BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited)

Regd. Officer : Koyla Bhawan

OFFICE OF THE GENERAL MANAGER(CONSTRUCTION)
CIVIL ENGINEERING DEPARTMENT
KOYLA NAGAR (DHANBAD)

1. Name of work : **Construction of W.B.M. Road from Workshop to Coal face at M.O.C.P., Barora Area**

2. Name of contractor :

   Address :

3. **N.I.T. Reference** : Ref. No. **BCCl/CED/TC/NIT-1/2009-10/*234-60***
   Dated 15.04.2009

4. Date of Receipt of tender : Up to **3.00** P.M. on **19.05.2009**

5. Date of open of Tender : At 4.0**0** P.M. on **19.05.2009**

6. Details of E.M.D. : No. Date

7. Money Receipt No. (for issue of tender paper) : No Date

SIGNATURE OF ISSUING OFFICER

PART - I

TECHNO COMMERCIAL BID

(To be submitted with Part-I envelope)

BHARAT COKING COAL LIMITED

(A Subsidiary of Coal India Ltd)

Civil Engineering Department
KOYLA NAGAR
DHANBAD - 826005
JHARKHAND

Phone : 0326-2230338
FAX : 0326-2230165

Ref. No: BCCL/CED/TC/NIT-1/2009-10/***234-60*** Date : 15.04.2009

NOTICE INVITING TENDERS

Sealed tender in two parts (part I & II) are invited from experienced and eligible contractors for the following work/s :-

Job No. 1– Construction of W.B.M. Road from Workshop to Coal face at M.O.C.P., Barora Area.

Estimated cost	Earnest money	Cost of tender paper	Time of completion
Rs.39,33,393.55	Rs.39,400.00	Rs.1000.00	08 (Eight) Months

Job No. 2 – Construction of W.B.M. Road from Mandra to KKC link siding via Feeder Breaker at M.O.C.P. Barora Area

Estimated cost	Earnest money	Cost of tender paper	Time of completion
Rs.21,98,457.55	Rs.22,000.00	Rs.500.00	06 (Six) months

1. Availability of tender documents - Tender documents can be had from the office of the G. M. (Constn.), Civil Engineering Department, HQ., Koyla Nagar, Dhanbad on deposition of requisite cost of tender paper in cash or bank draft of Nationalized bank drawn in favour of Bharat Coking Coal Ltd., payable at Dhanbad during office hours on all working days from **27.04.2009 to 12.05.2009**

2. Receipt and submission of Tender - Sealed tender documents (part I & II), as detailed below ,complete in all respect will be received at C.I.S.F. Post, near Koyla Bhawan gate, Koyla Nagar, BCCL, Dhanbad on **19.05.2009** upto 3.00 P.M. Part-I shall consist of tender document issued to the tenderer and tenderer's credentials, sealed in a envelope superscribing as Part-I. Part-II shall consist of bill of quantity as issued to the tenderers duly filled in for rates, amounts etc. and sealed in a envelope superscribing as Part-II. Similarly the Earnest money deposit is to be submitted in a envelope super scribing as "Earnest Money Deposit", Thereafter all the three envelopes should be submitted in a sealed envelope with appropriate superscription.

3.Opening of Tender - The Part-I of the tenders will be opened at 4.00 P.M. itself in presence of the intending tenderer or their authorized representative in the Office of General Manager (Constn.), Civil Engineering Department, HQ., Koyla Nagar, Dhanbad on **19.05.2009**.

Part-II of the tender will be opened only after acceptance of Part-I.

In the event of the specified date for submission/opening of bids being declared a holiday the bids will be received/opened on the appointed time on the next working day.

4. Eligibility criteria :-

a) The intending tenderer must have in its name as a prime contractor or as a sub-contractor provided there is a sub-contract provision in the original contract awarded to the prime contractor, experience of having successfully completed **similar works** during last 7 (seven) years ending last day of month previous to the one in which bid applications are invited should be either of the following :-

Three similar completed works each costing not less than the amount equal to 40% of the estimated cost. OR
Two similar completed works each costing not less than the amount equal to 50% of the estimated cost. OR
One similar completed work costing not less than the amount equal to 80% of the estimated cost.

Similar work means : Experience in Construction / Repair & maintenance of W.B.M. Road.

b) Average annual financial turnover of civil works during the last 3 (three) years, ending 31st March of the previous financial year, should be at least 30% of the estimated cost.

Intending tenderer must submit documentary evidence in support of (4) (a) & (b) above in the form of certified copy of work order, completion certificate, payment certificates/ vouchers etc. indicating the period of work for which the payment has been made, duly signed by him/them.

P.T.O.

c) The earnest money is to be deposited as per detail given in the tender documents.
d) Attested Sales Tax clearance certificate & TIN No.
e) The tenderers have to submit Permanent Account No. of Income Tax (PAN No.).
5) Conditional tenders will not be accepted.
6) Issuance of tender documents does not mean that the parties are considered qualified.
7) The validity of the tender will be 120 days from the date of opening price bid or revised price bid if any.
8) The management of BCCL reserves right to reject any or all tender or split the work among two or more tenderers with out assigning any reasons whatsoever.
9) For more please see detailed tender notice/tender documents/website - http://bccl.cmpdi.co.in.
10) In case of down loaded tender documents :-

i) Tenderers are required to deposit along with their tender, a Bank Draft of any Nationalized / Schedule Commercial Bank payable at Dhanbad exclusively towards the cost of Tender Document for the amount indicated as above, in a separate envelope. Bank Draft, prepared after the scheduled closure of sale of Tender Documents are liable for rejection.

ii) The contents of the Tender Documents available in our offices, shall be deemed as authentic .The bidder will be required to submit an undertaking that they will accept the tender document as available in the web-site and their tender shall be rejected if any tempering is there in the tender document thus submitted.

Dy. Chief Engineer(C)TC

Copy to :-

1) All CGMs/GMs/of Areas of BCCL.
2) CGM(Admn), BCCL, Koyla Nagar.
3) G.M.(Constn.), CED, Koyla Nagar.
4) GM(System), BCCL for logging of detailed N.I.T. on Website on or before **27.04.2009**.
5) C.V.O., Koyla Bhawan.BCCL.
6) Dy. Chief Engineer (Civil)TC, CED, Koyla Nagar.
7) Dy. Chief Engineer(Civil), BTA.
8) F.M.(Civil), CED, BCCL,
9) Inspector I/C, CISF, Koyla Bhawan.
10) Builders Association of India, Central Akashkinaree Kanta, Katras Garh, Dhanbad-828113.
11) PRO, BCCL – with 10 copies for wide publication of the following abridge NIT in News Paper as per BCCL norms on or before **27.04 .2009** as well as display in Website.

Tenders for the following work/works are invited by Civil Engineering Deptt., BCCL, Koyla Bhawan on behalf of BCCL Management.

Job No. 1– Construction of W.B.M. Road from Workshop to Coal face at M.O.C.P., Barora Area.

Estimated cost	Earnest money	Cost of tender paper	Time of completion
Rs.39,33,393.55	Rs.39,400.00	Rs.1000.00	08 (Eight) Months

Job No. 2 – Construction of W.B.M. Road from Mandra to KKC link siding via Feeder Breaker at MOCP. Barora Area

Estimated cost	Earnest money	Cost of tender paper	Time of completion
Rs.21,98,457.55	Rs.22,000.00	Rs.500.00	06 (Six) months

All other details i.e. Estimated cost of work, Completion period, Cost of E.M.D. etc. can be seen on Company's Website **www.cmpdil.co.in**

The Sale period for tender documents : **from 27.04.2009 to 12.05.2009**.

Date of receipt & opening of tender on : **19.05.2009 by 3.00 P.M. & at 4.00 P.M. respectively**.

12) Notice Board.

MOCP Road/

GENERAL INSTRUCTIONS AND ELIGIBILITY CRITERIA

SPECIAL TERMS AND CONDITIONS

1. The contractor shall make his own arrangement for obtaining transporting & storing of construction materials at site.

2. Possession of following mechanical/construction equipment required for the work as owner or in any other capacity (such as hire or lease arrangement) ensuring full control over such equipment/machinery.

Sl No.	Description	Unit	Quantity
1	Hot Mix Plant	No.	1
2	8 Cum Tippers	No.	1
3	Road Roller	Nos.	1

Any other tools required for construction work shall be responsibility of contractor at his own cost. Also proper storage for construction equipment at site is to be done by the contractors. These equipment can not be removed from site without prior approval of Engineer-in-charge.

3. All works shall be executed in accordance with the relevant rules/CPWD/IRC/MORT&H specifications/code of practice.

4. All construction materials (confirming to I.S.) shall be arranged by the contractor at his own cost.

5. Sample for assessing the quality of materials and works as per description of Engineer-in-charge & I.S. norms shall be arranged by the contractor. All charges towards these tests shall be borne by the contractor.

6. Technical specifications pertaining to following equipment to be furnished by the tenderers.

   a) Hot mix plant.
   b) 8 Cum Tippers.
   c) Road Roller/Compactor.

DETAILED TENDER NOTICE

1. Sealed tenders in prescribed forms and parts with the name of works superscribed as _____as per NIT_____ N.I.T. Ref. No._____as per NIT_____on each of the envelopes are invited from bonafide and experienced contractors and will be received at _____as per NIT_____ **Dhanbad upto 3.00 P.M. on as per NIT**_____. All tenders will be opened at **4.00 P.M.** on ___as per NIT___ in the presence of the intending tenderers or their authorised representatives who wish to be present .In case where the tender is in two parts, only Part-I, will be opened on the above day and time.

2 (a) Tenders should be submitted in the prescribed form in time. These forms together with the proposed contract document including specifications and tender drawings (if available) may be obtained from the above office during normal working hours on payment of **Rs.**_____**as per NIT**_____ (non-refundable) **(Rupees** _____as per NIT_____only **)** as Application Fee for each set. The payment may be made either in Cash or by Bank Draft drawn in favour of Bharat Coking Coal Ltd. on Nationalized Bank payable at .Dhanbad. General specification and description of work is enclosed with the tender document.

2 (b) ***Any Bids received after the deadline prescribed at Clause 1 above due to any reasons what soever will not be accepted.*** **In the event of the specified date for the submission of bids being declared a holiday by the employer, the bids will be received up to the appointed time on the next working day.**

2 (c) Tenders thus submitted shall consist of the following:

i) Complete set of tender documents as sold, duly filled in and signed on all pages and at different places as required of the tender documents including Part I & Part II of the tenders as per the tender notice as applicable.

ii) Sales-tax clearance certificate copy attested by a Gazetted Officer of the Govt. (Central or State)&TIN No.

iii). PAN (Permanent I. Tax Account Number)

iii) Earnest money deposit (as specified hereafter)

iv) Power of Attorney in the case the tender is signed by an authorised representative of the tenderer.

v) Full name and address of the tenderer shall be written on the bottom left hand corner of the sealed covers.

vi) Every Tenderer will have to submit a declaration in support of the authenticity of the credentials submitted by him along with the Tender in the form of an AFFIDAVIT as per the format provided at ANNEXURE VI.

2 (d) The tender document in which the tender is submitted by the tenderer shall become the property of the Company and the Company shall have no obligation to return the same to the tenderer.

2 (e) The Tender shall be submitted,

EITHER

* in Two Envelope System with the first envelope containing credentials (duly authenticated by the bidder) in support of his qualifications in accordance with the eligibility criteria along with the EMD in a separate envelope and the original tender document issued to the bidder duly signed by authorized signatory of the bidder on all pages as proof of accepting the conditions of the contract (excluding the price bid) and the second envelope comprising of priced bill of quantities superscribing Envelope I , II and EMD on the cover.

OR

* in two parts as indicated in the Notice Inviting Tenders. Part-I shall consist of any deviations from terms & conditions of the tender and additional terms & conditions and if asked for, technical bid and credentials (documentary evidence in support of eligibility criteria and bid assessment duly authenticated by the bidder) and the original tender document issued to the bidder duly signed by authorized signatory of the bidder on all pages as proof of accepting the conditions of contract (excluding the price bid).

Part II shall consist of tender documents as sold to the tenderers duly filling in rates, amounts etc. i.e. price bid.

The Earnest Money Deposit is to be submitted in a separate Envelope altogether; super-scribing “Earnest Money Deposit"; and not inside the envelope containing Part I or part II of the Bid.

The bidders, who will download the tender documents from the website of the company, will be required to pay the cost of tender documents (Application Fee) by Bank Draft as per NIT at the time of submission of tenders.

The bidders will be required to submit an undertaking that they will accept the tender documents as available in the website and their tender shall be rejected if any tampering in the tender document is found to be done at the time of opening of tender.

The Bank Draft towards the cost of tender documents (Application Fee) and the undertaking of the tenderer as above shall be submitted in a separate envelope marked “Cost of Tender Documents and the Undertaking” and not with Part-I/ EMD.

In case of any discrepancy between the tender documents downloaded from the web site and the master copy available in the office, the latter shall prevail and will be binding on the tenderers. No claim on this account will be entertained.

The Part I & Part II should also be put into separate sealed envelopes superscribed as such. Thereafter all the three envelopes (four envelopes in case of Bidders using downloaded Bid document) should be submitted in a sealed envelope with appropriate superscription.

The date of opening of the Second Envelope or Part II of the tenders shall be communicated in due course after consideration of First Envelope or Part-I.

(* STRIKE OUT WHICHEVER IS NOT APPLICABLE AS PER THE ESTIMATED VALUE OF THE WORK)

2 (f) Each bidder shall submit only one bid for one package. A bidder who submits or participates in more than one bid (other than as sub-contractor or in case of alternatives that have been permitted or requested) will cause all the proposals with the bidders’ participation to be disqualified.

3. Earnest Money/ Bid Security @1% of the estimated cost (rounded of to nearest hundred rupees subject to maximum of Rs. 50 lakhs) is to be deposited in the form of irrevocable Bank Guarantee (from Scheduled Bank/ Branch acceptable to the owner) with validity 28 days beyond the validity of the Bid in the format given in the Bid Document in a separate envelope alongwith the tender. Certified Cheques and Demand Drafts will also be acceptable as Earnest Money/ Bid Security drawn in favour of Bharat Coking Coal Limited on any scheduled Bank payable at its branch at Dhanbad. For works valued upto Rs. 5 lakhs the earnest money may be deposited in cash or in the aforesaid form. In case of earnest money deposit by cash, cash receipt is to be submitted in a separate envelope alongwith the tender. Earnest Money/ Bid Security of the unsuccessful bidder shall be refunded as promptly as possible after opening of Price Bid and finalisation of the tender and shall bear no interest.

4. No tender shall be considered unless accompanied by the said Earnest Money.

5. The earnest money will be retained in the case of successful tenderer and refunded to the unsuccessful tenderer in due course and will not carry any interest. The unsuccessful bidder for this purpose means the bidder who have not qualified for opening of Part-II (Price Bid) and those who have not emerged as L-1 tenderer after opening of price bid. The earnest money deposited by the successful tenderer will be dealt with as provided elsewhere in the tender documents.

6 (a) Site Investigation Report: The contractor, in preparing the bid, shall rely on the site investigation report referred to in the bid document, supplemented by any information available to the bidder.

6 (b). Every tenderer is expected, before quoting his rates, to go through the requirements of materials/workmanship under specification/requirements and conditions of contract and to inspect the site/area of the proposed work.

In case of item rate tender a schedule of quantities is enclosed with the tender document. He should quote specific rate for each item in the schedule and the rates shall be in rupees and paise. The rates shall be written both in words and figures and the unit in the words and the amount against each item totaled. In the event of any discrepancy between the description in words and figures, the description in words will prevail. The rates for the work should be inclusive of all incidentals, overheads, all taxes, Octroi's, duties, leads, lifts, carriage, tools & plant etc. as required for execution and completion of the work. It shall be deemed that the tenderer has visited the site/area and got fully acquainted with the working conditions and other prevalent conditions and fluctuations thereto whether they actually visited the site/area or not and have taken all the above factors into account while quoting his rates.

7 (a) Corrections where unavoidable, shall be made by crossing out and rewriting duly authenticated with full signature and date by the tenderer. Erasing or over-writing in the tender documents may disqualify the tender.

7 (b) The tender shall be submitted either in English or in Hindi.

7 (c) Cost of Bidding: The bidder shall bear all costs associated with the preparation and submission of his bid and the Employer will in no case be responsible and liable for those cost

8. The tenderer shall closely study all specification in detail, which govern the rates for which he is tendering.

9. Sales-tax clearance certificate for the last financial year or the last assessment whichever is later or proof of filing the returns for the previous financial year should accompany the tender.

10. The work should be completed within _____as per NIT_____ from expiry of ten (10) days from the issue of letter of acceptance of tender/work order or handing over the site or handing over reasonable number of working drawings to the contractor or the period of mobilisation allowed in the work order for starting the work in special circumstances, whichever is latest.

11. On completion of the work all rubbish, debris, brick bats etc. shall be removed by the contractor(s) at his/their own expense and the site cleaned and handed over to the company and he/they shall intimate officially of having completed the work as per contract.

12. The Company does not bind itself to accept the lowest tender and reserves the right to reject any or all the tenders without assigning any reasons whatsoever and to split up the work between two or more tenderers or accept the tender in part and not in its entirety.

13. The tenderer(s) will indicate the equipment/machinery/ vehicles he/they is/are going to use on this job and also give adequate evidence of experience in doing similar works and financial capacity to complete the work in time.

14. The tenderer(s) should also state what technical/ supervisory personal he/they would be employing for supervising the work.

14 (a). Full information should be given by the tenderer in respect of following:

i) If an individual:	Full name. Postal Address. Place of Business.
ii) If proprietary firm:	Name of the Proprietor. Full postal address of Firm/ Proprietors.
iii) If partnership firm:	Full name of partners. Full postal addresses of the registered office of firm & the partners. Registered partnership Deed.
iv) In case of Company:	Date and place of registration. Memorandum & Articles of Association. Name of all the Directors. Full postal address of the registered office & all Directors.
v) Joint Venture	Two or three companies/ contractors participating in the tender as Joint Venture should submit Firm-wise participation details, Banker's name, execution of work with details of contribution of each and all other relevant details.

<u>Notes:</u> Joint ventures must comply the following requirements:

i) Following are the minimum qualification requirements for joint ventures:
a) The qualifying criteria parameter i.e. experience, financial resources etc. of the individual partners of the J.V. will be added together and the total criteria should not be less than as spett out in qualification criteria.

ii) The formation of joint venture or change in the joint venture character/ partners after submission of the bid and any change in the bidding regarding joint venture will not be permitted.

iii) Any bid shall be signed so as to legally bind all partners jointly and severally and any bid shall be submitted with a copy of the Joint Venture Agreement (JV Agreement) providing the joint and several liabilities with respect to the contract.

iv) The pre-qualification of a joint venture does not necessarily pre-qualify any of its partners individually or as a partner in any other joint venture or association. In case of dissolution of a joint venture, each one of the constituent firms may pre-qualify if they meet all the pre-qualification requirements, subject to written approval of the employer.

v) The bid submission must include documentary evidence to the relationship between joint venture partners in the form of JV Agreement to legally bind all partners jointly and severally for the proposed agreement which should set out the principles for the constitution, operation, responsibilities regarding work and financial arrangements, participation (percentage share in the total) and liabilities (joint and several) in respect of each and all of the firms in the joint venture. Such JV Agreement must evidence the commitment of the parties to bid for the facilities applied for (if pre-qualified) and to execute the contract for the facilities if their bid is successful.

vi) One of the partners responsible for performing a key component of the contract shall be designated as Lead Partner. This authorization shall be evidenced by submitting with the bid a Power of Attorney signed by legally authorized signatories of all the partners.

vii) The JV Agreement must provide that the Lead Partner shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the Joint Venture and the entire execution of the contract shall be done with active participation of the Lead Partner.

viii) The contract agreement should be signed jointly by each Joint Venture Partners.

ix) An entity can be a partner in only one Joint Venture. Bid submitted by Joint Ventures including the same entity as partner will be rejected.

x) The J. V. agreement may specify the share of each individual partner for the purpose of execution of this contract. This is required only for the sole purpose of apportioning bid the value of the contract to that extend to individual partner for subsequent submission in other bids if the intends to do so for the purpose of the qualifications in that tender.

14(b) Change in Constitution of the Contracting Agency:

Prior approval in writing of the company shall be obtained before any change is made in the constitution of the contracting agency, otherwise it will be treated as a breach of Contract.

15. Canvassing in connection with the tenders in any shape or form is strictly prohibited and tenders submitted by such tenderers who resort to canvassing shall be liable for rejection.

16 (a) Every Tenderer will have to submit a declaration in support of the authenticity of the credentials submitted by him along with the Tender in the form of an AFFIDAVIT as per the format provided at ANNEXURE VI.

16 (b) If a Tenderer deliberately provides wrong information or submits false credentials in support of his qualifications, the Company reserves the right to terminate/rescind the contract, forfeit the EMD and other dues of the contractor and to take any other action as may be deemed fit.*

*** (STRIKE OUT WHICHEVER IS NOT APPLICABLE**)

17 (a) An intending tenderer, after obtaining tender documents on payment of Application Fee, having doubts as to the meaning of any part of the tender documents may submit to the official inviting tender a written request for interpretation or clarification thereof. Any interpretation or clarification of the tender documents by formal addendum if issued by the official inviting tender, shall be final and valid and binding on the company and the tenderers.

17(b) A pre-bid meeting may be held (if the subsidiary company feels it necessary) on …….. at…… Hrs at the Office of the ……..….. to clarify the issues and to answer questions on any matter that may be raised at that stage.
(Pre-bid meeting will be held for turnkey civil works only.).

