accompanying papers those being submitted by me before the Executive Engineer, Keonjhar Irrigation Division, Kendujhar including E.M.D. in any shape are all authentic and bonafied documents in the eyes of the law of the land.

That the facts stated in the affidavit are true to the best of my knowledge and belief.

Signature of Contractor /
Authorized Signatory

Note :

*Mention the license issuing authority.

* *Mention the date up to which the license is valid

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – K

AFFIDAVIT

I, Sri……..... Aged..... years
Son/ Daughter/ Wife of Sri……..... at present residing At……..... P.O.....
P.S…….....Dist……(State/Country) Pin……
do here by declare that , I have not registered under the GST act in the state of Odisha as I have not started any business in the state and I have no liability under the act.
In the event of this contract is awarded to me, I will register my-self in the GST Act in the State of Odisha and I will produce the GSTIN and VAT clearance certificate in prescibed form before drawl of agreement.

That the facts stated in the affidavit are true to the best of my knowledge and belief.

Signature of Contractor /
Authorized Signatory

Note:
This certificate is required to be furnished by the outside contractors who have not started any business in the state of Odisha.

CONTRACTOR **EXECUTIVE ENGINEER**

FORM – L

CERTIFICATE TO BE ISSUED BY THE SUPERINTENDING ENGINEER UNDER WHOM MECHANERIES / EQUIPMENTS ARE DEPLOYED

(Not issued prior to 90days of received of the tender)

Sl. No.	Name of the Machineries / Equipments	Identification No. Engine / Chassis No.	Capacity	Year of Purchase	Condition (Working / Breakdown)	Since when deployed under Him	When it is likely to be released from current assignment
1	2	3	4	5	6	7	8

Certified That

1. I have verified ownership documents with the identification no of the Machineries / equipments.
2. Machines are currently utilized exclusively for the work under the Division.
3. The facts provided are true as on the date of issue of this documents to the best of my knowledge.

CONTRACTOR **EXECUTIVE ENGINEER**

FORM-M

DETAILS OF OTHER WORKS TENDERRED FOR AND WORKS IN HAND ON THE DATE OF SUBMISSION OF THE TENDER

Sl No.	Name of works with No. & Date of agreement & Division / Dept. concerned	Place & Country	Work in Hand			Work Tendered for			Remarks
			Tendered cost	Cost of work remaining to be executed	Anticipated date of completion	Amount put to Tender	Date when decision is expected	Stipulated date & period of completion	
1	2	3	4	5	6	7	8	9	10

CONTRACTOR **EXECUTIVE ENGINEER**

FORM-N

DETAILS OF WORK OF SIMILAR TYPE AND MAGNITUDE CARRIED ON BY THE CONTRACTOR IN THE PAST

Sl No.	Name of works with No. & Date of agreement & Division / Deptt. Concerned	Place & Country	Tendered cost	Final cost of completion	Stipulated period of completion	Period of actual completion	Principal Features
1	2	3	4	5	6	7	8

CONTRACTOR **EXECUTIVE ENGINEER**

Form-O

FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES

BANK CERTIFICATE

This is to certify that M/s.....is a reputed company with a good financial standing.

If the contract for the work, namely "_____

_____" having bid identification No._____is awarded to the above firm, we shall be able to provide overdraft / credit facilities to the extent of Rs._____to meet their working capital requirements for executing the above work.

Signature & Seal of Bank Manager

Name & Address of Bank

CHECK LIST

SL. NO.	DOCUMENTS	SUBMITTED OR NOT
1. Form A	No relation Certificate	Yes/No
2. Form B	Structure and Organization	
3. Form C	Financial Statement	Yes/No
	a) Balance sheet of last six years	Yes/No
4. Form C	Banker's certificate regarding tenderers Financial soundness True copies PAN / GSTIN / VAT clearance certificate	Yes/No
5. Form D	Resources / Personnel	Yes/No
6. Form E	Plant/Equipment	Yes/No
7. Form F	Experience Geographical	Yes/No
8. Form G	Additional information	Yes/No
9. Form H	Format for performance record of contractors	Yes/No.
10. Form I	Separate Sheet for each work	Yes/No
11. Form J	AFFIDAVIT	Yes/No
12. Form K	AFFIDAVIT (for out of State contractors) Yes/No	
13. Form L Yes/No	Certificate to be issued by the Superintending Engineer used Whom machineries/ equipments are deployed	
14. Form M	Details of other works tendered for and works in hand on the Date of submission of the tender	Yes/No
15. Form N	Details of similar type and magnitude carried on by the contractor In the past	Yes/No
16. Form O	Format for Evidence of Access to or Availability of Credit Facilities (Bank Certificate)	Yes/No

Signature of Contractor

CONTRACTOR **EXECUTIVE ENGINEER**

BILL OF QUANTITY

For the Work:-

Improvement to Jamunaposi Minor from RD 2511m to 2611m (Construction of Troughwall) for the year 2026-27