18. Tender Evaluation & Bid Assessment:

The Tenders received will be scrutinised and evaluated by a duly constituted Tender Committee.

The Tender Committee will examine the Comparative Statements prepared by the concerned technical department and will satisfy itself that all aspects/conditions of each offer has been properly evaluated with respect to financial implications etc.

Tenders received without Earnest Money will be rejected.

The deviations from the commercial terms & conditions & the Tender specifications are scrutinised before opening of price bids. Normally no deviations in the commercial terms & conditions will be accepted.

However, the Tender Committee may decide to scrutinise the different conditions given by the tenderers and formulate and freeze the acceptable conditions and intimate all the tenderers about the same and give them an opportunity to revise their price bid if necessary before opening the same.

The Price Bids are opened at the time and place fixed for the same in presence of the tenderers & committee members and due information for opening of Price Bid is to be given to all concerned. In case where the tenderes are given opportunity to revise their Price Bids, only the revised price bids are opened and the original Price Bids are to be kept in tact in the custody of the company.

The Price Bids of the tenderers will have no condition. The Price Bids which are incomplete & not submitted as per instructions given in the Tender Document will be rejected.

Bidders who meet the minimum qualifications criteria will be qualified only if their available bid capacity is more than the updated estimated value. The available bid capacity will be calculated as under:

Assessed Available Bid capacity= (A x N x 2 - B)

where,

A= Maximum value of Civil Engineering Works executed in any one year during the last five years (updated to present level @ 5% per calendar year) taking into account the completed as well as works in progress.

N= Number of years prescribed for completion of the works for which bids are invited.

B= Value at present price level, of existing commitments and on going works to be completed during the next .....months (period of completion of works for which bids are invited)

Financial turn over and cost of completed works of previous works shall be given a weightage of 5% per year (average annual rate of inflation) to bring them at current price level, while evaluating the **qualification requirement and bid assessment of the bidders.**

Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they made misleading or false representation in the forms, statement and attachment submitted in proof of qualifying requirement.

Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.:

1 (A) Existing commitments and on going works.

Description of work	Place & State	Contract No.& Date	Name and address of Employer	Value of Contract (Rs.lakh)	Stipulated period of completion	Value of works remaining to be completed	Anticipated date of completion
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1 (B) Works for which bids already submitted.

Description of work	Place & State	Estimated value of works (Rs.lakhs)	Stipulated period of completion	Date when decision is expected	Remarks if any
(1)	(2)	(3)	(4)	(5)	(6)

2. Works performed as prime contractor (In the same name) on works of a similar nature over the last seven years **

Project Name	Name of employer	Description of work	Contract No.	Value of contract (Rs.lakh)	Date of issue of work order	Stipulated period of completion	Actual date of completion	Remarks explaining reasons for delay and work completed

3. Quantities of work executed as prime contractor (in the same name and style) in the last seven years:**

(Table given below is a typical example & the contents may vary depending upon the nature & scope of work)

Year	Name of the work	Quantity of work performed(cum)			Remarks (indicate contract ref.)
		Cement concrete (Including RCC & PCC)	Masonry	Earth Work	
19… - 20…. 20… - 20…. 20… - 20…. 20… - 20…. 20… - 20….					

1. *Enclose a certificate(s) from Engineer(s)-in-charge.*
2. *Immediately preceding the financial year in which bids are received.*

(THE SYSTEM OF DETERMINATION OF BID ASSESSMENT CAPACITY AS ABOVE WILL BE USED ONLY IN CASE OF WORKS OF ESTIMATED VALUE OF OVER Rs. 1 CRORE.)

No document presented by the bidder after the closing date & time of the bid will be taken into account unless it is of purely technical nature which has no bearing financially on the contract & which does not seek major changes in the technical specifications given in the bid documents. If a bidder offers a rebate unilaterally after the closing date & time of the bid, it will not be taken into account for evaluating purposes by the Tender Committee, but if that bidder emerges as the lowest evaluated, the rebate offered will be taken into account for determination of the total offer.

If the bid of the successful bidder is seriously unbalanced in relation to the estimate of the cost of work to be performed under the contract, the company may require the bidder to produce detailed price analysis for any or all items of the Bill of quantities to demonstrate the internal consistency of these prices with the construction method and the schedule proposed. After evaluation of the price analysis, the company may require that the amount of the performance security/security deposit is increased at the expense of the successful bidder to a level sufficient to protect the company against financial loss in the event of default on the part of the successful bidder under the contract.

19. Negotiations:

Work will be awarded to the lowest bidder (L1) without post tender negotiations if the rates are reasonable.

20. Banned or delisted Contractors:

The bidders would give a declaration that they have not been banned or delisted by any Govt. or Quasi Govt. agencies or PSU's. If a bidder has been banned or delisted by any Govt. or Quasi Govt. agencies or PSU's this fact must be clearly stated and it may not necessarily be a cause for disqualification. If the declaration is not given, the bid will be rejected as non-responsive.

21. On receipt of letter for acceptance of the tender issued by the Company, the successful tenderer shall execute/accept contract agreement/work order in the company's prescribed form for the due fulfillment of the contract. Failure to enter into the required contract/accept the work order issued by the company within the specified period in the work order shall entail cancellation of letter of acceptance of tender/work order and forfeiture of the earnest money. The written contract/ work order to be entered into between the contractor and the company shall be the foundation of the rights of both the parties and the contract shall not be deemed to be executed until the contract/ work order is signed/ accepted by both the parties i.e. Contractor and the Company.

22(a) The validity period of the tenders shall be 4 (four) months from the date of opening of price bid or revised price bid, if any.

The tenderer shall not, during the said period or within the period extended by mutual consent, revoke or cancel his tender or alter the tender or any terms/conditions thereof without consent in writing of the company. In case the tenderer violates to abide by this, the Company will be entitled to forfeit the Earnest Money and reject the tender.

22 (b) The Company reserves the right to postpone the date of receipt and opening of tenders or to cancel the tenders without assigning any reason whatsoever.

23. The Company reserves its right to allow Public Enterprises purchase preference facility as admissible under prevailing policy.

24. This detailed Tender Notice shall be deemed to be part of the Contract Agreement/Work Order.

25. No subletting of work as a whole by the contractor is permissible. Subletting of work in piece rated jobs is permissible with the prior approval of the department.

The Contract Agreement will specify major items of supply or services for which the contractor proposes to engage sub-contractor/sub-vendor. The contractor may from time to time propose any addition or deletion from any such list and will submit proposals in this regard to the Engineer-in -Charge/Designated Officer in charge for approval well in advance so as not to impede the progress of work. Such approval of the Engineer in Charge / Designated Officer in Charge will not relieve the contractor from any of his obligations, duties and responsibilities under the contract.

26. In case the contractor enters into any litigation, such action should have to be taken in a court of law with jurisdiction over the place where the subject work is to be executed.

GENERAL TERMS AND CONDITIONS

1. Definitions

i) **"Employer"** or "Company" means the Coal India Limited or any of its subsidiaries who will employ the contractor represented by the appropriate authority.

ii) **"Principal Employer"** means the Coal India Limited or any of its subsidiaries or the officer nominated by the Company to function on its behalf.

iii) The word **"Contractor/ Contractors"** wherever occurs means the successful tenderer/ tenderers who has/have deposited the necessary Earnest money and has/have been given written intimation about the acceptance of tender and shall include legal representative of such individual or persons composing a firm or a company or the successors and permitted assignees of such individual, firm or Company, as the case may be.

iv) **"Site"** means the land and places including any building and erection thereon, over, under, in or through which the Permanent works or Temporary works designed by the Engineer in Charge are to be executed and any other lands and places provided by the Employer for working space or any other purpose as may be specifically designated in the Contract as forming part of the site.

v) The term **"Sub-Contractor"** as employed herein, includes those having a direct contract with Contractor either on piece rate, item rate, time rate or any other basis and it includes one who furnishes work to a special design according to the plans or specifications of this work but does not include one who merely supplies materials.

vi) **"Accepting Authority"** shall mean the management of the company and includes an authorized representative of the company or any other person or body of persons empowered in this behalf by the company.

vii) **"Engineer-in-charge"** shall mean the officer nominated by the company in the Civil Engineering cadre/ discipline who is competent to direct supervisors and authorised to be in charge of the works for the purpose of this contract. The Engineer in Charge /Designated Officer in Charge who is of an appropriate seniority, will be responsible for supervising and administering the contract, certifying payments due to the contractor, valuing variations to the contract, awarding extension of time and valuing compensation events. The Engineer in Charge /Designated Officer in Charge may further appoint his representatives i.e. another person/Project Manager or any other competent person and notify to the contractor who is directly responsible for supervising the work being executed at the site, on his behalf under their Delegation of Powers of the company. However, overall responsibility, as far as the contract is concerned ,will be that of the Engineer in Charge/Designated Officer in Charge.

viii) The **"Contract"** shall mean the notice inviting tender, the tender as accepted by the Company, the work order issued to the contractor, and the formal contract agreement executed between the company and the contractor together with the documents referred to therein including general terms and conditions, special conditions, if any, scope of work, frozen terms & conditions/technical parameters/scope of work and revised offer, if any, specifications, drawings, including those to be submitted during progress of work, schedule of quantities with rates and amounts.

ix) A **"Day"** shall mean a day of 24 hours from midnight to midnight.

x) The **"Work"** shall mean the works required to be executed in accordance with the contract/work order or parts thereof as the case may be and shall include all extra or additional, altered or substituted works or any work of emergent nature, which in the opinion of the Engineer-in-charge, become necessary during the progress of the works to obviate any risk or accident or failure or become necessary for security.

xi) **"Schedule of Rates"** referred to in this conditions shall mean the standard schedule of rates prescribed by the company and the amendments issued from time to time.

xii) **"Contract amount"** shall mean:

a) in the case of turnkey contracts the total sum for which tender is accepted by the company.

b) in the case of other types of contracts the total sum arrived at based on the individual rates quoted by the tenderer for the various items shown in the "Schedule of Quantities" of the tender document as accepted by the Company with or without any alteration as the case may be.

xiii) **"Written notice"** shall mean a notice or communication in writing and shall be deemed to have been duly served if delivered in persons to the individual or to a member of the contractors firm or to an office of the company for whom it is intended, or if delivered at or sent by registered mail to the last business address known to him who gives the notice.

xiv) **"The constructional plant"** means all appliances, tools, plants or machinery or whatsoever nature required in or about the execution, completion or maintenance of the works but does not include materials or other things intended to form part of the permanent work.

xv) **"Letter of Acceptance of Tender"** means letter giving intimation to the tenderer that his tender has been accepted in accordance with the provisions contained in that letter.

xvi) **"Department"** means the Civil Engineering Department of Coal India Limited or any of its subsidiary companies/units represented by the appropriate authority.

xvii) **"Act of insolvency"** means as it is designed by Presidency Town Insolvency Act or Provincial Insolvency Act or any act amending such originals.

xviii) The words indicating the singular only also include the plural and vice-versa where the context so requires.

2. Contract Documents:

The following documents shall constitute the contract documents :

i) Notice Inviting Tender/Detailed Tender Notice.
ii) Articles of Agreement / Letter of Acceptance of Tender/ Work Order.
iii) General Terms & Conditions of contract/ Commercial Terms & Conditions of contract.
iv) Additional Terms & Conditions of contract, if any.
v) Specifications.
vi) Schedule of quantities (or Bill of Quantities)/ Schedule of work/ Scope of work and schedule of deviation *(to be provided by the contractor.)*
vii) Frozen terms & conditions / technical parameters/ scope of work and revised offer, if any.
viii) Contract drawings and work programme.
ix) Safety Code etc. forming part of the tender.

N.B. Deviations: Deviations sought by the bidders, whether they are technical or commercial deviations, must only be given in the schedules prescribed for them. Any willful attempt by the bidders to camouflage the deviations by giving them in the covering letter or in any other documents than the prescribed schedules may render the bid itself as non-responsive.

2.1 The contractor shall enter into and execute contract agreement in the prescribed form (ref. format at ANNEXURE VII). The cost of the stamp papers for the contract agreement shall be borne by the contractor. Two sets of contract document/agreements shall be prepared and signed by both the parties One of the sets shall be stamped "Original" and the other "Duplicate". The duplicate copy will be supplied to the contractor free of cost and the original is to be retained by the company. For any additional copies required by the contractors the price to be charged would be that of the cost of the Tender Document (Application Fee).

All additional copies should be certified by the Engineer in Charge.

The contractor shall keep copy of these documents on the site/place of work in proper manner so that these are available for inspection at all reasonable times by the Engineer-in-charge, his representatives or any other officials authorised by the company for the purpose.

2.2 The contract document shall not be used by the contractor for any purpose other than this contract and the contractor shall ensure that all persons employed for this contract strictly adhere to this and maintain secrecy, as required of such documents.

2.3 Tender Evaluation & Bid Assessment
[Refer clause 18 of Detailed Tender Notice]

2.4. Abnormally High Rate (AHR) & Abnormally Low Rate (ALR) Items.

Abnormally High Rates & Abnormally Low Rates, if quoted by the contractor, in item rate tenders will be identified & dealt with as under:

i) For identification of AHR & ALR items the ceiling of +/- 20% respectively, when compared with the updated estimated rate ,will be considered.

ii) Variation in Quantity on quoted rate during execution for AHR & ALR items shall be permitted upto +/-25%(+25% for AHR & -25% for ALR) of the quantity provided for items of work below plinth level & +/- 5% of the quantity provided for items of work above plinth level respectively.

iii) Quantity variation beyond the limit mentioned at ii) above shall be dealt by arriving at new rate based on prevalent market rates of materials & labour analysed as per standard analysis of rate of N.B.O./ C.P.W.D. Payment of extra quantity over the permitted quantity of +/-25% and +/-5%(as the case may be) would be made on the basis of the new analysed rate.

iv) For identified abnormally low rate (ALR) items, the contractor will be required to deposit with the company the difference in amount calculated between the departmental justified rate multiplied by the quantity of a particular ALR item and the ALR rate quoted by the contractor multiplied by the quantity of the same item.

The total amount to be deposited will be the sum total of all the identified ALR items calculated as per the method outlined above.

The amount so retained will be refunded on successful completion of individual ALR items of work.

2.5 Negotiations:
[Refer clause 19 of Detailed Tender Notice]

2.6 Acceptance of Offer :

Letter of Acceptance is an acceptance of offer by the company and it need not be accepted by the tenderer. But the tenderer should acknowledge the receipt of the order within 15 days of mailing of work order and any delay in acknowledging the receipt will be treated as a breach of contract and compensation for the loss caused by such breach will be declared by the company by forfeiting EMD .

2.7 Banned or delisted Contractors: ***[Refer clause 20 of Detailed Tender Notice]***

3. Discrepancies in contract documents & Adjustments thereof

The documents forming part of the contract are to be treated as mutually explanatory of one another and in case of discrepancy between schedule of quantity, the specifications and/or drawing, the following order of preference shall be observed;

a) Description in Bill of Quantities of work.
b) Particular specification and special conditions, if any
c) Drawings.
d) General specifications.

3.1 In the event of varying or conflicting provision in any of the document(s) forming part of the contract, the Accepting Authority's decision/clarification shall hold good with regard to the intention of the document or contract as the case may be.

3.2 Any error in description, quantity or rate in Bill of Quantities or any omission there from, shall not vitiate the contract or release the contractor from discharging his obligations under the contract including execution of work according to the Drawings and Specifications forming part of the particular contract document.

3.3 Any difference detected in the tender/ tenders submitted resulting from :

a) discrepancy between description in words and figures, the rate which corresponds to the amount worked out by the contractor shall be taken as correct.
b) discrepancy in the amount quoted by the contractor due to calculation mistake of the unit rate and quantity, the unit rate shall be regarded as firm and amount corrected.
c) when the amount of an item is not worked out by the contractor or it does not correspond with the rates written either in figures or words, then the rates quoted by the Contractor in words shall be taken as correct.
d) in the case of percentage rate tender, the Contractors are required to quote their rates both in amount as well as in the percentage below/above the rates entered in the Schedule. In such cases in the event of Arithmetical error committed in amount by the contractor, the tender percentage and not the amount should be taken into account.
e) discrepancy in totaling or carry forward in the amount quoted by the contractor shall be corrected.

The tendered sum so corrected and altered shall be substituted for the sum originally tendered and considered for acceptance instead of the original sum quoted by the tenderer alongwith other tender/tenders. Rounding off to the nearest rupee should be done in the final summary of the amount instead of in totals of various sections of the offer.

4. Security Deposit:

4.1.1 Security Deposit shall consist of two parts;

a) Performance Security to be submitted at award of work and
b) Retention Money to be recovered from running bills.

The security deposit shall bear no interest.

4.1.2 Performance Security should be 5% of contract amount and should be submitted within 28 days of receipt of LOA by the successful bidders in any of the form given below

- a Bank Guarantee in the form given in the bid document
- Govt. Securities, FDR or any other form of deposit stipulated by the owner
- Demand Draft drawn in favour of ……. Coalfields Ltd on any Scheduled Bank payable at its Branch at……..

The Earnest Money/ Bid Security deposited in the form of Bank Guarantee shall be discharged when the Bidder has signed the Agreement and furnished the required Performance Security/ Security Deposit. The bid security deposited in the form of Demand draft/ cash shall be adjusted against the security deposit.

If performance security is provided by the successful bidders in the form of bank guarantee it shall be issued either -
(a) at Bidder's option by a nationalized/ Scheduled Indian Bank or
(b) by a foreign bank located in India and acceptable to the employer.
(c) the validity of the Bank Guarantee shall be for a period of one year or ninety days beyond the period of contract, whichever is more.

Failure of the successful bidder to comply with the requirement as above shall constitute sufficient ground for cancellation of the award of work and forfeiture of the bid security.

4.2..1 All running on account bills shall be paid at 95% (ninety five percent) of work value. This 5% (five percent) deduction towards Retention Money will be the second part of security deposit.

4.2.2 . 5% Performance Security should be refunded within 14 days of the issue of defect liability certificate (taking over certificate with a list of defects). Retention Money should be refunded after issue of No Defect Certificate. Retention Money should be deducted at 5% from running bills.

4.3 The Bank Guarantee towards security deposit shall be acceptable only for values above Rs.50, 000/- and the Bank Guarantee shall also be valid for a minimum period of one year or ninety days beyond the period of contract, whichever is more.. Bank Guarantee is to be submitted in the format prescribed by the company. Bank Guarantee shall be irrevocable and will be from amongst the list of Banks (Scheduled Banks) provided in the bid document.

4.4 The Company shall be at liberty to deduct/appropriate from the security deposit such sums as are due and payable by the contractor to the company as may be determined in terms of the contract, and the amount appropriated from the security deposit shall have to be restored by further deduction from the contractors subsequent on account running bills, if any.

The refund of security deposit shall be subject to company's right to deduct/ appropriate its due against the contractor under this contract or under any other contract.

4.5 On completion of the entire work and issue of defect liability certificate (taking over certificate with a list of defects) by the Engineer-in-charge, one half of the security deposit remaining with the company shall be refunded. The other half shall be refunded to the contractor after issue of No Defect Certificate by the Engineer-in-Charge. on the expiry of Defect Liability Period of six months , subject to the following conditions:

a) Any defect/defects in the work, if detected after issue of defect liability certificate is/are rectified to the satisfaction of the Engineer-in-Charge within the said period.
b) In the case of building work or other work of similar nature, the refund shall be made on the expiry of the said six months period or at the end of one full monsoon period i.e. June to September, whichever is later in point of time and any defects such as leakages in roof, effloresces in walls, dampness, defects in drainage etc. should be rectified to the satisfaction of Engineer-in-Charge.

5. Deviations/Variations in Quantities and Pricing

The quantities given in the "Schedule of Quantities" are based on estimates and are meant to indicate the extent of the work and to provide a uniform basis for tendering and any variation either by addition or omission shall not vitiate the contract.

5.1 The company through its Engineer In Charge or his representative shall, without radically changing the original scope and nature of the work, under contract, have power to make any alterations in or additions to or

substitution of the original specifications, drawings, designs and instructions that may appear to be necessary or advisable during the progress of the work.

The contractor shall be bound to carry out the works in accordance with the instructions given to him in writing by the Engineer In Charge or his representative on behalf of the company. Such altered or additional or substituted work, which shall form part of the original contract, shall be carried out by the contractor on the same terms and conditions in all respects on which they agreed to do the main work and at the same rate/rates as are specified in the contract/ work-order.

5.2 The right is reserved to cancel any items of work included in the contract agreement or portion thereof in any stage of execution if found necessary to the work and such omission shall not be a waiver of any condition of the contract nor invalidate any of the provisions thereof.

5.3 If the additional, altered or substituted work includes any class of work for which rate/rates is/are not specified in the contract/work order, rates for such items shall be determined by the Engineer In Charge as follows:

a) In the case of percentage tenders, if the rate for the item of work executed is available in the company's approved SOR, it will be paid at the schedule rate plus or minus the accepted percentage as per contract,

b) In case of item rate tenders, the rate for extra item shall be derived from the rate for similar item or near similar item of work available in the agreement schedule of work or by analysis of rates as at (c) below and the lower rate out of the above two shall be considered.

c) In case the rate for extra item is to be derived by analysis of rate, the same shall be done by analysis on prevalent market rate of materials and labour based on standard norms of analysis of rate of N.B.O./C.P.W.D.

d) In case of combined tender with partly item rate for non-schedule items & partly percentage tenders for SOR items, the rate for extra item shall be derived as at (b) above in case of non-schedule items rates and in case of percentage rates for SOR items the rate for extra item shall be derived as at (a) above.

In case of any difference between the contractor and the Engineer-In Charge as to the fixation of rates, the matter shall be referred to the accepting authority of the company i.e. CGM(C)/GM(C)/CE(C) of the company or Staff Officer(C) for the work awarded at Company Hqrs. level and Area level respectively, whose decision shall be final and binding on the contractor.

5.4 Payment for such deviated items (additional/ altered / substituted items of work or excess quantities of work beyond +/- 25% of the agreement schedule) shall be made in the contractors running on account bills, till the revised estimate regularising these items are sanctioned by the competent authority of the company, at the provisional rates and shall not exceed :

a) 75% of the rate recommended by the Engineer In Charge to the accepting authority of the company i.e. CGM(C)/GM(C)/ CE(C) of the company or SO(C) of the Area , if the rate is directly available in the SOR of the company.

b) 50% of the rate recommended by the Engineer In Charge to the accepting authority of the company, i.e. CGM(C)/ GM(C)/ CE(C) of the company or SO(C) of the Area , if it is analysed item rates based on prevalent market rates of materials and labour following NBO/CPWD norms.

5.5 ***The time for completion of the originally contracted work shall be extended by the company in the proportion that the additional work (in value) bears to the original contracted work (in value) plus 25% of the time calculated as explained above or such further additional time as may be considered reasonable by the Engineer in Charge.***

5.6 The company through its Engineer In Charge or his representative, on behalf of the company, shall have power to omit any part of the work in case of non-availability of a portion of the site or for any other reason and the contractor shall be bound to carry out the rest of the work in accordance with the instructions given by the Engineer In Charge. No claim from the Contractor shall be entertained/ accepted on these grounds.

5.7 In the event of any deviation being ordered which in the opinion of the contractor changes radically the original scope/nature of the contract, the contractor shall under no circumstances suspend the work, either original or altered or substituted, and the dispute/disagreement as to the nature of deviation and the rate/rates to be paid for such deviations shall be resolved separately with the company as per the procedures/ norms laid down hereafter.

6. Time for Completion of Contract, Extension thereof, Defaults and Compensation for Delay

Time is the essence of the contract and as such all works shall be completed within the time stipulated in the contract/ work order.

Immediately after the contract is executed/the work order is issued, the Engineer In Charge and the contractor shall agree upon a detailed time and progress chart prepared based on BAR CHART/ PERT CPM techniques on the basis of a construction schedule submitted by the contractor at the time of executing contract showing the order in which the work is proposed to be carried out within the time specified in the contract document/work order.

For the purpose of this detailed time and progress chart, the work shall be deemed to have commenced on the expiry of 10 (ten) days from the issue of Letter of Acceptance of Tender/Work Order or handing over the site of work or handing over reasonable number of working drawings to the contractor or the period of mobilisation allowed in the work order for starting the work in special circumstances, whichever is later.

6.1 If the contractor, without reasonable cause or valid reasons, commits default in commencing the work within the aforesaid time limit, the company shall without prejudice to any other right or remedy, be at liberty, by giving 15 days notice in writing to the contractor to commence the work, to forfeit the Earnest Money deposited by him and to rescind the Letter of Acceptance of Tender/Work Order.

Additionally, the Company will reserve the right to debar such defaulting Contractors from participating in future Tenders for a minimum period of 1 (One) year.

6.2 If the contractor fails to maintain the required progress in terms of the agreed time and progress chart 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 company on account of such breach, pay as compensation (Liquidated Damages) @ half percent (1/2%) of the contract price per week of delay. The aggregate of such compensation/ compensations shall not exceed 10 (ten) percent of the total value as shown in the contract.

This will also apply to items or group of items for which separate period of completion has been specified. The amount of compensation may be adjusted or setoff against any sum payable to the contractor under this or any other contract with the company.

6.2.1 The company, if satisfied, that the works can be completed by the contractor within a reasonable time after the specified time of completion, may allow further extension of time at its discretion with or without the levy of L.D. In the event of extension granted being with L.D, the company will be entitled without prejudice to any other right or remedy available in that behalf, to recover from the contractor as agreed damages equivalent to half percent of the contract value of the works for each week or part of the week subject to a ceiling of 10% of the contract price.

6.2.2 The company, if not satisfied that the works can be completed by the contractor, and in the event of failure on the part of the contractor to complete work within further extension of time allowed as aforesaid, shall be entitled, without prejudice to any other right, or remedy available in that behalf, to rescind the contract.

6.2.3 The company, if not satisfied with the progress of the contract and in the event of failure of the contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.

6.2.4 In the event of such termination of the contract as described in clauses 6.2.2 or 6.2.3 or both, the company, shall be entitled to recover L.D. upto ten percent (10%) of the contract value and forfeit the security deposit made by the contractor besides getting the work completed by other means at the risk and cost of the contractor.

6.3 a) The company may at its sole discretion, waive the payment of compensation on request received from the contractor indicating valid and acceptable reasons if the entire work is completed within the date as specified in the contract/work order or as validly extended date without stipulating any compensation for delay. **or**

b) If the progress of the work or of any portion of the work is unsatisfactory, the Engineer In-charge shall be entitled, after giving the contractor 15 days' notice in writing, to employ another Agency for executing the job or to carry out the work departmentally either wholly or partly debiting the contractor with the cost involved in engaging another Agency or the cost involved in executing the work departmentally, as the case may be. The certificate to be issued by the Engineer In-charge for the cost of the work so done shall be final and conclusive and the extra cost, if any, shall be borne by the contractor.

6.4 Extension of date of completion: On occurrences of any events causing delay as stated here-under, the contractor shall intimate immediately in writing to the Engineer In Charge.

a) Force Majeure :

i) Natural phenomena, including but not limited to abnormally bad weather, unprecedented flood and draught, earthquakes & epidemics.
ii) Political upheaval, civil commotion, strikes, lockouts, acts of any Govt. (domestic/foreign) including but not limited to war, proprieties, quarantine embargoes

The successful bidder/ contractor will advise in the event of his having to resort to this clause by a registered letter duly certified by the local chamber of commerce or statutory authorities, the beginning and end of the cause of delay, within fifteen days of the occurrence and cessation of such Force Majeure condition.

In the event of delay due to Force Majeure for more than one month the contract may be terminated at the discretion of the company. Termination under such circumstances will be without any liability on either side.

b) Serious loss or damage by fire

c) Non-availability of stores which are the responsibility of the company to supply as per contract

d) Non-availability of working drawings in time, which are to be made available by the company as per contract during progress of the work

e) Delay on the part of the contractors or tradesmen engaged by the company not forming part of the contract, holding up further progress of the work

f) Non-availability or breakdown of tools and plant to be made available or made available by the company

g) The execution of any modified or additional items of work or excess quantity of work.

h) Any other causes which, at the sole discretion of the company, is beyond the control of the contractor.

6.4.1 A HINDRANCE REGISTER shall be maintained by both department and the contractor at site to record the various hindrances, as stated above, encountered during the course of execution.

Hindrance register will be signed by both the parties. The contractor may also record his observations in the Hindrance Register. In case the contractor has a different opinion for hindrance and a dispute arises then the matter would be referred to the EIC and or the next higher authority whose decision would be final & binding on the contractor & the decision to be communicated within 15 days.

6.4.2 The contractor shall request the company in writing for extension of time within 15 days of happening of such event causing delay stating also, the period for which extension is required. The company may, considering the genuinity of the request, give a reasonable extension of time for completion of the work. Such extension shall be communicated to the contractor in writing by the company through the Engineer In Charge within 1(one) month of the date of receipt of such request.

6.4.3 The opinion of the Engineer-in-charge, whether the grounds shown for the extension of time are or are not reasonable, is final. If the Engineer-in-charge is of the opinion that the grounds shown by the contractor are not reasonable and declines to the grant of extension to time, the contractor can not challenge the soundness of the opinion by reference to arbitration.

The opinion of the Engineer-in-charge that the period of extension granted by him is proper or necessary is not, however, final. If the contractor feels that the period of extension granted is inadequate he can appeal to the CGM(Civil)/ GM(Civil)/ CE(Civil) of the company for consideration on the question whether the period of extension is or is not proper or necessary.

6.4.4 Provisional extension of time may also be granted by the Engineer In Charge during the course of execution, on written request for extension of time within 15(fifteen) days of happening of such events as stated above, reserving the company's right to impose/ waive penalty at the time of granting final extension of time as per contract agreement.

6.4.5 When the period fixed for the completion of the contract is about to expire, the question of extension of the contract may be considered at the instance of the Contractor or the Department or of both. The extension will have to be by party's agreement, express or implied.

In case the contractor does not apply for grant of extension of time within 15(fifteen) days of the hindrance occurring in execution of the work and the department wants to continue with the work beyond the stipulated date of completion for reason of the work having been unavoidably hindered, the Engineer-in-charge can grant extension of time even in the absence of application from the contractor.

Such extension of time granted by the Engineer In Charge is valid provided the contractor accepts the same either expressly or implied by his actions before and subsequent to the date of completion. Such extension of time shall be without prejudice to Company's right to levy compensation under the relevant clause of the contract.

The contractor shall however use his best efforts to prevent or make good the delay by putting his endeavors constantly as may be reasonably required of him to the satisfaction of the Engineer In Charge.

7. Material Supply & other facilities

7.1* The company does not undertake any responsibility for supply of any materials to the contractor.

7.2 If the steel is issued by the department, the wastage of steel shall be the barest minimum. The wastage allowed from theoretical quantity will be upto a maximum of 5% to cover the wastage due to cutting into pieces, bending and other factors. No cut pieces or scrap less than 2 mtr. in length will be taken by the department. Efforts should be made to use the cut pieces of 2 mtr. or above length as far as possible.

If the wastage of steel is more than the permissible variation mentioned above the cost of excess wastage made by the contractor shall be recovered at double the issue rates indicated above, or 115% of prevailing market rate including sales tax and general tax during the period of work, whichever is more.

No allowances shall be entertained on account of Rolling Margin for the steel either issued by the department or procured by the contractor.

7.3 If the cement is issued by the department, the variation of 5% will be permitted over the theoretical consumption of cement for value of work upto Rs.10.00 lakhs and 3% for value of work above Rs.10.00 lakhs. In the event of cement consumed is more/less than specified above, the recovery for the quantity of cement consumed in excess or less than the specified quantity shall be made at double the issue rate or 115% of prevailing market rate including sales tax and general tax during the period of work, whichever is more.

7.4 In case the department is not able to supply cement/steel as per the provisions of the contract, the Engineer In Charge may allow, with the approval of CGM(Civil)/ GM(Civil)/ CE(Civil) of the company, the contractor in writing for procurement of cement/ steel from the approved sources and the extra on this account including transport charges, if any, over the issue rate shall be reimbursed to the contractor on production of authentic documents. Transportation of cement/ steel from the place of purchase to the site of work and proper storage of cement/steel at site shall be contractor's responsibility. He should maintain proper account of cement/steel issued/procured by him and should allow inspection of his godown and his cement/steel account by the concerned Engineer-in-charge or any other authorised officers of the company. Contractor should draw materials from the company on the basis of actual requirement as assessed by the Engineer In Charge on "as and when required" basis.

7.5 Recovery of cost of materials issued on sale A/c will be made as per actual consumption basis but the Engineer In Charge will have the discretion for making full recovery while processing a particular bill or asking for the return of the balance materials if the work is not progressing satisfactorily.

The contractor shall keep accurate record of materials issued by the company, maintain proper account for the materials received and consumed in the work and shall be open to check by the Engineer In Charge or his authorised representative. The contractor shall ensure that such materials are consumed for the contract works only and the Register for the aforesaid account shall be signed both by the representatives of Engineer In Charge and the contractor.

7.6 All materials, tools and plants brought to site by the contractor including the materials supplied by the company shall be deemed to be held in lien by the company and the contractor shall not have the right to remove the same from the site, without the written permission of the Engineer In Charge. The company shall not however be liable for any loss, theft or damage due to fire or other cause during this period of lien, the responsibility for which shall lie entirely on the contractor.

7.7 The contractor shall bear the cost of loading, transportation to site, unloading, storing under cover as required etc. as may be necessary for the use and keeping the materials in good condition.

7.8 Any surplus materials issued by the company, remaining after completion or termination of the contract, shall be returned by the contractor at his cost to the place of issue and the Engineer In Charge shall accept the same at the rate not exceeding the rate at which these were originally issued taking into consideration the deterioration or damage, if any, that may have been caused during the custody of the contractor. In the event, the contractor fails to return the surplus materials out of those supplied by the company, the Engineer In Charge may, in addition to any other liability which the contractor would incur in this regard, by giving notice in writing require the contractor to pay the amount at double the issue rate for such unreturned surplus materials or 115% of the prevailing market rate including Sales Tax & General Tax during the period of work, whichever is more.

7.9 On completion or on termination of the contract and on complete recovery of secured advance paid by the company, if any, in respect of materials brought to site, the contractor with due permission of the Engineer In Charge shall be entitled to remove at his expenses all surplus materials originally supplied by him and upon such removal, the same shall become the property of the contractor.

7.10 All charges on account of octroi, terminal or sales tax and other duties on materials obtained for the works from any source (excluding materials supplied by the company) shall be borne by the contractor.

7.11 The contractor shall arrange necessary electricity at his own cost for the work and his own establishment. However, if available and feasible the company may arrange electricity at one point near the work site and necessary recovery of cost of energy consumed will be made at rates prescribed by the company from time to time. Energy meter for this purpose shall be provided by the contractor.

7.12 The contractor shall arrange necessary water for the work and his own establishment. However, if available and feasible the company may arrange water at one point near the work site for which recovery @ 1% of the contract value of work done will be made from the contractor's bills.

7.13 Coal required for manufacturing of bricks to be used in the work will be issued @ 25 tonnes per one lakh of bricks on payment at the rate prevailing on the date of issue. Requirement of coal may vary depending on the quality of coal. Transportation of coal and the charges thereof shall be contractor's responsibility.

7.14 Explosives, detonators and other inflammable materials shall not be used in the execution of the work at site by the contractor without prior written permission of the Engineer In Charge. Transportation and storage of such materials shall be done in specified manner in accordance with the law in force. The contractor shall also obtain licence under such laws for, transportation, storage, use and all other operations, connected with the handling of the same.

8. Quality Assurance - Materials and Workmanship

The contractor shall carry out and complete the work in every respect in accordance with the contract and shall ensure that the work conforms strictly to the drawings, specifications, instructions of the Engineer In Charge. The Engineer In Charge may issue, from time to time, further drawings, detailed instructions/ directions in writing to the contractor. All such drawings, instructions/directions shall be consistent with the contract documents and should be reasonably inferable therefrom, alongwith clarifications/ explanations thereof, if necessary.

8.1 For Quality Assurances of all the Civil Engineering Works the norms/ guidelines laid down by the company herein and elsewhere will form part of the contract for the purpose of quality of works.

8.2 The contractor shall be responsible for correct and complete execution of the work in a workman like manner with the materials as per specification which shall be subject to the approval of the company. All work under execution in pursuance of the contract shall be open to inspection and supervision by the Engineer In Charge or by his authorised representative or any other official of higher rank or any other person authorised by the company in his behalf & the contractor shall allow the same.

8.3 All materials to be provided by the contractor shall be in conformity with the specifications/schedule of work as per the contract and the contractor shall furnish proof, if so required by the Engineer In Charge to his satisfaction that the materials do so comply.

8.4 The contractor shall immediately after the award of work draw up a schedule giving dates for submission of samples as required or necessary as per the specification for approval of Engineer In Charge who shall approve ,if found acceptable, promptly so that there is no delay in the progress of the work of the contractor or of the work of any of the sub-contractor.

On receipt of samples as per schedule, the Engineer In Charge shall arrange to examine/test with reasonable promptness ensuring conformity of the samples with the required specification and complying with the requirements as per contract documents keeping in view that the work shall be in accordance with the samples approved by him. The contractor shall not start bringing materials at the site unless the respective samples are approved. Materials con-forming to approved samples shall only be brought to site.

Samples are to be supplied by the contractor at his own cost. The cost involved in tests shall be borne by the contractor. If any test is ordered by the Engineer In Charge which is to be carried out by any independent person or agency at any place other than the site even then the cost of materials and testing charge etc. shall be borne by the contractor. If the test shows that the materials are not in accordance with the specifications, the said materials shall not be used in the work and removed from the site at contractors cost.

8.5 The company, through the Engineer In Charge, shall have full powers to reject any materials or work due to a defect therein for not conforming to the required specification, or for materials not being of the required quality and standard or for reasons of poor workmanship or for not being in accordance with the sample approved by him. The contractor shall forthwith remedy the defect/replace the materials at his expense and no further work shall be done pending such rectification/replacement of materials, if so instructed by the Engineer In Charge.

In case of default on the part of the contractor, the Engineer In Charge shall be at liberty to procure the proper materials for replacement and/or to carry out the rectifications in any manner considered advisable under the circumstances and the entire cost & delay for such procurement/rectification shall be borne by the contractor.

8.6 The Engineer In Charge shall be entitled to have tests carried out for any materials, according to the standard practice followed for such tests, other then those for which satisfactory proof has already been furnished by the contractor who shall provide at his expense all facilities which the Engineer In Charge may require for the purpose.

The cost of any other tests, if so required by the Engineer In Charge, shall be borne by the contractor only, if the test shows the workmanship or materials not to be in accordance with the provision of the contract or the instruction of Engineer In Charge, but otherwise by the company.

8.7 Access to the works: The Engineer-in-charge and any person authorised by the company shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles are being obtained for the works and the contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

8.8 Inspection of works: i) No work shall be covered up or put out of view without the approval of the Engineer-in-charge or the Engineer-in-charge's representative or any other officer nominated by the company for the purpose and the contractor shall afford full opportunity for the EIC or EIC`s representative or any other officer nominated by the company for the purpose to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. the contractor shall give due notice to the Engineer-in-charge's representative whenever any such work or foundations is ready or about to be ready for examination and the Engineer-in-charge's representative shall, without unreasonable delay, unless he considers it unnecessary and advises the contractor accordingly, attend for the purpose of examining and measuring such work or foundations.

ii) The contractor shall uncover any part or parts of the works or making openings in or through the same as the Engineer In Charge may from time to time direct and shall reinstate and make good such part or parts to the satisfaction of Engineer-in-charge.

If any such part or parts have been covered up or put out of view after compliance with the requirement of sub-clause above and are found to be executed in accordance with the contract, the expenses of uncovering, making openings in or through and making good the same shall be borne by the Employer, but in any other cases all costs shall be borne by the contractor.

8.9 Removal of Improper Work and Materials:

i) The Engineer-in-charge shall during the progress of the works have power to order in writing from time to time :
a) The removal from the site, of any materials which in the opinion of Engineer-in-charge, are not in accordance with the contract/ work order/ approved sample.
b) The substitution with proper and suitable materials.

c) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment thereform, of any work which in respect of materials or workmanship is not in accordance with the contract.

ii) In case of default on the part of the contractor in carrying out such order, the Engineer-in -charge shall be entitled to employ and pay other agency to carry out the same and all expenses consequent thereon shall be recoverable from the contractor or may be deducted from any amount due or which may become due to the contractor.

8.10 Devaluation of Work : In lieu of rejecting work done or materials supplied not in conformity with the contract/work order/approved samples , the Engineer-in-charge or any other officer nominated by the company for the purpose may allow such work or materials to remain, provided the Engineer In Charge/ the officer nominated by the company is satisfied with the quality of any materials, or the strength and structural safety of the work, and in that case shall make such deduction for the difference in value, as in his opinion may be reasonable.

8.11 Final Inspection of Work: The Engineer-in-charge and any other officer nominated by the company for the purpose shall make final inspection of all work included in the contract/work order, or any portion thereof, or any completed structure forming part of the work of the contract, as soon as practicable after notification by the contractor that the work is completed and ready for acceptance. If the work is not acceptable to the Engineer-in-charge at the time of such inspection, he shall inform the contractor in writing as to the particular defects to be remedied before final acceptance can be made.

8.12 Defects appearing after acceptance: Any defects which may appear within the defect liability period and arising, in the opinion of the Engineer-in-charge, from lack of conformance with the drawings and specifications, shall, if so required by the Engineer-in-charge in writing, be remedied by the contractor at his own cost within the time stipulated by the Engineer-in-charge. If the contractor fails to comply, the Engineer-in-charge may employ other persons to remedy the defects and recover the cost thereof from the dues of the contractor.

8.13 Site Order Book : A Site Order Book is a Register duly certified by the Engineer-in-charge regarding number of pages it contains, each page being numbered, name of work, name of contractor, reference of contract/ work order and the aforesaid certificate should be recorded on its first page.

Site Order Books shall be maintained on the sites of works and should never be removed therefrom under any circumstances. It shall be the property of the company. The Engineer In Charge or his authorised representative shall duly record his observations regarding any work which needs action on the part of the contractor like, improvement in the quality of work, failure to adhere to the scheduled programme etc. as per contract/work order. The contractor shall promptly sign the site order book and note the orders given therein by the EIC or his representative and comply with them. The compliance shall be reported by the contractor in writing to EIC in time so that it can be checked.

The Site Order Book will be consulted by the Engineer In Charge at the time of making both running on account and final bills of the contractor. A certificate to this effect should be given in the Measurement books by the Engineer In Charge or his representative.