Item	Description	Unit	Quantity	Rate in Rs.	Amount
				In figure	In Rs.
1	2	3	4	5	7
1	Excavation of foundation in canal/drain by manual means in hard soil) in both wet & dry condition, trimming of slope & bed to design section including stump removal, shoring, strutting, propping bullahs, pilling, dewatering and removing the excavated materials with all leads and de-lift, etc and depositing the useful excavated materials in the embankment sections in layers not exceeding 22.50 cm. in depth breaking clods to maximum 5 cm to 7cm size and depositing the unsuitable earth in spoil bank or any other specified space with all taxes and cess etc. complete including all cost incidental to work but excluding GST as per specification and direction of Engineer-in-charge.	Cum	190.00	282.90	53,751.00
2	Filling sand in foundation well watered and rammed in layers as per drawing & specification with al with all leads, lifts and de-lifts including cost, conveyance, taxes & royalty of sand, T & P , labour & cess etc. complete including all cost incidental to work but excluding GST as directed by the Engineer-in-charge.	Cum	32.00	850.50	27,216.00

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3	Providing & laying of P.C.C confirming to M-15 grade using hard granite crusher broken aggregate of size 40 mm. & downgraded mixed mechanical means including cost & conveyance of all materials to mixing yard and transportation of mixed concrete for laying on approved surface as per approved drawing, with all lead, lift, de-lift and transportation by manual/mechanical means including cost, conveyance, royalty, taxes of all materials, labour & cess including dewatering by suitable means, vibrating the concrete by mechanical means, hire & running charges of machineries, curing for specified days by suitable means supervision charges including mobilisation and demobilisation with cost of construction and dismantling of gang ways and scaffolding including construction of cofferdam, approach road, diversion road, site illumination etc. complete as per approved drawing with all cost incidental to the work but excluding GST as directed by the Engineer-in-charge.	Cum	32.00	6021.40	192,684.80
4	Providing & laying of PCC/RCC confirming M-20 grade using hard granite crusher broken aggregate of size 20 mm. & downgraded mixed in batching & mixing plant including cost & conveyance of all materials to mixing yard and transportation of mixed concrete for laying on approved surface as per approved drawing, with all lead, lift, de-lift and transportation by manual/mechanical means including cost, conveyance, royalty, taxes of all materials, labour & cess including dewatering by suitable means, vibrating the concrete by mechanical means, hire & running charges of machineries, curing for specified days by suitable means supervision charges including mobilisation and demobilisation with cost of construction and dismantling of gang ways and scaffolding including construction of cofferdam, approach road, diversion road, site illumination etc. complete as per approved drawing with all cost incidental to the work as directed by the Engineer-in-charge.	Cum	80.25	6437.70	516,625.43

CONTRACTOR **EXECUTIVE ENGINEER**

5	Supplying, providing and straightening the coiled or bent up HYSD bars of approved quality confirming to grade as specified, cutting, bending and placing the grills in position and binding the grills in position binding with wire 18 to 20 SWG, lapping, splicing, welding the joints wherever necessary for RCC work as per approved design, drawing with all lead, lift and delift and all cost of materials, labour, T&P, conveyance, taxes of all materials, labour & Cess with cost of mobilization, demobilization, diversion road, approach road, site illumination etc. complete cost with all incidental to the work but excluding GST and as per specification and direction of the Engineer-in-charge.	Qntl.	36.10	7927.10	286,168.31
6	Rigid smooth cantering and shuttering for C.C./R.C.C. work including false works and dismantling the same after specified date of casting and disposal of debris clear of work site including cost, conveyance of all materials along with all taxed, cess the labour charges etc. but excluding GST completed as directed by the Engineer-in-charge.	Sqm	462.00	250.40	115,684.80
7	Providing weep holes in PCC/RCC abutment wing wall, return wall with 100 mm dia AC pipes extending through the full width of the structure with slope of IV :20H towards draining face complete as per approved drawing and technical specification including providing graded back fill for filter zone in rear side removal of clogged materials from weep holes and cost, carriage, Royality, taxes & T&P Labour, cess and supervision charges etc. complete including cost incidental to work but excluding GST as per the direction of Engineer in charge.	Rmt	9.90	193.40	1,914.66
8	Filling in foundation trenches with useable quality of earth available from foundation excavation in layer not exceeding 15 cm thick including watering ramming manually or mechanically fully compacted with all leads, lifts and delift, tools and plants, all taxes, labour, Cess and cost incidental to work but excluding GST as per direction of Engineer-in-charge.	Cum	126.67	157.16	19,907.46
(8	Items) Only		Total		**1,213,952.46**

Rupees Twelve Lakhs Thirteen Thousand Nine Hundred Fifty Two and Paise Forty Six Only

CONTRACTOR **EXECUTIVE ENGINEER**

Executive Engineer
Keonjhar Irrigation Division
Kendujhar

CONTRACTOR **EXECUTIVE ENGINEER**