8.14 Samples and Testing of Materials: All the materials to be procured by the contractor and to be used in work shall be approved by the Engineer In Charge in advance, and shall pass the tests and analysis required by him, which will be as specified in the specifications of the items concerned and or as specified by BIS or the IRC standard specifications acceptable to the Engineer In Charge. The method of sampling and testing shall be as per the relevant BIS, IRC and other relevant standards and practices. Minor minerals like sand, stone chips etc. shall be conforming to relevant BIS standards. All bought out items including Cement and Steel shall be procured from such manufacturers who hold valid license conforming to relevant BIS standards for manufacturing of such items.

8.15 Storage of Materials : Materials shall be so stored as to ensure the preservation of the quality and fitness for the work. When considered necessary by the Engineer-in-charge, they shall be placed on wooden platforms or other hard, clean surfaces and not directly on the ground.

Materials shall be placed under cover when so directed and the contractor shall erect and maintain at his own cost temporary weather-proof sheds at the work site for the purpose. Stored materials shall be so located as to facilitate prompt inspection. All stored materials shall be inspected at the time of use in the work, even though they may have been inspected and approved before being placed in storage or during storage.

8.16 Defective Materials: All materials not conforming to the requirements of the specifications shall be considered as defective, and all such materials, whether in place or not shall be rejected. They shall be removed immediately by the contractor at his expenses and replaced with acceptable material.

No rejected material, the defects of which have been subsequently corrected, shall be used on the work until approval in writing has been given by the Engineer In Charge. Upon failure on the part of the contractor to comply with any instruction of the Engineer-in-charge made under the provisions of this article within the time stipulated by the Engineer-in-charge, the Engineer-in-charge shall have authority to remove and replace defective material and recover the cost of removal and replacement from the contractor.

Further all such defective material lying at site not removed and replaced within 30 days after issue of notice by the Engineer-in-charge, if the Engineer-in-charge so decides, shall dispose off such material in any manner without any further written notice to the contractor.

9. Measurement and Payments

Except where any general or detailed description of the work in the Bill of Quantities or specifications of the contract/ work order provides otherwise, measurement of work done shall be taken in accordance with the relevant standard method of measurement published by the Bureau of Indian Standards(BIS) and if not covered by the above, other relevant Standards/practices shall be followed as per instructions of the Engineer In Charge.

9.1 All items of work carried out by the contractor in accordance with the provision of the contract having a financial value shall be entered in the Measurement Book as prescribed by the company so that a complete record of the measurements is available for all the works executed under the contract and the value of the work executed can be ascertained and determined therefrom. Measurements of completed work / portion of completed work shall be recorded only in the Measurement Books.

9.2 Measurement shall be taken jointly by the Engineer-in-Charge or his authorised representative and by the contractor or his authorised representative.

9.3 Before taking measurements of any work, the Engineer In Charge or the person deputed by him for the purpose shall intimate the contractor to attend or to send his representative to attend the measurement. Every measurement thus taken shall be signed and dated by both the parties on the site on completion of the measurement. If the contractor objects to any measurements, a note to that effect shall be made in the Measurement Book / Log Book and signed and dated by both the parties.

9.4 The measurement of the portion of work/items of work objected to, shall be re-measured by the Engineer In Charge himself or the authority nominated by the company for the purpose in the presence of the contractor or his authorised representative and recorded in the M.B. which shall be signed and dated by both the parties. Measurements so recorded shall be final and binding upon the contractor and no claim whatsoever shall thereafter be entertained.

In case the contractor or his authorised representative does not attend to the joint measurements at the prefixed date and time after due notice, the measurements taken by the Engineer In Charge or his representative shall be final and binding on the contractor.

Measurement of the extra items of work or excess quantities of work duly authorised in writing by the Engineer In Charge shall also be taken and recorded in the M.B. based on the existing items in the SOR of the company and if such items do not exist in the company's SOR, the description of the work shall be as per actual execution. Payment for such extra items will be based on the rates to be derived as described in the relevant clauses of the contract/ work-order

9.5 No work shall be covered up or put out of view without the approval by the Engineer In Charge and recording of measurements and check measurement thereof duly accepted by the contractor. The contractor shall provide full opportunity to the Engineer In Charge or his representative to examine and measure all works to be covered up and to examine the foundations before covering up.

The contractor shall also give notice to Engineer In Charge whenever such works or foundations are ready for examination and the Engineer In Charge shall without unreasonable delay arrange to inspect and to record the measurements, if the work is acceptable and advise the contractor regarding covering of such works or foundations.

9.6 In case of items which are claimed by the contractor but are not admissible according to the department, measurements of such items, will be taken by for record purposes only and without prejudice so that in case it is subsequently decided by the department to admit the contractor's claims, there should be no difficulty in determining the quantities of such work. A suitable remark should, however, be made against such measurements to guard against payment in the ordinary way.

9.7 **Payments**: The running on account payments may be made once in a month or at intervals stipulated in the work order/ contract agreement.

9.7.01 Running on account bill/bills for the work executed/ materials supplied in accordance with the work order/ contract shall be prepared on the basis of detailed measurements recorded as described hereinbefore and processed for payments.

9.7.02 Payment of on account bill shall be made on the Engineer In Charge's certifying the sum to which the contractor is considered entitled by way of interim payment for the following :

a) The work executed as covered by the bill/bills after deducting the amount already paid, the security deposit and such other amounts as may be deductible or recoverable in terms of the work order/ contract.

b) (i) Payment for excess quantity of work done with the written instructions of the Engineer In Charge for items already appearing in the bill of quantities of work with approved rates, will be made alongwith the on account bills only upto 10% of the quantity provided in the agreement subject to overall value of work not exceeding the agreement value.

(ii) The CGM(Civil)/ GM(Civil)/ CE(Civil) of the company and / or the Staff Officer(C) of the Area may authorise interim payment for excess work done upto 20 % of the quantity of work provided in the Bill of Quantity of the work awarded from Company level and Area level respectively subject to overall value of work done does not exceed the contract value.

c) Extra items of work executed will be paid on specific written authorisation of CGM (Civil)/ GM(C)/ CE(C) of the company or Staff Officer (Civil) of the Area provided that the value of such extra items of work when added together is not more than 10% of the contract value and the total gross payment including excess quantity does not exceed the contract value.

Balance amount on account of excess quantity and extra items of work executed shall be paid after the deviation estimate / revised estimate regularising the extra items and excess quantities of work is sanctioned by the competent authority of the company with the concurrence of the Finance Department of the company.

d) On the Engineer In Charge's certificate of completion in respect of the work covered by the contract / final measurements of the work certified by the Engineer In Charge or his representative.

9.7.03 The measurements shall be entered in the M.B for the work done upto the date of completion and evaluated based on the approved rates for the items in the contract agreement/sanctioned revised estimate. In case of extra items of work, the rates shall be derived as stated in the relevant clause of the contract.

The payments shall be released against the final bill subject to all deductions which may be made on account of materials supplied, water supply for construction, supply of electricity and any other dues payable by

the contractor to the company, and further subject to the contractor having given to the Engineer In Charge a no claim certificate.

The contractor shall indemnify the company against proof of depositing royalty on account of minor minerals used in the work before the final bill is processed for payments. The final payment to be made will also be subject to Clause-4.5 of the General Terms & Conditions of the contract.

9.7.04 Any certificate given by the Engineer In Charge for the purpose of payment of interim bill/bills shall not of itself be conclusive evidence that any work/materials to which it relate is/are in accordance with the contract and may be modified or corrected by the Engineer In Charge by any subsequent certificate or by the final certificate.

9.7.05 The company reserve the right to recover/enforce recovery of any over payments detected after the payment as a result of post payment audit or technical examination or by any other means, not withstanding the fact that the amount of disputed claims, if any, of the contractor exceeds the amount of such overpayment and irrespective of the facts whether such disputed claims of the contractor are the subject matter of arbitration or not.

The amount of such over payments shall be recovered from subsequent bills under the contract, failing that from contractor's claim under any other contract with the company or form the contractor's security deposit or the contractor shall pay the amount of over payment on demand. In case of contractor's non-payment on such demand, the same should be realised from the contractor's dues, if any, with Coal India Limited or any of it's subsidiaries.

9.7.06 The contractors are required to execute all works satisfactorily and according to the specifications laid down in the contract/ work order. If certain items of work, executed by the contractor, are below specifications, the contractor should re-do them according to the specifications and instructions of EIC and if the contractor fails to rectify the defect within the time and in the manner specified by the EIC, the work shall be got re-done or rectified by the department at the risk and cost of the contractor. Engineer In Charge may accept such work of below specifications provided the department is satisfied with the quality of such works and the strength/ structural safety of such works. In that case Engineer In Charge shall make such deductions for the difference in value, as in his opinion is reasonable and is approved by the accepting authority of the company i.e. CGM(C)/ GM(C)/ CE(C) of the company in this case or any other officer nominated by CGM(C)/ GM(C)/ CE(C) for the purpose.

9.7.07 Payment Stage: The payment stage involved will be as under,

i) Signature of EA(Civil)/ Sr. Overseer(C) / Overseer(C) in MB's both in pages recording measurements, abstract of bill & the duly filled in bill form.
ii) Signature of Engineer(C)/ EE(C) with appropriate check measurements in the MB's and the bill form.
iii) Signature of Sr. EE(C)/ SE(C) with appropriate check measurements in MB's and the bill form.

iv) Signature of Engineer in Charge as per definition as at clause 1(vii) of the General Terms and Conditions, as a token of acceptance for payment of the bill. The EIC may sign in the abstract of the bill in the MB & the bill form. In between stage iii) and iv) accountal checking may be made by the concerned Accounts Officer/ Accountant.

9.7.08 Secured Advance: Secured advance can be paid for items of materials required for execution of the work and covered under categories A & B and supplied by the contractor at work site, supported by necessary vouchers, challans, test certificates etc. after execution of indemnity bond as per prescribed Form of the company on non-judicial stamp paper of prescribed value.

This advance shall be recovered in four equal installments or as per consumption whichever is higher. Engineer In Charge shall recover at his discretion all or any part of secured advance paid, if in his opinion the work is not progressing satisfactorily or the security of these materials at site is not adequately taken care of by the contractor. Secured advance shall be payable for contracts of value above Rs.10.00 lakhs only.

Secured advance for structural steel sections, reinforcement steel and cement, collected at site, will be paid upto 75% of the corresponding stock yard prices of SAIL for the corresponding steel items and Govt. approved/ D.G.S.D. prices for cement, if the same exist.

In case of non-availability of Govt. approved prices of cement & steel and for the materials falling under Category - A and B the secured advance will be paid at the basic rate available in the approved schedule of rates of

the company plus or minus the overall percentage on which the work was awarded, provided such rate is not more than 60% of the quoted rate of the contractor for the actual work.

At any point of time the outstanding recoverable secured advance shall not be more than 10% of the contract value.

Items against which secured advance can be granted:

Category-A

Civil:

1. Bricks
2. Stone and brick aggregate
3. Stones
4. Finished products of brass, iron and steel such as doors & windows frames, wire mesh, gate, GI Sheets.
5. Pre-cast R.C.C. products such as pipes, jali, water storage tanks etc.
6. Doors & Window fittings.
7. Pipes and sanitary fittings of CI, SCI & HCI

Electrical :

1. Steel conduits
2. G.I. Pipes
3. I.C. Boards
4. Switchgears (Air circuit beakers and Air break switches)
5. C.I. Boxes.
6. A.C.S.R. Conductors
7. A.C. Plant & Machinery
8. Pumps
9. Generating sets (without oil)

Items against which secured advance can be granted:

Category- B

Civil:

1. Glazed tiles, terrazzo tiles and similar articles.
2. Marble slabs
3. Asbestos cement products
4. Finished timber products such as doors, windows, flush doors, particle boards (subject to mandatory test being satisfactory) etc.
5. Bitumen in sealed drums
6. Bitumen felt
7. Polythene pipes and fittings and tanks
8. Sanitary fittings and pipes of S.W., porcelain and chinaware materials
9. Laminated / Safety, one way vision, and bullet proof glasses.
10. Chemical required for anti-termite treatment (in sealed drums)
11. Paints, varnishes, distempers, pigment, spirits etc.

Electrical:

1. Transformers

2. Oil-filled switch gears.
3. L.T. & H.T.Cables
4. Fans
5. Storage and Dry Batteries
6. Insulation tapes
7. Epoxy cable compounds
8. Electric light fittings
9. Wooden battens, casing & capping and wooden boards
10.Flexible wires
11.PVC materials
12.Oil and lubricants
13.Rubber materials
14.Glass wool, thermocole & other insulating materials
15.Porcelain H.T. and L.T. insulators.

In addition to indemnity bond, for materials listed under Category-B, the contractor shall be required to provide necessary insurance cover of equivalent value of materials.

Items against which no secured advance shall be granted:

Civil:

1. Glass products other than those indicated in Category-B.
2. Sand and moorum
3. Chemical compounds other than those indicated in Category-B.

Electrical:

1. Glass gloves and shades
2. Bulbs and tubes
3. Petrol and diesel
4. Freon and other refrigeration gases.

9.8 Income tax deduction @ 2% (Two percent) of the gross value of each bill or at the rate as amended from time to time, shall be made unless exempted by the competent authority of the Income Tax Department

Sales tax on works contract shall be payable by the contractor. If, however, the company is asked to make deduction from the contractor's bills, the same shall be done and a certificate to this effect shall be issued to the contractor for dealing with the State Govt. and the company does not take any responsibility to do anything further in this regard.

9.9 No interest shall be payable on the amounts withheld, under the terms of the Contract Agreement/Work-order.

10. Termination, Cancellation, Suspension and Foreclosure of Contract

The company shall, in addition to other remedial steps to be taken as provided in the conditions of contract be entitled to cancel the contract in full or in part, if the contractor :-

a) makes default in proceeding with the works with due diligence and continues to do so even after a notice in writing from the Engineer In Charge, then on the expiry of the period as specified in the notice

Or

b) commits default/breach in complying with any of the terms and conditions of the contract and does not remedy it or fails to take effective steps for the remedy to the satisfaction of the Engineer In Charge, then on the expiry of the period as may be specified by the Engineer In Charge in a notice in writing.

Or

c) obtains a contract with the company as a result of ring tendering or other non-bonafide methods of competitive tendering

Or

d) shall offer or give or agree to give any person in the service of the company or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for act/acts of favour in relation to the obtaining or execution of this or any other contract for his company.

Or

e) fails to complete the work or items of work with individual dates of completion, on or before the date/dates of completion or as extended by the company, then on the expiry of the period as may be specified by the Engineer In Charge in a notice in writing.

Or

f) transfers, sublets, assigns the entire work or any portion thereof without the prior approval in writing from the Engineer In Charge. The Engineer In Charge may by giving a written notice, cancel the whole contract or portion of it in default.

10.1 The contract shall also stand terminated under any of the following circumstances :

a) If the contractor being an individual in the case of proprietary concern or in the case of a partnership firm any of its partners is declared insolvent under the provisions of Insolvency Act for the time being in force, or makes any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors amounting to proceedings for liquidation or composition under any Insolvency Act.

b) In the case of the contractor being a company, its affairs are under liquidation either by a resolution passed by the contractors company or by an order of court, not being a voluntary liquidation proceedings for the purpose of amalgamation or reorganisation, or a receiver or manager is appointed by the court on the application by the debenture holders of the contractor's company, if any.

c) If the contractor shall suffer an execution being levied on his/their goods, estates and allow it to be continued for a period of 21 (twenty-one) days.

d) On the death of the contractor being a proprietary concern or of any of the partners in the case of a partnership concern and the company is not satisfied that the legal representative of the deceased proprietor or the other surviving partners of the partnership concern are capable of carrying out and completing the contract. The decision of the company in this respect shall be final and binding which is to be intimated in writing to the legal representative or to the partnership concern.

10.2 On cancellation of the contract or on termination of the contract, the Engineer In Charge shall have powers:

a) to take possession of the site and any materials, constructional plant, equipments, stores etc. thereon.

b) to carry out the incomplete work by any means at the risk and cost of the contractor.

c) to determine the amount to be recovered from the contractor for completing the remaining work or in the event the remaining work is not to be completed the loss/damage suffered, if any, by the company after giving credit for the value of the work executed by the contractor upto the time of cancellation less on a/c payments made till date and value of contractor's materials, plant, equipments, etc. taken possession of after cancellation.

d) to recover the amount determined as above, if any, from any money due to the contractor on any account or under any other contract and in the event of any shortfall, the contractor shall be called upon to pay the same on demand. The need for determination of the amount of recovery of any extra cost/expenditure or of any loss/damage suffered by the company shall not however arise in the case of termination of the contract for death/demise of the contractor as stated in clause 10.1(d) of the contract.

e) to give the contractor or his representative of the work 7 (seven) days notice in writing for taking final measurement for the works executed till the date of cancellation or termination of the contract. The Engineer In Charge shall fix the time for taking such final measurement and intimate the contractor in writing. The final measurement shall be carried out at the said appointed time notwithstanding whether the contractor is present or not. Any claim as regards measurement which the contractor is to make shall be made in writing within 7 (seven)

days of taking final measurement by Engineer-In-charge as aforesaid and if no such claim is received, the contractor shall be deemed to have waived all claims regarding above measurements and any claim made thereafter shall not be entertained.

10.3 Suspension of Work:

i) The company shall have power to suspend the work or any part thereof and the Engineer In Charge may direct the contractor in writing to suspend the work, for such period and in such manner as may be specified therein, on account of any default on the part of the contractor, or for proper execution of the work for reasons other than any default on part of the contractor, or on ground of safety of the work.

ii) In the event of suspension for reasons other than any default on the part of the contractor, extension of time shall be allowed by the company equal to the period of such suspension and the contractor shall properly protect and secure the works to the extent necessary during such suspension.

The contractor shall carry out the instructions given in this respect by the Engineer-In Charge & if such suspension exceeds 45 (forty five) days, the contractor will be compensated on mutually agreed terms.

10.4 The work shall, throughout the stipulated period of contract, be carried out with all due diligence on the part of the contractor. In the event of termination or suspension of the contract, on account of default on the part of the contractor, as narrated hereinbefore, the security deposit and other dues of this work or any other work done under this company shall be forfeited and brought under the absolute disposal of the company provided, that the amount so forfeited shall not exceed 10 (ten) percent of the contract value.

10.5 Foreclosure of contract:

If at any time after acceptance of the tender the company decides to abandon for any reason whatsoever the company, through its Engineer In Charge, shall give notice in writing to that effect to the contractor. In the event of abandonment the company shall be liable :-

a) to pay reasonable amount assessed and certified by the Engineer In Charge of the expenditure incurred, if any, by the contractor on preliminary works at site e.g. temporary access roads, temporary construction for labour and staff quarters, office accommodation, storage of materials, water storage tanks and water supply for the work including supply to labour/ staff quarters, office etc.

b) to pay the contractor at the contract rates full amount for works executed and measured at site upto the date of such abandonment.

c) to pay for the materials brought to site or to be delivered at site, which the contractor is legally liable to pay, for the purpose of consumption in works carried out or were to be carried out but for the foreclosure, including the cost of purchase and transportation and cost of delivery of such materials. The materials to be taken over by the company should be in good condition and the company may allow at its discretion the contractor to retain the materials in full or in part if so desired by him and to be transported by the contractor from site to his place at his own cost with due permission of the EIC.

d) to take back the materials issued by the company but remaining unused, if any, in the work on the date of abandonment/reduction in the work, at the original issue price less allowance for any deterioration or damage caused while in custody of the contractor.

e) to pay for the transportation of tools and plants of the contractor from site to contractor's place or to any other destination, whichever is less.

10.5.01 The contractor shall, if required by the Engineer In Charge, furnish to him books of accounts, papers, relevant documents as may be necessary to enable the Engineer In Charge to assess the amounts payable in terms of clauses10.5(b) (c) & (e) of the contract. The contractor shall not have any claim for compensation for abandonment of the work, other than those as specified above.

11. Completion Certificate / Defect Liability Certificate

Except in cases where the contract provides for "Performance Test" before issue of Defect Liability certificate, in which case the issue of Defect Liability certificate shall be in accordance with the procedure specified therein, the contractor shall give notice of completion of work, as soon as the work is completed, to the Engineer In Charge. The Engineer In Charge and or any other Officer, nominated for the purpose by the company, shall within 30 (thirty) days from the receipt thereof, inspect the work and ascertain the defects/deficiencies, if any, to be rectified by the contractor as also the items, if any, for which payment shall be made at reduced rate.

If the defects, according to the Engineer In Charge are of a major nature and the rectification of which is necessary for the satisfactory performance of the contract, he shall intimate in writing the defects and instruct the contractor to rectify the defects/remove deficiencies within the period and in the manner to be specified therein. In such cases Defect Liability Certificate will be issued by the EIC after the above rectifications are carried out/ deficiencies are removed by the contractor to the satisfaction of EIC.

In the event there are no defects or the defects/ deficiencies are of a minor nature and the Engineer In Charge is satisfied that the contractor has already made arrangements for rectification, or in the event of contractor's failure to rectify the defects for any reason whatsoever, the defects can be rectified by the company departmentally or by other means and the 50% of the security deposit of the contractor shall be sufficient to cover the cost thereof, he shall issue the Defect Liability Certificate (Taking Over Certificate with list of defects)indicating the date of completion of the work, defects to be rectified, if any, and the items, if any, for which payment shall be made at reduced rate indicating reasons therefor and with necessary instructions to the contractor to clear the site/place of work or all debris/ waste materials, scaffoldings, sheds, surplus materials etc. making it clean.

11.1 In cases where separate period of completion for certain items or groups of items are specified in the contract, separate Defect Liability certificate for such items or groups of items may be issued by the Engineer In Charge after completion of such items on receipt of notice from the contractor only in the event the work is completed satisfactorily in every respect.

Refund of security deposit and payment of final bill shall, however, be made on completion of the entire contract work, but not on completion of such items of work.

12. Additional Responsibilities of the Contractor(s)

The cost on account of the "Additional Responsibilities of the Contractors" under this clause is deemed to be included in the tendered rates.

i) The company reserves the right to let other contractors also works in connection with the Project and the contractor/contractors shall co-operate in the works for the introduction and stores and materials and execution of his/their works.

ii) The contractor/contractors shall keep on the work site during the progress a competent and experienced Resident Engineer exclusively for the work and necessary assistants who shall represent the contractor(s). The contractor shall employ, on the site in connection with the execution and maintenance of the work, the following technical staff :

For Buildings Roads, Water Supply & Sanitary Works:

1)	For value of work ranging from Rs.10 lakhs to Rs.20 lakhs.	1 Experienced Diploma holder.
2)	For value of work above Rs.20 lakhs and upto Rs.1 crore.	1 Experienced Graduate Engineer in addition to Diploma holder as per sl.no.4 below.
3)	For value of work in excess of Rs.1 crore & for every	1 Graduate Engineer extra in addition to Graduate

	additional Rs.2 crores or part thereof.	Engineer and Diploma holder as per sl.no.1 & 4.
4)	For value of work in excess of Rs.20 lakhs & for every additional Rs.50 lakhs or part thereof.	1 Diploma holder extra.

For Industrial Structures :

1)	For value of work ranging from Rs.5 lakhs to Rs.15 lakhs.	1 Experienced Diploma holder.
2)	For value of work above Rs.15 lakhs and upto Rs.75 lakhs.	1 Experienced Graduate Engineer in addition to Diploma holder as per sl.no.4 below.
3)	For value of work in excess of Rs.75 lakhs & for every additional Rs.1.5 crores or part thereof.	1 Graduate Engineer extra in addition to Graduate Engineer and Diploma holder as per sl.no.1 & 4.
4)	For value of work in excess of Rs.15 lakhs & for every additional Rs.50 lakhs or part thereof.	1 Diploma holder extra.

The contractor shall intimate the Engineer In Charge in writing the names, qualifications, experience and full postal address of each and every technical personnel employed at site by him.

The contractor(s) shall not be allowed to execute the work unless he/they engage the required technical staff at site as stated above. The delay on this account, if any, shall be the contractor's responsibility.

Important instructions shall be confirmed to the contractor(s) in writing. If the contractor/contractors in course of the works finds/find any discrepancy between the drawing, forming part of the contract documents and the physical conditions of the locality or any errors or omissions in drawings except those prepared by himself / themselves and not approved by the Engineer In Charge. It shall be his/their duty to immediately inform the Engineer In Charge in writing and the Engineer In Charge shall verify the same. Any work done after such discovery and without intimation as indicated above will be done at the risk of the contractor/contractors.

iii) The contractor / contractors shall employ only competent, skillful and orderly men to do the work. The Engineer In Charge shall have the right to ask the contractor/ contractors to remove from the work site any men of the contractor/contractors who in his opinion is undesirable and the contractor/contractors will have to remove him within 3 (three) hours of such orders.

The contractor shall employ apprentices in the execution of the contract work as required under Apprentices Act.

The contractor shall further be responsible for making arrangements at his own cost, or accommodation and social needs of the staff and workers under his employment.

iv) Precautions shall be exercised at all times by the contractor(s) for the protection of persons (including employees) and property. The safety required or recommended by all applicable laws, codes, statutes and

regulations shall be observed by the contractor(s).In case of accidents, the contractor(s) shall be responsible for compliance with all the requirements imposed by the Workmen's Compensation Act or any other similar laws in force, and the contractor(s) shall indemnify the company against any claim on this account.

All scaffoldings, ladders and such other structures which the workmen are likely to use shall be examined by the Engineer In Charge or his authorised representative whenever they want and the structure must be strong, durable, and safe and of such design as required by Engineer In Charge.

In no case any structure condemned by the Engineer In Charge or his authorised representatives shall be kept on the work and such structure must be pulled down within three hours of such condemnation and any certificate or instructions, however, shall in no way absolve the contractor/contractors from his/their responsibility, as an employer, as the company shall in no way be responsible for any claim.

The contractor / contractors shall at all times exercises reasonable precautions for the safety of employees in the performance of his/their contract and shall comply with all applicable provisions of the safety laws drawn up by the State Govt. or Central Govt. or Municipalities and other authorities in India. The contractor/contractors shall comply with the provision of the safety hand book as approved and amended from time to time by the Government of India.

v) The contractor / contractors shall familiarise themselves with and be governed by all laws and rules of India and Local statutes and orders and regulations applicable to his/ their work.

vi) The contractor shall maintain all records as per the provision made in the various statutes including Contract Labour (Regulation & Abolition) Act, 1970 and the Contract Labour (Regulation & Abolition) Central Rules,1971, Minimum Wages Act, Workmen Compensation Act etc. and latest amendment thereof. Such records maintained by the contractor shall be opened for inspection by the Engineer In Charge or by the nominated representative of the Principal Employer.

vii) The contractor/ contractors shall provide facilities for the sanitary necessities of all persons employed on the work shall be constructed and maintained in the number, manner and place approved or ordered by the Engineer In Charge. The contractor/contractors shall vigorously prohibit committing of nuisance at any other place. Cost of all works under this item shall be covered by the contractor/contractor's tendered rates.

viii) The contractor/contractors shall furnish to the Engineer In Charge or his authorised representative with work reports from time to time regarding the contractor / contractors organisation and the progress made by him / them in the execution of the work as per the contract.

ix) All taxes,levies,cess,royalties,whether local,municipal,provincial or central pertaining to the the contract are payable during the entire periods of contract, shall be to the contractor/ contractors account and shall be deemed to have been included in the contracted rate for the work to be executed by the contractor. The Company shall not be liable for any taxes or levies etc. whatsoever in connection with this contract.

The company reserves the right to deduct/ withheld any amount towards taxes,levies,etc. and to deal with such amount in terms of the provisions of the Statute or in terms of the direction of any Statutory authority and the company shall only provide with certificate towards such deduction and shall not be responcible for any reason whatsoever.

In case the company land is used for manufacture of bricks or extraction of gravels etc. the contractor will have to pay compensation to the company (apart from the liability of the contractor to make the payment of royalty etc. to the State Government) at the same rates or royalty fixed by the State Government or an appropriate deduction may be made in the rate to be paid to the contractors.

x) The contractor / contractors shall make his / their own arrangement for all materials, tools, staff and labourer required for the contract, which shall include cost of lead, lift, loading, unloading, railway freight, recruiting expenses and any other charges for the completion of the work to entire satisfaction of the company.

xi) The contractor / contractors shall make their own arrangement for carriage of all materials to the work site at his/their own cost.

xii) The work shall not be sublet to any other party, unless approved by Engineer In Charge, in writing.

xiii) a) No fruit trees or valuable plants or trees with trunk diameter exceeding 150mm shall be pulled, destroyed or damaged by the contractor/contractors or any of his/their employees without the prior permission of the company, failing which the cost of such trees or plants shall be deducted from the contractor/contractors dues at the rate to be decided by the company. The rates quoted are supposed to include clearance of shrubs and jungles and removal of such trees upto 150 mm dia., as will be permitted by the Engineer In Charge in writing.

b) Anything of historical or other interest or of significant value unexpectedly discovered on the site is the property of the employer. The Contractor is to notify the Nodal Officer or his nominee of such discoveries and carry out the Nodal Officer or his nominee's instructions for dealing with him.

xiv) The contractor / contractors shall not pay less than the minimum wages to the labourers engaged by him/them as per Minimum Wages Act or such other legislation or award of the minimum wage fixed by the respective State Govt. or Central Govt. as may be in force.

xv) All accounts shall be maintained properly and the company shall have the right of access and inspection of all such books of accounts etc., relating to payment of labourer considered necessary and the company may arrange for witnessing the payment to the labourer by its representatives.

xvi) The contractor shall in additions to any indemnity provided by the relevant clauses of the agreement or by law, indemnify and keep indemnified for the following :

a) The company or any agent or employee of the company against any action, claim or proceeding relating to infringement or use of any patent or design right and shall pay any royalties or other charges which may be payable in respect of any article or material included in the contract.

However, the amount so paid shall be reimbursed by the company in the event such infringement has taken place in complying with the specific directions issued by the company or the use of such article or material was the result of any drawing and/or specifications issued by the company after submission of tender by the contractor. The contractor must notify immediately after any claim being made or any action brought against the company, or any agent or employee of company in respect of any such matter.

b) The company against all claims, damages or compensation under the provisions of payment of Wages Act, 1938, Minimum Wages Act, 1948, Employer's Liability Act, 1938, The Workmen's Compensation Act, 1923, Industrial Dispute Act, 1947, Mines Act as applicable, Employees State Insurance Act 1948 and Maternity Benefit Act, 1961, Acts regulating P.F.or any modification thereof or any other law relating thereto and rules made thereunder from time to time, as may be applicable to the contract which may arise out of or in consequence of the construction or maintenance or performance of the work under the contract and also against costs, charges and expenses of any suit, action or proceedings arising out of any accident or injury.

c) The company against all losses and claims for injuries or damages to any third party or to any property belonging to any third party which may arise out of or in consequence of the construction or maintenance or performance of the work under the contract and against all claims/demands proceedings/damages, cost charges and expenses whatsoever in respect of or in relation thereto.

xvii) The contractor is under obligation to hand over to the company the vacant possession of the completed building structures failing which the Engineer In Charge can impose a levy upon the contractor upto 5% of the total contract value for the delay in handing over the vacant possession of the completed works after giving a 15 (fifteen) days notice to the contractor.

xviii) **a) INSURANCE** : The contractor shall take full responsibility to take all precautions to prevent loss or damage to the works or part thereof for any reasons whatsoever

(excluding act of God e.g. flood, riots, war, earthquake, etc.) and shall at his own cost repair and make good the loss/damage to the work so that on completion, the work shall be in good order and condition and in conformity with the requirements of the contract and instructions of the Engineer In Charge.

In case of construction works without limiting the obligations and responsibilities under the contract, the contractor shall take insurance policy for the total value of work for the period from commencement to completion including defect liability period against risk of loss/ damage to the extent as permissible under the law of insurance.

The contractor shall arrange necessary insurance and pledge the same in the name of the company and all moneys payable by the insurers shall be recovered by the company which shall be paid to the contractor in installments as may be certified by the Engineer In Charge for the purpose of rebuilding or replacement or repair of the works and/or goods destroyed or damaged for which payment was received from the insurers.

b) Where any company building or part thereof is used, rented or leased by the contractor for the purpose of storing or using materials of combustible nature, the contractor shall take separate insurance policy for the entire building and the policy shall be deposited with the company.

c) The contractor shall at all times during the tenure of the contract indemnify the company against all claims, damages or compensation under the provision of the Workmen's Compensation Act and shall take insurance policy covering all risk, claims, damages, or compensation payable under the Workmen's Compensation Act or under any other law relating thereto.

d) The contractor shall ensure that the insurance policy/ policies is/are kept alive till full expiry of the contract by timely payment of premiums and it/they shall not be cancelled without the approval of the company and a provision is made to this effect in all policies, and similar insurance policies are also taken by his sub-contractors if any. The cost of premium shall be borne by the contractor and it shall be deemed to have been included in the tendered rate.

e) In the event of contractor's failure to effect or to keep in force the insurance referred to above or any other insurance which the contractor is required to effect under the terms of the contract, the company may effect and keep in force any such insurance and pay such premium/premiums as may be necessary for that purpose from time to time and recover the amount thus paid from any moneys due to the contractor.

THE CLAUSE 12 xviii SHALL BE APPLICABLE FOR WORKS OF ESTIMATED VALUE OF OVER Rs. 50 LAKHS.

xix**) Setting Out:** The contractor shall be responsible for the contract and proper setting out of the works and correctness of the position, reduced levels, dimensions and alignment of all parts of the work including marking out the correct lay out in reference to the permanent bench mark and reference points. Only one permanent bench mark and basic reference lines shall be marked and shown to the contractor as basic data.

The contractor shall have all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of work any error is detected in respect of the position, levels, dimensions or alignment of any part of the work, the contractor on being required to do so by the Engineer In Charge or his representative shall at the expenses of the contractor rectify such errors to the satisfaction of Engineer In Charge unless such error is due to incorrect data supplied by the Engineer In Charge.

xx) On receipt of Letter of Acceptance of Tender / Work Order the contractor shall forthwith Register and obtain License from the competent authority under the Contract Labour (Regulation & Abolition)Act 1970,the Contract Labour (Regulation & Abolition) Central Rules, 1971 and submit certified copies of the same to the Engineer In Charge and the Principal Employer.

xxi) The contractor shall be registered with the concerned State Govt. and the Central Govt. in respect of Sales Tax Act and the certificate having details of Registration No., period of validity etc. should be submitted to the Engineer In Charge.

xxii) The contractor shall, in connection with works, provide and maintain, at his own cost, all lights, security guards, fencing when and where necessary as required by the Engineer In Charge for the purpose of protection of the works, materials at site, safety of workmen and convenience of the public.

xxiii) All materials (e.g. stone, moorum and other materials) obtained in the course of execution of the work during excavation and dismantling etc. shall be the property of the company and the same may be issued to the contractors, if required for use in the works at the rates to be fixed by the Engineer In Charge.

xxiv) Unless otherwise specifically provided for, dewatering of excavation pits, working areas etc. shall be the contractor's responsibility and is to be carried out at his own cost as per instructions of EIC. The rates quoted by the contractor shall be deemed to include the dewatering costs.

xxv) Approval by the Nodal Officer/Engineer in Charge or his nominee: The contractor shall submit specifications and drawings showing the proposed temporary work to the Nodal Officer/Engineer-in-Charge or his nominee, who is to approve them if they comply with the specifications and drawings.

The contractor shall be responsible for design of Temporary Works.

The Nodal Officer/Engineer-in-charge or his nominee's approval shall not alter the contractor's responsibility for design of the Temporary Works.

13. Defects Liability Period:

In addition to the defect/s to be rectified by the contractor as per terms of the contract/ work order, the contractor shall be responsible to make good and remedy at his own expense the defect/s mentioned hereunder within such period as may be stipulated by the Engineer In Charge in writing :

a) Any defect/defects in the work detected by the Engineer In Charge within a period of 6 (six) months from the date of issue of Defect Liability certificate / completion certificate.

b) In the case of building works or other works of similar nature any defect in the work detected by the Engineer In Charge within a period of 6 (six) months from the date of issue of Defect Liability certificate/ completion certificate or before the expiry of one full monsoon period i.e. June to October whichever is later in point of time.

13.1 A programme shall be drawn by the contractor and the Engineer In Charge for carrying out the defects by the contractor detected within the defect liability period and if the contractor fails to adhere to this programme, the Engineer In Charge shall be at liberty to procure proper materials and carry out the rectifications in any manner considered advisable under the circumstances and the cost of such procurement of materials and rectification work shall be chargeable to the contractor and recoverable from any of the pending dues of the contractors.

The defect liability period can be extended by the company on getting request from the contractor only for valid reasons.

There will be no defect liability period for works like Grass Cutting, Jungle Cutting, Surface Dressing & any other work of similar nature to be decided by the Engineer in Charge.

14. Operating and Maintenance Manual:

If "as built" drawings and/or Operating and Maintenance Manual are required the contractor shall supply them by the dates as per instruction of the Engineer-in-charge.

If the contractor does not supply the drawings and/or Manual by the dates as stated above, or they do not receive the Nodal Officer or his nominee's approval, the Nodal Officer or his nominee shall withhold the amount as stated in the agreement.

15. Settlement of Disputes/ Arbitration

15.1 It is incumbent upon the contractor to avoid litigation and disputes during the course of execution. However, if such disputes take place between the contractor and the department, effort shall be made first to settle the disputes at the company level.

The contractor should make request in writing to the Engineer-in-charge for settlement of such disputes/ claims within 30 (thirty) days of arising of the cause of dispute/ claim failing which no disputes/ claims of the contractor shall be entertained by the company.

15.2 If differences still persist, the settlement of the dispute with Govt. Agencies shall be dealt with as per the Guidelines issued by the Ministry of Finance, Govt. of India in this regard. In case of parties other than Govt. Agencies, the redressal of the dispute may be sought in the Court of Law.

ADDITIONAL TERMS AND CONDITIONS

1. The following additional terms and conditions are also acceptable to the company. The tenderers are requested not to quote any further additional conditions in the tender.

2. Application of Price Variation Cause.

If the prices of materials (not being the materials supplied at fixed issue rates by the company) and wages of labour required for execution of the work increase or decrease, the contractor shall be compensated for such increase or recoveries will be made from the bills for such decrease as per provisions detailed hereafter:

a) The amount of the contract shall accordingly be varied subject to the condition that such compensation for escalation/ de-escalation in price shall be available only for the work done during the stipulated period of the contract including such period for which the contract is validily extended under the provisions of the contract without any penal action. The Price Variation Clause shall not be applicable for works for which stipulated period of completion is six months or less.

b) The base date for working out such escalation/de-escalation shall be the last date on which the price bids or revised price bids were stipulated to be received.

c) The compensation for escalation or recoveries to be made shall be worked out at quarterly intervals and shall be with respect to the cost of work done during the previous three months. The first such payment will be made at the end of three months after the month (excluding) in which the tender was accepted and there after at three months' interval.

2.1 Escalation/ De-escalation for Labour: The amount paid to the contractor for the work done shall be adjusted for increase or decrease in the cost of labour and the cost shall be calculated quarterly in accordance with the following formula :

$$VL = W \times \frac{A}{100} \times \frac{L - Lo}{Lo}$$

Where :

VL= Variation in labour cost i.e., increase or decrease in the amount in rupees to be paid or recovered.

W = Value of work done during the period under reckoning to which the escalation/de-escalation relates as indicated in clause-2.4 of the Additional Terms & Conditions of the contract.

A = Component of labour expressed as percentage of the total value of the work adopted from the Table-1.

Lo = Minimum wages for unskilled workers payable as per the Minimum Wages Act / Rules of the State or Central Govt., whichever is more, applicable to the place of work as on the last date stipulated for receipt of the price bids or revised price bids whichever is later.

L = Revised minimum wages of unskilled worker corresponding to Lo during the period to which the escalation/de-escalation relates.

2.2 Escalation /De-escalation on Materials: The amount to be paid to the contractor for the work done will be adjusted for increase or decrease in the cost of materials and the cost shall be calculated quarterly in accordance with the following formula :

$$Vm = W \times \frac{B}{100} \times \frac{M - Mo}{Mo}$$

Where :

Vm = Variation in the material cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of work done during the period under reckoning to which the escalation / de-escalation relates as indicated in clause-2.4 of the Additional Terms & Conditions of the contract.

B = Component of material expressed as percentage of the total value of the work adopted from the Table -1.

M = Average All India Wholesale Price Index for all commodities for the period to which escalation/de-escalation relates as published by the RBI Bulletin, Ministry of Industry & Commerce, Govt. of India.

Mo = All India Wholesale Price Index for all commodities as published by the RBI Bulletin, Ministry of Industry & Commerce, Govt. of India, relating to the last date on which the price bids or revised price bids whichever is later were stipulated to be received.

2.3 Escalation/ De-escalation on POL : The amount to be paid to the contractor for the work done shall be adjusted for the increase or decrease in the cost of POL and the cost shall be calculated quarterly in accordance with the formula given below :

$$Vf = W \times \frac{C}{100} \times \frac{F - Fo}{Fo}$$

Where :

Vf = Variation in the cost of fuel, oil and lubricants increase or decrease in the rupees to be paid or recovered.

W = Value of work done during the period under reckoning to which the escalation/ de-escalation relates as indicated in clause 2.4 of the Additional terms & Conditions of the contract.

C = Component of POL expressed as percentage of the total cost of the work taken from Table -1.

F = Average Index Number for wholesale price for the group of `Fuel, Power, Light & Lubricants' as published by the Economic Adviser, Ministry of Industry, Govt. of India for the period to which the escalation/de-escalation relates.

Fo = Index number of wholesale price for the group, Fuel, Power, light & lubricants as published by the Economic Adviser, Ministry of Industry, Govt. of India prevalent on the last date of receipt of price bids or revised price bids whichever is later.

2.4 While calculating the value of "W" the following may be noted : The cost on which the escalation will be payable shall be reckoned as 85 % of the cost of work as per the bills to which escalation relates, and from this amount the value of materials supplied or services rendered at the prescribed charges under the relevant provisions of the contract, and proposed to be recovered in the particular bill, shall be deducted before the amount of compensation for escalation or de-escalation is worked out. In the case of materials brought to site for which any secured advance is included in the bill, the full value of such materials as assessed by the Engineer In Charge (and not the reduced amount for which secured advance has been paid) shall be included in the cost of work done for operation of this clause. Similarly, when such materials are incorporated in the work and the secured advance is deducted from the bill, the full assessed value of the materials originally considered for operation of this clause should be deducted from the cost of the work shown in the bill, running or final. Further the cost of work shall not include any work for which payment is made at prevailing market rates.

2.5 In the event the price of materials and/ or wages of labour required for execution of the work decreases, there shall be downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formulae herein before stated under this clause shall mutatis/mutandis apply provided that no such adjustment for the decrease in material price and/ or wages of labour before mentioned would be made in case of contracts in which the stipulated period of completion of the work is less than six (6) months.

2.6 Application of Price Variation Clause during extended period of Contracts.

The Price Variation Clause as stated above will be applied for extended time frame of a contract by following the principle stated as under,

i) Normally, if and when it is understood that a contract is not going to be completed within the scheduled time period, the contract is kept operative by extending the time of completion provisionally. During this provisional extended period the operation of the Price Variation Clause will remain suspended.

ii) If and when it is decided at the end of successful completion of the work that the delay was due to causes NOT attributable to the Contractor, then the Price Variation Clause will be revived and applied as if the scheduled date of completion has been shifted to the approved extended date.

iii) If it is decided at the end of completion of the work that the delay was due to the fault of the Contractor, then the Price Variation Clause will not be revived and NO PAYMENT will be made to the Contractor on this account. Additionally the Clause related to Compensation for Delay will be applied.

No payment will be made by applying “FROZEN INDICES “under any circumstances.

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Table – 1

Value of A, B & C in the escalation formula in the additional terms & conditions for Civil Works :

Sl. No.	Particulars	A % (Labour component)	B % (Material component)	C % (POL component)	REMARKS
1.	For building works	25	75	Nil	
2.	For Road works	15	80	05	
3.	For external sewerage, external water supply, and external electrification	10	90	Nil	
4.	For external water supply,external sanitary and external electrification (through labourrate contract)	75	25	Nil	
5.	For steel structural works	15	85	Nil	
6.	For steel structural works with Deptt. free supply of rolled steel sections (through labour rate contract)	75	25	Nil	
7.	For Coal Handling Plant Civil Works	25	75	Nil	
8.	For under-ground civil works such as Incline Drivage, Shaft Sinking etc.	35	65	Nil	

For all other works not listed above, the component of labour, material and POL of the total cost of work shall be as specifically indicated in the tender document.

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CPWD SPECIFICATION FOR WBM ROAD

17.1.16. Screenings : Screening to fill voids in the coarse aggregate shall generally consists of the same material as the coarse aggregate. However, where permitted, predominantly non-plastic material such as moorum or gravel (other than river bome rounded material) may be used for this purpose provided liquid limit and plasticity index of such material is below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 percent.

As far as possible screenings shall conform to the gradings set-forth in Table 17.9. Screenings of type A shall be used with coarse aggregate of grade I of Table 17.2. Screenings of type A or B as specified shall be used with coarse aggregates of grading 2. Type B screenings shall be used with coarse aggregates of grading 3. The use of screenings may ,be on-dtted in the case of soft aggregates such as brick metal, kankar and laterite. For screenings like moonun or gravel the gradings given in Table 17.9 shall not be binding.

TABLE 17.9

GRADING FOR SCREENINGS

Grading Classification	size of sieve designation screening	% by wt. passing sieve	
A	13.2 mm	13.2 mm	100
	11.2 mm	95 - 100	
	5.6 mm	15 - 35	
	180micron	0	10
B	11.2 mm	11.2 mm	100
	5.6 mm	90	100
	180 micron	15	35

17.1.17. Sealing Compound: After the curing period is over the joint portion above the filler board shall be cleaned thoroughly as directed by the Engineer.incharge. The joints shall be filled with hot applied sealing,compound. Grade A (Normal) for concrete constructions other than those which are subjected .to contact of kerosene or other heavy petroleum oils and Grade B Oet fuel resistant) for concrete constructions of runways for jet air crafts, conforming to IS:1834.

17.LI8. Sign Board (Fig.3) : It shall be casted cement concrete 1:2:4 (I Cement : 2 Coarse sand 4 Graded stone aggregate 12.5 mm nominal size) reinforced with 10 mm and 6 mm M.S. bar as directed and finished smooth with cement mortar 1 : 2 (I Cement :2 fine sand). The specifications for R.C,C, work in general shall apply as far as applicable, l20 x 60 x 30 cm high platform shall be provided in front as well as back in cement concrete 1:2:4 (I ement : 2 Coarse sand :4 Graded stone aggregate
12.5 mm nominal size) over 7.5 cm-thick lean concrete base of cement concrete 1:5:10 (I Cement : 5 Fine sand : 10 Graded stone aggregate 40 mm nominal size). Red reflectors shall be provided in the platform as shown in the drawing. 10 cm high kerb stone shall be provided along the sides of the sign post, in cement mortar 1:4 (I Cement:4 Fine sand). The are I ea between the kerb stone and the platform shall be filled up with earth and well consolidated. Specification for kerb stone and platform shall apply as per relevant clause and shall be paid for separately.

17-1.19. Soil : Soil having a plasticity index (PI) between 5 and 20 shall be suitable. Atleast
one test for 200 cubic metre of soil for determining P.I. shall be conducted.

17.1.20. Stones : These shall be clean, hard, sound and durable stones, free from decay and weathering. They shall be in blocks and hammer dressed on all sides. The size, of pitching stones shall be approximately 22.5 cm in depth and not less than 1,5 cm in any other direction.

17.1-21. Stone Chippings For Surface Dressing/ Painting: The stone chipping shall consist of fairly cubical fragment of clean, hard, tough and durable rock of uniform quality throughout. These shall be obtained by crushing stone river gravel (shingle) or other approved materials. Rounded gravel shall be used only if specifically permitted by the Engineering-Charge. The chipping shall be free of elongated or falky pieces, soft or disintegrated stone, Wt, @p vegetable matter, dust and adherant coatings. They shall conform to the quality requirements of Table 17.10.
However, the total quantity of such deleterious material including clay lumps, soft fragments,
foreign material shall not exceed 5% of the weight if the aggregate.

The aggregate shall be got tested to ensure the requirements specified in Table 17.10.

TABLE 17.10
PHYSICAL REQUIREMENTS OF AGGREGATES FOR
SURFACE DRESSING/ASPHALTIC CONCRETE

Sr.NO.	Test	Test method	Requirements
1.	Los Angles Abrasion Value	IS: 2386 (Pt.[V)	40%. max.
2.	Aggregate Impact* Value' - IS : 2386 (Pt.IV)		30% max.
3.	Flakiness Ind"	IS: 2356(part-I)	25%max.
4.	Stripping Value	Vide method given in appendix.	2S% max.
5.	Water Absorption	IS: 2386 (Pt.III)	1% max. –

*Aggregates may satisfy requirements of either of the two tests.

17.L22. Stones for Kerb and Channels : Kerb and channel stones are provided on roads having raised berms for foot path etc. These shall be of selected hard stone, sound, durable free from land nations and other structural defects. The length of each kerb and channel stone shall be not less than 49.5 cm except that 29.5 cm long stones shall be permitted for closures and for curves. The other dimensions shall be 30 x 20 cm for kerb stones and 30 x 10 cm for channel stones, unless specified otherwise. Kerb and channel stones shall be chisel dressed on exposed surface and edges. The dimensions of the exposed faces of kerb and channel stones shall be of sizes as specified with a tolerance of 10 mm in width and depth. In the case of kerb stones a tolerance of 5 cm shall be allowed in the dimensions of unexposed back and bottom faces and in the case of channel stones a tolerance of 10 nun shall be -allowed in thickness.

17.1.23. Boundary Stone (Fig. 4 ilhe boundary stones shau be of either hard stone or sound and durable quality or precast R.C.C. These shall be in blocks of size 15 x 15 x 90 cm unless directed otherwise by the Engineer-in-Charge. A tolerance of 12.5 mm shall be permitted in the specified size. In the case of boundary stones of hard stone, the top 30 cms @'be chisel dressed on all the four sides and on the top",-

The R.C.C. boundary stones shall be cast in cement concrete 1:2:4 (I cement : 2 coarse sand : 4 graded stone aggregate 20 mm non'tinal size), reinforced with 6 mm diameter mild steel bars or as directed and finished Smooth with cement mortar 1:3 (1 cement: 3 fine sand The specifications for R.C.C. work shall apply –

17.1.24. Kilometer stone (Fi& 7) : Standard design of kilometer stones are given in Fig. 6. Ordinary kilometer stone for National Highways, State highways and Major District shall be of the size 35 x 111 x 25 cm. One cm offset shall be provided around the stone slab in 10 cm height above the formation level to serve as the pedestal, - The kilometer stones shall be fixed at right angle to the centre line of the carriage way. The kilometer stone shall indicate the name
and distance of the next (intermediate) important town only. the side of the kilometer stone
facing the carriage way the number of the kilometer stone shall be marked (without the name of any place).

Kilometer stones for every fifth kilo'metre .for,," National Highways, State highwayi and, major district roads shall be of the size 50 x 152.5 x 25,caL One an offset shall be' prov-ided around the stone slab in 13 cm height above the fomi'atim level serve as the pedestal. This kilometer stone shall be fixed at right angles to the centre line way. It shall show the name and also m of the terminal or the starting station also above those of intermediate town. On the side facing the carriage way, the number of the kilometre stone in continuity of ordinary kilometre stone shall be inscribed (without the name of anyplace). Kilometre stone f -or other district roads and roads shall be of the size 35 x 93.5 x 18 CM offset shall be provided around the stone slab in 10 cnL height above the formation level to serve as the pedestal. It shall be fixed at right angles to the ' tre line of carriage way and shall indicate the name and the distance of the next important stadord on the side facing the carriage way, the number of the kilometre stone shall be prescribed (without the name of any place).,

The kilometer stones shall be fixed at the edge of the road way outside the shoulder on specially erected platforms, if necessary. In cutting these shall be fixed clear of the shoulder and the side drain as per Fig. 7(a). On existing roads stones be fixed on the side of the road a other which miles stones exist on new roads, shall be located on left hand side of the road as one from the station from which kilometer count starts.

Kilometer stones shall be of R.C.C. or stone slabs.

(a) Kilometre Stones in R.C.C. : It shall be cast in cement concrete 1:2:4 (1 cement :2 coarse sand : 4 graded stone aggregate 20 mm nominal size) with reinforcement as directed and finished smooth with cement mortar 1 :3 (1 cement:3 fine sand) on exposed surfaces above the ground. The specifications for R.C.C. work shall apply.

(b) Kilometre Stone Slabs : The stone slabs shall be of red or white sand stone unless otherwise specified. The slab shall be hard, even, sound and durable. Slabs shall have been sawn or chiselled in a plane parallel to the natural bed of the stone.The slabs shall be chisel dressed on the exposed surfaces above ground facing road side, so that the dressed face shall not be more than 3 mm from a straight edge placed on it. The thickness of the slab shall be uniform and as specified in the item with a permissible tolerance of 1.5 nun. The thickness shall be measured correct to 3 mm.

17.2 SUPPLYING AND STACKING OF MATERIALS

17.2.1 Aggregate /Red Bajri
17.2.I.0 The item of work shall specify stone aggregate/brick aggregate/red bajri, as the case
may be.

.17.2.1.1. Stacking : Ground where stacks are proposed to be made shall be cleared, levelled or dressed to a uniform slope and all lumps, 'depressions etc. shall be removed. The
stacked metal shall be free from vegetation and other foreign matter. Coarse aggregates stack shall be made at places as directed by the Engineer-incharge. All rejected stone metal shall be removed from the site.

The aggregate shall be stacked in convenient units of one metre top width, 2.2 m bottom width, 60 cm height and of length in multiples of 3 m for new roads. Where berm width is limited or for repair works it shall be stacked in units of 40 cm top width 1.4 in bottom width, 50 cm height and length in multiples of 3 m. Template of steel shall be used for making the stacks and shall always be kept at site for check measurements. The Engineer-in-Charge may permit stacking in different sizes and height ranging between 45 to 75 cm for new roads and 40 to 60 cm for repair work, in case the site condition so demand. In a particular reach of road as decided by- the Engineer-in-Charge, the quantity of stacked material shall be comparable to the theoretical quantity required for W.B.M. to be laid in that reach.

The stack,,, shall be uniformly distributed along tile road and shall be numbered serially. The number plate shall be planted on each stack, which shall remain in position until the stack is used in the work. A register showing daily consumption of stacks shall be maintained at site of work. The collection of stone metal shall be for completed length of one km (for each layer of W.B. macadam) or as directed by the Engineer-in-Charge in writing.

17.2-1.2. Measurements: Lengh, breadth and height shall be measured correct to a cm. The total quantity so arrived shall be reduced by 7.5% to arrive at the net quantity for payment, in cases of aggregates. No such reduction shall be made in case of fine aggregate i.e. Red Bajri & screening etc. as defined under clause 17.1.2.

17.2.1.3. Rate : The rate shall include the cost of all materials and labour involved in all the operations described above.

17.2.1 Binder

Stacking : Specified binder shall be brought to the site of work in the sealed original containers. Binder brought in damaged containers shall not be allowed. The material shall be stacked in fenced enclosures, as directed by the Engineer-in-Charge, on one side of the roadway. The material shall be purchased from reputed firms or their authorized dealer. All the drums brought to site shall be serially numbered and used in the same order. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or for atleast a fortnight's work.

For major bituminous road works, supply of bitumen in bulk may be taken for economical reasons, or if the contingencies of the work so require. Sufficient storage arrangement shall be made at site for atleast ten days requirement.

Materials shall be kept in the joint custody of the contractor and the representative of the Engineering-Charge. The empty containers shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from tile Engineer-in-Charge. A few drums may be removed before completion of work for heating bitumen and mixing aggregates etc. with the permission to the Engineer-in-Charge.

Empty drums required to be returned to stores shall be in good condition. Recovery rate for nonreturn of the empty drums or for the damaged drums shall be as decided by the engineer-in- charge.

17.2.2.2. Measurements : The materials shall be recorded as per standard weights of different type of container as intimated by manufacturers. The material shall be weighed where containers are found leaking.

172.2.3. Rate : The rate shall include the cost of all Tabour and materials involved in all the operations described above.

1723. Moorum/stone chippings

17.L3.0. The item of work shall specify moorum/ stone cydppings, as the cases may be.

17.2.3.1. Stacking : Ground where stacks are proposed to be made, shall be dressed to a uniform slope and all lumps, depressions etc. shall be removed. Sample of moorum shall be got approved from the Engineer-in-Charge, before the material in bulk is brought to site.

Moorum shall be stacked in convenient units of one cubic metre in between aggregate stacks in each length of 100 m as per requirement. The stacks shall be made with wooden boxes open at both ends and of 2 x 2 x 0.25 m dimensions. These shall always be kept at site for stacking and check measurement.

The stacks shall be uniformly distributed along the road. The supply of moorum shall be completed for the entire work or for a complete length of one km or 'as' directed by the
Engineer-in-charge in writing.

17.2.3.1 Measurements: Length and breadth of boxes shall be measured correct to a cm. Volume shall be, calculated in cubic metres, correct to two places of decimal.

172-3.3. Rate : The rate shall include the cost of all materials and labour involved in all the operations described above.

17.3. EARTHWORK IN ROAD CONSTRUCTION

17-3.1. Earthwork connected with road construction fall broadly into three categories.
a) Earthwork in cutting including borrow pits.
b) Earthwork in fillings in embankments (without optimum moisture conditions).
c) Earthwork in fillings in embankments (under optimum moisture conditions).

17-3.2. Detailed specifications relating to Earthwork already described in Chapter 2.0 of CPWD specification Vol. 1 1996 so far as the various options in the earthwork for road construction as indicated below shall be applicable.

2.4 Site clearance
2.5 Setting out and making profile
2.6 Blasting operations
2.7 Excavation in all kinds of soils
2-8 Excavation in ordinary/hard rock
2.9 Earthwork in filling
2.10 Measurements

2.11 Rates

2.12 Surface excavation
2.13 Rough excavation and filling

17.3.3. In addition to the above, there are certain special requirements of earthwork for road constructions, especially in embankments and excavations from borrow pits. These shall broadly conform to.

a) IRC: 36 Recommended practice for construction of earth embankments for road works.
b) IRC : 1 0 Recommended practice for borrow pits for road embankments by manual operations.

Excavation from borrow pits shall conform to provisions in para 3 of IRC: 10 'and the road embankment shall generally conform to section, slopes and location of borrow pits as per Fig. 5.

17.4. EMBANKMENT CONSTRUCTION (WITHOUT OPTIMUM UM MOISTURE CONDITIONS)

17.4.0. In addition to what is described in 17.3 above, the following shall apply : materials used in embankments shall be earth moorum, gravel, a mixture of these or any other material approved by the Engineer-in-Charge. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredients likely to deteriorate or affect the stability of the embankment. The work shall be so planned and executed that the best available materials are saved for the top portion of the embankment.

Highly expansive clays exhibiting marked swell and shrinkage properties may be deposited only at the bottom of the embankment and no such material shall be placed nor permitted to remain in the top 500 mm portion of the embankment below the subgrade.

17.4.1. Preparation of Foundations: The foundations of the embankment shall be ploughed to a depth of 15 to 25 cm. All clods shall be broken into fine earth and the area roughly levelled. The surface shall then be well watered before the earth work is started.

17.4.2. Source of Supply

17.4.2.1. The material 'used in embankment shall be obtained either from cutting highground or from borrow pits as directed by the Engineer-in-Charge. In case of.road embankments, the borrow pits may be excavated along the sides of the road so as to form road side drains with proper slopes and sections. The clear beam width between the toe of the bank and the inner edge of the borrow pits shall be specified by the Engineer-in-Charge but it shall not be less than 5 metres after making due allowance for future development.

17.4.2.2 Borrow pits shall be rectangular in shape with one side parallel to the centre line of the road. If on road land, these shall be dug as near the boundar), as possible. Borrow pits all not be dug continuously. Ridges of not less than 8 metres width should Se left at intervals not exceeding 300 metres. Small drains should be cut through the ridges to facilitate rainage. Borrow pits shall be well drained. The bed level of the borrow pits, shall, as far as possible, slope down progressively towards the nearest cross drain, if any and shall not be lower than tl)e bed of the cross drain. Borrow pits shall not be dug within 0.8 km of towns or villages. If unavoidable these shall not exceed 30 cm in in depth and shall be drained.

17.4.2.3. Where it becomes necessary to borrow filling materials from temporarily acquire cultivable lands the depth of borrow pit.,, shall not exceed 45 cm. The top soil to a depth of 15 cm -;hall be stripped and stocked aside Therefore soil shall be dug out to a further depth not exceeding 30 cm and used in forming the embankment. The top soil shall then be spread back on the land.

17.4.2.4. In case of flood and marginal banks, earth shall be obtained from borrow pits on the river side of the banks. No borro", pit shall be excavated on the land side of the bank, unless permitted b-.1 the Engineer-in-Charge in writing depending upon the depth of borrow pits and height of embankment. However the minimum berm width between the toe of the bank and the edge of the borrow pits on the river side shall be 15 metres and that between the toe of the bank and the edge of the borrow pit. -; on the land side 25 metres.

17.4.2.5. Guide-banks shall be constructed from material obtained from excavation for laying stone aprons and further borrow pits excavated if necessary according to the directions of the Engineering-Charge.

17.4.3. Earth filling and compactions

17.4.3.1. Before commencement of filling the toe lines of the embankment shall be marked by pegs driven into the ground at 15 metres intervals and by continuous ni cking (daf balings to indicate the limit., of the side slopes. Bamboo and string profiles shall be erected at ever), 60 metres interval in straight reaches and 15 metres apart in curved portions.

17.4.3.2. Embankment material shall be laid in 20 cm layers which shall be continuous and parallel to the finished grade. The placing of earth fill shall be done in the full width of embankment including slopes, and the section of formation shall be kept slightly 'sloping away from the centre to avoid pools of water forming due to rain. The height of filling in different sections shall be uniform as far as possible. All clods shall be broken while the earth is being placed. Organic matter of any kind shall be removed and disposed off is directed by the Engineer-in-Charge.

17.4.3.3. Joining of old and new embankments shill be done by stepping in an overall slope of about 1 to 5.

17.4.3.4. Each layer of earth still be adequately watered to aid compaction.

17.4.3.5. If the material delivered to the road bed is too wet it shall be dried by aeration and exposure to the sun, till the moisture content is acceptable for compaction. It shall them be rolled with roller of minimum 1/2 tonne weight, not less than 5 times, till it gets evenly and densely consolidated with wooden or steel rammers of 7 to 10 kg weight having a base of 20 cm square or 20 cm diameter. The labour for ramming shall be atleast one rammer to six diggers. Every third layer of earth and the top most layer shall be well consolidated with a power roller of minimum 8 tonnes weight, rolled not less than 5 times, till the soft be have s as anelastic material and gets compressed only elastically under the load of roller.

17.4.4. Dressing: The embankment shall be dressed neatly as per designed section and grade, after it has been completed and thoroughly consolidated. The top and slopes shall be
protected from any damage and maintained, till the work is completed and handed over to the Engineer-in-Charge.

17.4.5. Embankment around structures

17.4.5.1. To avoid interference with the construction of abutments, wing walls or return walls of culvert/ bridge structure, the contractor shall at points to be determined by the Engineer-in-Charge suspend work on embankments forming approaches to such structures, until such time as the construction of the latter of sufficiently advanced to permit the completion of approaches without the risk of interference of damage to the bridge work

17.4.5.2. Urdess directed otherwise, the filling around culverts, bridges and other structures upto a distance of twice the height of the embankment. The fill material shall not be placed against any abutment or wing wall unless permission has been given by the Engineer-in-Charge but in any case not until the concrete or masonry has been in position for 14 days. The embankment shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of work in this regard
shall be got approved from the Engineer-in-Charge.

17-4.5-3. Where the provision of any filter medium is specified behind the abutment, the Same shall be laid in layers simultaneously with the laying of fill material. The material used for filter material shall conform to the requirements for filter medium as specified. Payment for providing filter material shall be made separately under relevant items.

17.4.5.4. Where it may be impracticable to use power roller or other heavy equipment, compaction shall be carried out by mechanical tempers or other methods approved by the Engineer-in-Charge. Care shall be taken to see that the compaction equipments does not hit or come too close to any structural member so as to cause any damage to it.

17.4.6. EARTH WORK FOR WIDENING EXISTING ROAD EMBANKMENT

17.4.6.1. When an existing embankment is to be widened and its slope is steeper than 4:1 continuous horizontal benches each atleast 0.3 metre wide, shall be cut into the old slope for
ensuring adequate bond with the fresh embankment material to be added. The material obtained from cutting of benches could be utilised in the widening of the embankment. However, when the existing slope against which the fresh material is to be placed is flatter than 4:1 the slope surface may only be ploughed or scarified instead of .resorting to benching.

17.4.6.2. Where the width of the widened portion is insufficient to permit the use of
standard rollers compaction shall be carried out with the help of sheep's foot roller mechanical tampers or other approved equipment. End dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other type of hauling equipment.

17.4.7. Cutting : Where the formation level of the road is lower than the ground level, cutting
shall be done up to formation level. Side slopes except in rock cutting shall be evenly and truly dressed.

17.4.8. Disposal of surplus Earth : Earth from cutting shall be utilised for filling in embankment as directed by the Engineer-in-Charge. Earth not required for embankment shall be disposed off as directed by the Engineer-in-Charge. The are a where the surplus earth is disposed off shall be leveled and neatly dressed. When the surplus earth is disposed off at a distance of more thin 50 meters the extra lead shall be paid for.

17.4-9. Measurements : The quantity of earth work shall be calculated by measuring the volume of earth excavated from the borrow pits and shall be done as specified in 17.3.2 and
17.3.3. Where it is not possible or convenient to take measurements from cutting the filling should be measured and the quantity of earth work computed from cross sections of the filling. The quantity of earth work so computed shall be reduced by 5% to arrive at the quantity for payment.
For the purpose of taking measurements of earth work in cutting or embankment, ground levels of the area shall be recorded as specified in 17.3.2.

17.4.10. Rate: It includes the cost of all the operations described above. The lead and lift
for depositing the earth or disposal of unsuitable material shall be as described in the

description of item. It also includes the work mentioned in sub-para (f) and (g) of 2.11.1 of C.P.W.D. Specification 1996 Vol. 1. Wherever applicable payment for jungle cutting and removing roots of trees of girth above 30 cm at a height of I m above ground shall be made separately as specified in 2.4.2 of C.P.W.D. Specification 1996 Vol. 1.

17.5. EMBANKMENT CONSTION (UNDER OPTIMUM MOISTURE CONDITIONS)

17.5.1. In the case of earth work consolidated under optimum moisture conditions each layer of earth shall be carefully moistened to give field moisture content of about +1% to -2% of the optimum moisture content (OMC). The OMC shall be determined according to IS: 2720 (Pt.VIII) Methods of Tests for Soils. Each laver shall then be compacted by rolling with 8 to 10 tonnes power road roller and a sheep foot roller if required. The required amount of water shall be added during consolidation to keep the moisture content of the soil at the optimum as per test. The density to be achieved for each layer of the material shall not be less than 95% of the density obtained in the laboratory (Proctor Method).

17.5.2 Each compacted layer shall be tested in the field for density and accepted before the operations for next layer are begun.

17.5.3. Control on compaction in the field shall be exercised through frequent moisture content and density determinations. A systematic record of these shall be maintained. At all times during construction the top of the embankment shall be maintained at such cross fall as will shed water, and prevent ponding.

17.5.4. Density measurement and acceptance criteria

17.5.4.1. One measurement of density shall be made for each 500 sqm of compacted area or for a srtialler area as decided by the Engineer-in-Charge. Each measurement shall consist of atleast 5 density determinations and the average of these 5 determinations shall be treated as the field density achieved. The determination of density shall be is per IS : 2720
(Pt.XXVIII).

17.5.42 In general the control at the top 40 cm thickness of the formation shall be more strict with density measurements being done at the rate of one measurement for 250 sqm of compacted area. Further for the determination of the mean density the number of tests in one measurement shall not be less than 10 and the work will be accepted if the mean dry density equals or exceeds the specified density.

17.5.4-3. When density measurements reveal any soft areas in the embankment, the Engineer-in-Charge shall direct that these be compacted further. If inspite of that the specified compaction is not achieved the material in the soft areas shall be removed and replaced by approved materials and compacted to the satisfaction of the Engineer-incharge.

17.5.5. Control tests on borrow material,

17.5.5.1. Soil suitable for consolidation under O.M.C. conditions should preferably have the following characteristics

a) Minimum percentage of clay 10%
b) Liquid limit 14
c) Plasticity index 4
d) Percentage of silt should not exceed 50%
e) Peat, muck and organic soil-, are unsuitable.

17.5.5.2 The Engineer-in-Charge may, however, relax these requirements taking into account availability of materials, cost of transportation and other relevant factors.

17.5.5.3 Various test required to be conducted on the borrow material with their recommended frequency are indicated below. All the test need not be stipulated on every project.

Depending upon site condition etc. only some may be found necessary at a particular project. The frequency of testing indicated refers generally to the minimum number of tests to be conducted. The rate of testing must be stepped up as found necessary depending upon the variability of the materials and compaction methods employed at a project.

a) Gradation : At least one test for each kind of soil. Usual rate of testing I to 2 tests per 8000 cum of soil.

b) Plasticity : At least one test for each kind of soil. Usual rate of testing I to 2 tests per 8000 cum of soil.
c) Proctor Tests : At the rate of 1 to 2 tests per 8000 cum of soil.
d) Deleterious Contents : As required.
e) Moisture contents : One test for every 250 *cum* of soil.

17.5.6. Measurements: The filling shall be measured and quantity of earth work computed from cross sections of filling or the embankment. No deduction shall be made for voids.

17-5.6.1. Rate shall include the cost of all operations described above including operation mentioned in 17.3 to the extent applicable.

17-6. SUB-GRADE : PREPARATION AND CONSOLIDATION.

17.6-0. In subgrade composed of clay, fine sand or other soils that may be forced up into the coarse aggregate during rolling operation, an insulation layer of granular materials or over size brick aggregate not less than 10 cm thick' of suitable thickness shall be provided for blanketing the' subgrade. Such shall be paid for separately, unrest otherwise specified.

In slushy soils or in areas that are water logged, special arrangements shall be made to improve the sub-grade and the total payment thickness shall be designed after testing the properties of the sub-grade soil. Necessary provision for the special treatment required shall be made in the project and paid for separately.

17.6-1. Preparation of sub-grade 'nic surface of the formation for a width of sub-base, which should be 15 cm more on either side of base course, shall first be cut to a depth equal to the combined depth of subbase and surface courses below the proposed finished level (due allowance being made for consolidation). It shall then be cleaned of all foreign substances. Any ruts or soft yielding patches that appear due to improper drainage conditions, traffic hauling or from any other cause, shall be corrected and the sub-grade dressed off parallel to the finished profile.

17.6.2. Consolidation : The sub-grade shall be consolidated with a power road roller of 8 to 12 tonnes. The roller shall run over the sub grade tifl the soil is everdy and densely consolidated and behaves as an elastic mass (the roller shafl pass a minimum of 5 runs on the sub grade). All undulations in the surface that develop due to rolling shall be made good with material or quarry spoils as the cases may be and the sub grade is rerollecl

17.6.3. Surface Regularity: The finished surface shall be uniform and conform to the fines, grades and typical cross section shown in the drawings, when tested ,with the template and straight edge, the variation shall be within the tolerances specified in Table 17.11.

TABLE 17.11

PERMISSIBLE TOLERANCES OF SURFACE
EVENNESS OF SUB GRADE

longitudinal profile	Cross profile
maximum permissible undulation when	maximum permissible variation from specified

measured with a 3 metre straight edge	profile when measured with a camber template
24 mm	15 mm

Where the surface irregularity of the sub grade falls outside the specified tolerance. The contractor shall be liable to rectify these with fresh material or quarry spoils as the case may be, and the subgrade rerolled to the satisfaction of Engineer-in-charge.

17.6.4. Measurements: The length and width shall be measured correct to a cm. The area shall be worked out in square metre, correct to two places of decimal.

17.6.5. Rate : The rate for preparation and consoli dation of sub grade shall include the cost
Of materials and labour involved for all the operations mentioned in 17.6.1 to 17.6.3 above unless otherwise specified.

17.7. SUB BASES

17.7.0. This may consists of one of the following

a) Lime fly ash stabilized soil : This may be used where lime and flyash conforming to IS specification are available and where arrangements can be made for pulverizing the soil and mixing it with lime and flyash. This can be used instead of soling or oversize metal in the sub base course of the pavement. This is not recommended in clayey sub grades with high moisture contents where the soil is in the form of wet lumps which cannot be pulverised.
b) Water bound macadam with stone aggregate: Stone aggregate of size 90 mm to 45mm is used , This is a standard sub base and is used where stone aggregate is available at reasonable rates. This consists of clean crushed coarse aggregate mechanically interlocked by rolling, and voids thereof filled with screening and binding material with the assistance of water, laid on a prepared sub grade, sub-base, base or existing pavement as the case may be. Water bound macadam may be used as a sub base, base course or surfacing course.
c) Water bound macadam brick aggregate: Brick aggregate of size 120 mm to 40 mm is used. This is used when stone aggregate is costly. This is also used oversoft clayey sub grades with high moisture contents and low CBR values.
d) Water bound macadam with over burnt (Jhama) brick agggreate : Over burnt Jhama) brick aggregate of size 90 mm to 45 mm is used. This is used when stone aggregate is costly and over burnt brick aggregate is available at reasonable rates.

e) Lime fly ash concrete Can be used in heavy rain fall areas, black cotton soil areas as it is resistance to softening under water and will lead-to reduction in thickness of base course in conformity with IRC 88.
' i .
17.7.1.. Lime fly ash stabilised soil sub-base

17.7-1-1. The thickness of lime fly ash soil layer for use as sub base should be designed in accordance with IRC 37. The minimum thickness shall not be less than 15 cm.

17.7.1.2. Soil : Granular soils free from high concentration of organic matter or deleterious salts and sand with fine silts produce better mixes than fine grained soil with high clay content. Clay, silts and low plastic clays with plasticity index between 5 and 20 and liquid limit less than 25 are however, suitable the minimum proportion of particles smaller than 425 micron should be between 15 and 25 percent by dry weight of the soil lime fly ash mixture. Selection of material and their gradation should be such as would be conducive to compaction to high density.

17.7.1.3. Lime : Should be commercial dry lime slaked at site or site or pre-slaked and delivered in airtight sacks. Suitable approve lime should have purity (Cao content) of not less than 50 percent. Only hydrated high calcium and mono hydration dolomitic limes are to beused. Quick hme is not recommended for use. Where in exceptional circumstances, when with 50% purity is not available, the deficiency can be compensated by using larger proportion of lime.

17.7.1.4. Fly ash : Shall conform to IS : 3812. ff it is partially set due to long storage, it should be pulverised and dry sieved before mixing, to conform to following grading,

Sieve Size (mm)	*Percenf passing*
12.5	100 (min)
9.5	95 (niin)
2.0	75 (min)

Flyash should be fine enough to have a specific surface are of 3200 sq.cm/gm or 320 sqm/kg. It should be ensured before its use, that fly ash possesses- lime relativity of not less than 35 kg/sq.cm. Fly ash should be stored in covered area safe from moisture.

17.7.1.5. Mix Proportioning : The mix proportion shall be determined in conformity with IRC-88 through laboratory tests for meeting the strength requirements. A typical mix proportion of soil lime, fly ash is given below: Soil 8,5 parts by weight lime 3 parts by weight (based on 80% purity of lime) Fly ash 12 parts by weight

17.7.1.6. Tolerance : L-mits of tolerance for various materials in percentage by weight shall be as folloa,s:

Lime + 0.3
Flyash + 1.5
Soil ± 2.0

17.7.1.7. Surface irregularities: The finish surface should be checked for line, level and grade and surface finish. The maximum permissible undulation in longitudinal profile shall not exceed 15 mm when checked with 3 metre straight edge and in cross profile the variation from specified profile should not exceed 12 mm.

The quantity of water shall be as per the O.M.C. requirements determined on soil lime flyash mixture by proctor density method,

17.7.1.8. Construction operation : Mixing shall preferably be done by mechanical plant either of the single pass or multiple pass type, where such plant is not available, manual method may be adopted with rigorous control over quality of construction, In the manual method, the soil shall be pulverised by means of crowbars, pick axes, bullock drawn ploughs etc. and deposited on the road bed in stacks of suitable size, about 30 cm in height. Water in requisite quantities shall be sprinkled on the soil for aiding pulverisation. The degree of pulverisation shall be as given in table 17.12.

TABLE 17.12

Siew Designation	% by weight passing the sieve.
25 nun	100 mm
4.75 mm	60 mm

On the pulverised soil stacks, lime and flyash in a thoroughly mixed form and in the requisite quantities shall be spread uniformly and mixed by cutting with spade till the whole mass is uniform. The mixed soil shall then be spread over the prepared sub-grade to the required
thickness and

TABLE 17.13.

Coarse aggregate			Stone screenings		Binding material
classification	Size range	Net qty.	Classification/grading & size	Quantity	
Grading - I	90to45 mm	1.21 to 1.28 cum.	Type A – 13.20 mm	0.27 to 0.30 cum.	0.08 to 0.10 cum.

Note : Net quantity = Loose quantity measured in stacks minus 7.5%.

17.7.2.2. Preparation of foundation In the case of an existing unsu'rfaced road, where new materials is to be laid, the surface shall be scarified ind reshaped to the required grade, camber and shape as rolled. Before rolling, the moisture content shall bt, adjusted to be within + 1% and –2% of the O.M.C.

17.7.1.9. Rolling : Rolling shall be done with and 810 tonne roller. Rolling is continued till the required density (100% of Lab. Proctor density as per IS : 2720 Pt.VII) and a smooth
surface obtained without leaving any roller marks on the surface. During rolling surface should be checked for grade and camber and irregularities corrected.

17.7.1.10. Curing : The compacted surface shall be cured for a minimum period of 7 days before the next layer is placed. Curing is done by sprinkling water over the surface five or six times a day. The surface shall not be allowed to dry during the curing period. Curing by ponding shall not be adopted.

17.7.1.11. Measurements: The lengths and breadth shall be taken to the nearest centimeterand the thickness to the nearest 'half centimeter. The consolidated cubical contents shall be calculated in cubic metres; correct to two places of decimals.

17.7.1.12. Rate : The rate shall include the cost of materials and labour involved in all the operation.-, described above.

17.7.2. Water bound macadam with stone aggregate (of size 90 mm to 45 mm)

17.7.2.1. Quantities of materials : Quantities of coarse aggregate, screening and binding material required to be stacked for 100 mm approximate compacted thickness of W.B.M. subbase course for 10 sqm shall be as per table 17.13. Supply and stacking of aggregates
screening which shall be piid. for separately, shall be as described in 17.2.

necessary. Weak places shall be strengthened, corrugations removed and depressions and
pot holes made good with suitable materials, before spreading the aggregate for W.B.M.

Where the existing surface over which the sub base of W.B.M. is to be laid is black topped, to ensure effective internal drainage, furrows 50 mm x 50 mm (depth of furrows increased to reach bottom bituminous layer Where necessary at one nietre intervals shall be cut in the existing bituminous surface at 45 degree C to the central line of carriageway before the W.B.M. is laid.

17.7.2.3. Provision of lateral confinement of aggregates : Before starting with W.B.M. construction, necessary arrangements shall be made for lateral confinement of aggregates. One method is to construct

side shoulders in advance to a compacted layer of the W.B.M. coarse (F;g.1). Inside edges may be trimmed vertical and the included area cleaned off all spilled materials thereby setting the stage for spreading the coarse aggregate.

The practice of laying W.B.M. after excavating a trench section in the finished formation must be completely avoided.

17.7.2.4. Spreading Aggregate: The coarse aggregate shall be spread uniformly and evenby upon the prepared base in required quantities with a twisting motion to avoid segregation. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed base be permitted. The aggregates shall be spread uniformly to proper profile by using templates placed across the road six metres apart. Where specified, approved mechanical devices may be used to spread the aggregates uniformly. The levels along the longitudinal direction upto which the metal shall be laid, shall be first obtained at site to the satisfaction of Engineer-in-Charge, and these shall be adhered to.

The surface of the aggregate spread shall be carefully trued up and all high or low spots remedied by removing or adding aggregate as may be required.

The W.B.M. sub-base shall be normally constructed in layer of 100 mm compacted thickness. No segregation of large or fine particles shall be allowed and thecoarse aggregiteas spread shall be of uniform gradation with no pockets of fine material.

The coarse aggregate shall normally not be spread in lengths exceeding three days average work aihead of the rolling and blending of the proceeding section.

17.7.2.5. Rolling : Immediate]), following at spreading of tl-ie coarse aggregate, it shall be compacted to the full width by rolling with either the tliree-wheel-power roller of 8 to 10 tonnes capacity or an equivalent vibratory roller. initially,, light rolling is to be done, which shall be discontinued when the aggregate is partially, compacted with sufficient void space in them to permit application of screenings.

The rolling shall begin from the edges with the roller running forward and backward and dding the screenings simultaneously until the edges have been firmly compacted. The roller shall then progress gradually from the edges to the centre, parallel to the centre line of the road and overlapping Uniformly, each preceding rear wheel track by one half width and shall continue until the entire area of the course has been rolled by the rear wheel. Rolling shall continue until the road metal is thoroughly, keyed wiith no creeping of metal ahead of the roller. Onl@, slight sprinkling of water may be done during rolling, if required. On super elevated curves, the rolling shall proceed from the lower edge and progress gradually continuing towards the tipper edge of the pavement.
Rolling shall not be done when the sub-grade is soft or yielding or when the rolling causes a wave like motion in the sub-base or sub-grade. When rolling develops irregularities that exceed 12 mm when tested with a three metre straight edge, the irregular surface shall be loosened and then aggregate added to or removed from it as required and the area rolled until it gives a uniform surface conforming to the desired cross-section and grade. The surface shall also be checked transversely by template for camber and any irregularities corrected in the manner described above. In no case shall the use of screenings to make up depressions be permitted.

17.7.2.6. Application of Screenings : After the coarse aggregate has been lightly rolled to the required true surface, screenings shall be applied gradually over tlle surface to completely full the interstices. Dry rolling shall be continued while the screenings are being spread so hat the jarring effect of the roller causes them to settle into the voids of the coarse aggregates. The screenings shall not be dumped in piles on the coarse aggregate but shall be spread uniformly in successive thin layers by the spreading motion of the hand, shovels or mechanical spreader.

The screenings shall be applied at a slow rate (in three or more applications) so as to ensure filling of all voids. Rolling and broorrdng shall continue with the spreading of the screenings, Either mechanical brooms or hand brooms or both may be used, In no case shall the screenings be applied, so fast and thick as to form cakes, ridges on the surface making the filling of voids difficult, or to prevent the direct bearing of the roller on the coarse aggregates. The spreading, rolling and brooming of screenings shall be performed on sections which can be completed within one day's operation and shall continue until no more screenings can be forced into the voids of the coarse aggregates Damp and wet screenings shall not be used under any circumstances.

17.7.2.7. Sprinkling and Grouting: After spreading the screening and rolling the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screening into' the voids and to distribute them evenly. The sprinkling, sweeping and rolling operations shall be continued and additional screenings applied where necessaryly until the coarse aggregates are well bonded and firmly set for the entire depth and until a grout has been formed of screenings and water that will fill all voids and form a wave of grout ahead of the wheels of the roller. The quantity of water to be used during the construction shall not be excessive so as to cause damage to the sub-base or sub-grade.

17.7.2-8. Application of Binding Material : After the application of screenings and rolling, a suitable binding material shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in with hand brooms or mechanical brooms or both so as to fill the voids properly. The, surface shall then be rolled by a 8-10 tonne roller, water being applied to the wheels in order to wash down the binding material that may get stuck to the wheels. The spreading of binding material, sprinkling of water, sweeping with brooms and rolling shall continue until the slurry, that is formed will, after filling the voids form a wave ahead of wheels of the moving roller.

17.7.2.9. Setting and Drying: After final compaction of the course, the road shall be allowed to cure overnight. Next morning' defective spots shall befilled with screenings or binding material, lightly sprinkled with water, if necessary and rolled.

No traffic shall be allowed till the macadam sets.
7.7.2.10. Surface Evenness : The surface evenness of completed W.B.M. sub-base in the longitudinal and transverse directions shall be as specified in Table 17.14.

TABLE 17.14

Siaze of coarse aggregate	Longitudinal profit measured with a 3m St. edge.			Cross profile
	Max Permissible	Max. no. of undulations permitted in any 300m length exceeding-		Max. permissible undulations when measured with a camber template.
		12mm	10mm	'--
90 to 45mm	15mm	30	--	12mm

The longitudinal profile shall be checked using a 3 meter long straight edge and graduated wedge at the middle of each traffic lane along a line parallel to the Centre line of the road. The transverse profile shall be checked with adjustable template at intervals of 10 meters.

17.7.2.11. Rectification of Defective Construction Where the surface irregularity of the W.B.M. subbase course exceeds the tolerances specified in table 17.14 or where the course is otherwise defective due to sub grade soil mixing with the aggregates, the layer to its full thickness shall be scarified over the affected area, reshaped with added material or removal and replaced with fresh materials as applicable, and recompacted. The area treated in the aforesaid manner shall not be less than 10 som. In no case shall depressions be filled up with screenings and binding materials

17.7.2.12. Measurements : The length and breadth shall be taken to the nearest centimeter. The depth of consolidated layer shall be computed to nearest half centimeter by taking average of depths at the. Center and at 30 cm from the-left and right edges at a cross section taken at 100 metre interval or less as decided by the Engineer-in-Charge by making small pits. The consolidated cubical contents calculated in Cubic metres correct to two places of decimal. The cubical contents fcr each 100 metres length should be compared with the volume of aggregate collected less 7.5% as described in 17.2.1.2 i.e : The rate shall include the cost of *all* material.-, involved in all the operations over except cost of store aggregate, mooruum, screenings and bajri, for which payments shall be made. Where W.B.M. is to be laid over an existing road, scarifying and consolidation of the aggregate received from scarifying shall be paid for separately.

17.7.3. Water bound Macadam with Brick Aggregate/overburnt (Jhama) brick Aggregate

17.7.3.1. Quantities of materials : Approximate quantity of brick aggregate (to be paid for separately) required to be stacked for 100 mm average compacted thickness of W.B.M. sub-base shall be 1.60 cum (approximate). The quantity of bindini,, *material,* if required shall be as specified by the Enoeer-in-Charge. Brick aggregate shall be broken from overbumt or well burnt brick bats. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt and other foreign matter.

17.7.3.2 Foundation shall be prepared as specified in I7.7.2.2.

17.7.3.3. For spreading aggregate clause 17.7.2.4 shall apply. except that the quantities of materials shall be as given above.

17.73.4. The rolling shall be done as specified in
17.7.2.5 except that rolling shall be done with the light power roller. The use of screenings shall also be omitted. Rolhng shall be done 3 to 5 times for each layer.

17.7.3.5 For rolling with Binding material clause 17.7.2.8 shall apply except that rolling shall be done with a light power roller instead of a heavy road roller and water shall not be used during rolling. Rolling shall be done 3 to 5 times for each layer.

17.7.3.6. Surface Evenness rectification of Defective construction, Measurements and
Rate shall be as specified under 17.7-2.10. to 17.7.2.13.

17.7.4. Lime Flyash concrete

17.7.4.1. Materials

17.7.4.1.1. Lime : Lime should coiiform to class C variety as per IS:712 standard
specification for building lime. Lime used shall be in dehydrated form and purity -,hill not be less thin 60 percent,

17.7.4.1.2. Flyash : Shall conform to IS:3812.

17.7.4.1.3. Aggregates shall be stone aggregate or brick aggregate as specified. Fine aggregate shall conform to IS:383. Aggregate shall be collected and stacked as described in 17.2.

17.7.4.1.4. Water used should be clean and free from deleterious matter.

17.7.4.2. The thickness of lime flyash concrete to be used as sub-base shall be designed according to IRC 37 guidelines for design of flexible pavements but the thickness in no case be less than 10 cm.

17.7.4.2.1. Besides superior load spreading properties, lime flaysh concrete is resistant to softening under water action and can be very suitable in very heavy rainfall areas black cotton soil areas (when hard over lime stabilised black cotton soil) and in areas where good stone has to be obtained invoking long leads. There will also be reduction in thickness of sub base bv 20-30 percent as compared to conventional granular base corners

17.7.4.2.7 The mix and thickness of base concrete shall be designed by trial and error method. Parti culars of typical lime flyash concrete mixes are given in Table 17.15 (as per table I of IRC 60 Part IV).

TABLE 17.15

PARTICULARS OF TYPICAL LIME-FLYASH MIXES

S. Mix Proportiorts (ky iieiglit)				*Water Content*	*28-d@ys strength kg.Aq.cm*	
Linic: Flyash: Sand: Coarse Agg.				*1%* by wt. of mix materials)	Compr-essive	Flexu-ral
1. 1	:2.0	:4.0	9.0	10.7	36	5.7
2. 1	2.0	4.0	9.0	9.7	49	8.0
3. 1	*2.0*	*2.5*	*5.25*	*10.0*	*69*	*14.8*
4. 1	*2.0*	*2.2.5 :*	*6.75*	*10.8*	*72*	*11,6*
5. 1	*2.0*	*2.7*	*6.3*	*11.0*	*75*	*14.8*
6. 1	*1.5*	*3.3*	*7.5*	*9.7*	*60*	*8.0*
7. 1	*1.5*	*2.7*	*8.3*	*7.0*	*69*	*11.6*
8. 1	1.5	2.25	5.25	9.7	75	14.8

Course Aggregite size shall not exceed 40 mm for 10 cm thick concrete The laboratory mix !should be designed for I:25 times the required field strength to provide for variation in 28 days strength in the field due to variation in grading, size of coarse and fine aggregate and water content.

17.7.4.2.3. Preparation of sub-grade shall be as per
17.6.1. To prevent absorption of water from lime flyash concrete the underlying layer should either be covered by water proof paper (to be paid for separately) or brought to moist conditions without free water as directed by the Engineer-in-Charge before laying lime flvash concrete. For this purpose the under layer may be saturated not less than 6 hours nor more than 20 hours in advance of laying flyash concrete, if necessary by light sprinkling prior to concreting the areas which have become dry.

17.7.4-3. Storage of lime and flaysh shall be done with adequate care. Lime prepared by slaking quick lime shall be used within a week to avoid carbonation by aeration. If stored lime is supplied in dry in-dehydrated form in air tight bags, the period of storage ma), be upto 3 months, provided it is stored in dry covered place.
Flyash being very fine material will be carried 3way by wind. For protection flyash may, be begged or stored in regular trapezoidal pits kept wet at top or covered by tarpaulins to Prevent loss by winds.

7.7.4.4. Materials for making lime flyash concrete hall batched by weight used approved weigh batching equipment, volume batching permitted only when unavoidable. Proportions of material ;hould be dearly specified. Due allowance should be made for free moisture absorption in aggregates lime and flyash.

7.7.4.5. Mixing shall be done in power driven mixtures of approved type and uniform homogeneous mixing of the ingredients assured. ixes shoul@iiot be over loaded and mixing time would not be less than 2 minutes.

7.7.4.6.1. Laying and compaction : The mixed concrete may be laid on the sub-grade to conform to ie required levels and profile with provision of in charge to account for compaction. The surcharge would be determined by trial mixes in the field and in normally 20-25 per cent of the thickness of layer) be laid.

Compaction of concrete shall be done by 8-10 torines roller in case of hard stone aggregate and 6-8 tonnes roller if soften aggregate is used. The rolling shall commence with lower dges and proceed towards the middle except at superelevated portion where it will commence with lower edge proceeding edging towards higher edge. Adequate number of passes of roller should be made to achieve full compaction which should be complete within specified period which should not exceed an hour.

17.7.4.7. The grade and camber should be checked during compaction and undulations noticed corrected by removing excess material or adding fresh material as required.

17.7.4.8. Curing: The compacted layer of lime flyash concrete shall be cured for the first 48 ours by covering it with wet gunny bags of Hassian and subsequently spreading wet sand or atering frequently in moderate quantities but not pounding as that would lead to leaking. Depending on seasonal and other factors curing shall be carried out for 7 to 14 days.

No traffic shall be allowed on lime flyash concrete sub-base ti!l subsequent covers are laid on it.

17.7.4.9. Measurements : The length and breadth shall be measured to the nearest centimetres and the thickness to nearest half centimetres. The compacted volume of concrete shall be calculated in cubic metres correct to two places of decimal.

17.7-4.10. The rate shall include the cost of all materials and labour involved in all the above operations. Scarifyng of existing road surfaces and consolidation of loose materials and any water proofing layer to be laid on sub grade shall be paid for separately.

17.6. BASES

17.8.0.The base course may consist of any one of the following:(of size 63 mm -45 mm or 53 mm - 22.4 n-un).

(a) Water Bound macadam with Stone Aggregate: The stone aggregate of size 63 mm to 45 mm or 53 mm to 22.4 mm as specified shall be used. This is a standard type of base course used in road work. In important roads such as national Highwa)-s and City Roads, this may form the lower part of the base Course overlaid by i bitumen bound base.

b) Water Bound Macadam surfacing /wearing course with stone aggregate : Water bound Macadam when laid as a surfacing/wearing course needs timely and constant maintenance. This will include patching pot holes, removal of ruts and blinding of surface with blinding material. This course is generally used only in roads of temporary nature.

17.8.1.2 Preparation of foundation : Shall be as specified in 17.7.2.2.

17.8.1.3 Spreading coarse aggregate shall be as specified in 17.7.2.4 except that the W.B.M. base course shall be normally constructed in layers of not more than 75 mm compacted thickness.

17.8.1.4 Rolling : Application of Screening, sprinking and grouting and application blending material shall be as specified under 17.7.2.5 to 17.7.2.8.

17.8.1.5 Setting and Drying : after final compaction of the course, the road shall be allowed to cure overnight. The next morning, defective spots shall be filled with screenings or binding
material, lightly sprinkled with water, if necessary and rolled. No traffic shall be allowed till the
macadam sets.

17.8.1.6 Surface Evenness : The surface eveness of completed W.B.M. courses in the longitudinal and transverses directions shall be within the tolerance specified in table 17.17.
17.8.1 Water Bound Macadam (Base or surfacing coarse)
17.8.1.1 Quantities of Materials : Quantities of coarse aggregates and screenings required to be stacked for 75 mm (Approximate) compacted thickness of W.B.M. base courses for 10 sqm shall be as specified in Table 17.16

Table 17.16

Coarse Aggregate			Stone screening		
Classification	Size range	Net Quantity	Gradings/classification	For W.B.M. base course	For W.B.M. surface course
Grading 2	63-45 mm	0.91 cum to 0.96 cum	Type A 13.2 mm	0.12 cum to 0.15 cum	0.10 cum to 0.12
-do-	63-45 mm	0.91 cum to 0.96 cum	Type B 11.2 mm	0.20 cum to 0.22 cum	0.18 cum to 0.14 cum
Grading 3	53-22.4 mm	0.91 cum to 0.96 cum	Type B 11.2 mm	0.18 cum to 0.21 cum	0.14 cum to 0.17 cum

The quantity of binding material required for 75 mm (Approximate) compacted thickness will be 0.09 cum/10 sqm in the case of W.B.M. base course and 0.13 cum/10 sqm when the W.B.M is to function as a surface course.

Table 17.17

Size of coarse aggregates	Longitudinal profile measured with a 3 metre straight edge		Cross profile
	Maximum permissible undulations	Max. No. of undulations permitted in any 300 m length exceeding 12 mm 10mm.	Max. permissible undulation when measured with a camber template
63-45 mm and 53-22.4 mm	12 mm	30	8 mm

The longitudinal profile shall be checked with a three metre long straight edge and graduated wedge at the middle of each traffic lan along a line parallel to the Center line of the road. The transverse profile shall be checked with adjustable templates at intervals of 10 meteres.

17.8.1.7 : Rectification of Defective construction, Measurement and Rates shall be as specified under 17.7.2.11 to 17.7.2.13

SPECIAL NOTES

Excavation :

1. Clearing the site : The area required is to be set out and should be cleared from allobstructions sucha s stone materials, rubbish of all kins, vegetations, bushes and trees (removed as, directed and roots being enti rely grabbed up). No payment shall be made for this to the contractor, Incase trees having girth of size 6" or more are cut and removed, the materials shall be the property of the company should be handed over to the engineer-incharge.

2. Setting out : After clearing the site, a central line will be given by the Engineer Incharge and it will be responsibility of the contractor to go ahead with further detailed layout, bench marks etc. permanent bench marking by constructing pillars and central line shall be permanently laid by the contractor at his own cost and shall remain at places till handing over the work.

3. Foundation : Foundation excacation shall incldue the removal of materials of whatever mentioned and whether wet or dry exactly in accordance with the land levels and contours shown on the plan or as directed by the Engineer incharge. It shall be taken to the exact level of the lowest footing and the site shall be left plumb or cut to slopes as per the instructions of the Engineer incharge, which shall be in writing.

The rates quoted shall be deemed to include dewatering of foundation, trenches as long as water is result of rain, seepage, sub soil water or broken water main.s In case spring water is met, dewatering of which shall be the responsibility of the Management.

Measurement of quantities if not specified shall be base on IS-1200-1974.

4. Concrete for plain and Reinforced cement concrete : as per Is 456-2000.

This specification covers the requirements of ordinary concrete of the specified properties for use in concrete items special requirement if specified shall also apply.

Material ; Cement : Cement shall be ordinary portland cement and should conform to IS 269-1967.

Water ; Water for mixing cement concrete shall not be salty or brackish and shall be clean reasonably clear and free from objectionable quantities of salt and traces of oil, acid and injurious alkali, salts, organic matter and other deleterious materials which will either weaken the concrete or cause affloresamnce or attack the steel in R.C.C. water shall be obtained from sources approved by the Engineer. Sources of water shall be maintained at such a depth and the water shall be withdrawn in such a manner as to exclude silt, mud, grass or other foreign materials. Container for transport, stronge and handling of wate shall be clean.+

(water fit for drinking is generally be found suitable for mixing concrete).

Water for curing:- As per IS 456-2000.

Fine Aggregate ; Sand for use oin concrete work shall be natural sand or a crushed stone screenings, sand shall be clean, well graded, hard, strong, durable and grithy particles free from injurious amount of dust, clay, kankar modules soft or flankly particles, shale, alkali, salts, organic matter, loam, mica or other deleterious materials and shall be approved by the Engineer. The maximum size of particles shall be limited so 5mm (above 3/16").

When the quality of fine aggregate is doubtful, it shall be tested for clay, organic impurities and other deleterious substances as laid down in IS 383-1963.

It shall not contain deleterious materials in such quantity as to reduce the strength or durability of the concrete or attach the reinforcement in case of R.C.C. work. The fineness modules may range between
2.6 to 36.

Coarse Aggregate :

Coarse aggregate shall consist of crushed or broken stone and be hard, strong, dense, durable, clean, of proper gradation and free from skin and coating likely to prevent proper adhesion of mortar. The aggregate shall generally be cubical in shape as far as possible flaky, elongated pieces shall be avoided. Aggregates shall be broken from the best trap granite quartzite gneiss stones in order available in the region pproved by the Engineer. Stone shall have not deleterious reaction with cement single of the appropriate grading may be permitted to be substitued for some proporation of the metal without price adjustment if it is shown that thereby strength of concrete is increased and workability improved.

The maximum size of the aggregate should be as large as possible and in no case should exceed ¼ of the minimum thickness of the member provided however this size presents no difficulty in the case of RCC to surround the reinforcement satisfactorily.

Maximum size of Aggregate	40 mm to 80 mm (1 ½" to 3")	20 mm to 40mm (3/4" to 1 ½")	5 mm to 20" (3/16"; to ¾")	10 mm to 20" (3/8"- ¾ ")	5 mm to 10 mm (3/16" to 3-14")
20 mm (about ¾")	--	--	100	55-67	33-45
40 " (about 1 ½")	--	40-50	50-60	28-40	18-30
80 " (about 3")	20-36	16-36	35-44	10-30	13-29

In the case of general concrete work maximum size of 40 mm (about 1 ½") is used and in R.C.C. work a maximum size of 20 mm (3/4") will be found satisfactory but it should be restricted to 6 mm (about ¼") less than the cover, which is smaller.

Coarse aggregate of a porous nature where absorption of water after 24 hours immersion in water, is more than 5 percent by weight, shall not be used. Limits of deleterious substance shall not exceed, those
as in IS 515 – 1959.

Proportion of Mix : M-20 design Mix Concrete as per IS 456-2000.
In ordinary concrete, although proportion of cement to fine and coarse aggregate is specified by volume, the quantity of cement shall be determined by weight assuming one bag of cement weighting 50 kg. (about 10 ibs). Net to be equivalent to 35 litres (about 1.2 cft.) Fine and coarse aggregates shall be measured by dry volume in suitable wooden steel boxes. Due allownce shall be made for bulking in the fine aggregate due to moisture if any, at the time of mixing.

Ingredients required for concrete containing are 50 kg bag of cement for different proportions of mix will be as under ;

Mix	Cement	Aggregate	Coarse Aggregate	Water
1;1:2	50	35 lts.	70 lts.	23 to 27 lts.
1:1/2:3	50	52.5 lts.	105 lts.	23 to 20
1;2:4	50	70 lts.	140 lts.	27 to 32'
1:3:6	50	105 lts.	210 lts.	37.5 to 47.5
1:4:8	50	140 lts.	280 lts.	47.5 to 57
1:5:10	50	175 lts.	350 lts.	56 to 68

The ratio of the volumes of fine aggregatre and coarse aggregates may be varied within limits of 1:1/2 to 1:2 ½ as directed by the Engineer to suit the mix size of coarse aggregate, the grading, density, workability and strength without extra cost. But the

sum of the volumes of fine and coarse aggregate so adjusted shall, however, be equal to the volume of fine and coarse aggregates give above for the particular mix.

The quantity of water shall be just sufficient, but not more than sufficient to produce a dense concrete of required workability for its purpose. An allowance shall be made for surface moisture present in the aggregate when computing water content as per IS 456 – 1964. In the case of reinforced concrete work, the workability shall be such that the concrete will sorround and properly grip all the reinforcement. Water cementratio will be such as will give concrete just sufficiently wet to be placed and compacted without difficulty.

For vibrated concrete water content may be reduced by 15% to 20% to give required slump. Mixing ; Mechanical mixer should be used for all concrete work. Mixing shall be continued till there is a uniform distribution of materials, colour and uniform coating on coarse aggregate. Mixing shall be done for not less than 1 ½ minutes. The water concrete ratio shall be between 0.55 to 0.64 for 1;2:4 mix le ast permited workability (ref. IS 456 appendix –6).

Compacting :

The concrete shall be thoroughly compacted during depositing to get a dense concrete. The vibrators shall have not less than 3600 and preferably about 5000 impulses per minute and shall be worked at intervals of 60 minutes use shall be doe to make required dense concrete without sinking and segregation of coarse aggregate

Curing ; -

The concrete shall be kept continously wet preferably by pounding water for a period of not less then 14 days. From the date of placing continuously without a break holidays.

Sampling and testing :

Sampling of materials and concrete shall be done carefully by the contractor under the direct supervision of departmental staff as per IS 456- 1964 at the cost of the contractor. All necessary labour, materials equipments, etc. for sampling, preparing test cubes, curing etc. shall be provided by the contractor. Compressive strength of concrete shall not be less than those specified in the guide lines for testing of materials incorporated in this document.

Steel : Structural steel should conform to IS- 226-1962 Fabrication and erection should conform to IS-800-962. Welding should conform oto IS-1956.

Measurement

For quantities mentioned in the estimates in case are not specified, should be measured as per IS-1200- 1974. Major earth work measurements are to be made by levels, taken initially and finaly.

Note : Testing charges for testing of materials, concrete cubes, shutters of door and windows, piles etc. shall be borne by the contractor.

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ADDITIONAL SAFETY MEASURES TO BE TAKEN BY THE CONTRACTORSSAFETY CODE

1. Suitable scaffolds should be provided for workman for all works that cannot be safety to be done from the ground or from solid construction except such short period work as can be done safety from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used in carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1/4 to 1/4 horizontal and 1 vertical.

2. Scaffolding or staging more than 12 above the ground or floor suspended from an over head support of erected with stationary supports shall have a guareed rail properly attached hoted breced and other wise secured atleast 3ft. high above floor or platform of such scaffolding or staging and ends theeof with only such openings as may be necessary for the delivery of materials. Such sc affolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

3. Working platform gangways and stair way should be so constructed that they should not segunduly or unequally, and if the height or the platform of the gangway or the stair way is more than 12 ft. above ground level or floor level they should be closely boared should have adequate with and should be suitable fenced as descripted in (1) above.

4. Every opening in the floor of building or in working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable, fencing or railing whose minimum height shall be 3 ft.

5. Safe means of access shall be provided to all working platform and other working place. Every ladder shall be provided securely fixed no portable single ladder shall be over 30 ft. in length while the width between side rails in rung ladder shall in no case be less than 1 1/2" for ladder upto and including 10 ft. in length. For longer ladders this width should be increased at least 1/4 % for each additional foot of length. Uniforms specing step specing shall not be exceed 12". Adequate precautions shall be taken to prevent danger from electrical equipments. No materials on any of the said of work shall be stacked or placed as to cause danger or inconvenince to any person or the public. The contractor shall also provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defence of every suit, action or other proceedings at all that may be any person injury sustained owing to neglect of the above precaution and to pay damages and cost which may be brought awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor, he has paid to compromise any claim by any such pesons.

6. All trenches four feet or more in depth, shall at all times be supplied with atleast one ladder for each 100 ft. in length or fraction thereof ladder shall be extended from bottom of th trench to atleast 3' suitable slope of securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 5 ft. of the edge of the trench or half of the tranch whichever is more. Cutting shall be done from top to bottom under no circumstance
Under mining or under cutting shall be done.

7. Before any demoition work is cemmenced and also during the process of the work :

a. All roads and open areas adjacent to the work site shall either be closed or suitably protected.
b. No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used be the operator shall remain, electrically charged
c. All practical steps shall be taken to prevent danger to persons employed from rise of fire explosion or flooding no floor roof or other part of the building shall be so overloading with debris or material as to render it unsafe.

8. All necessary safety equipment as considered adequate by the Engineer Incharge should be kept available for the sue of the persons employed on the site and maintained in condition suitable for immediate use and the contractor should take adequate steps to ensure proper use of equipment by the concerned.

a. Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
b. Those engaged in white and mixing or stocking of cement bags or any materials which is injurious to the eye shall be provided with protecti ve goggles.
c. Those engaged in welding works shall be provided with protective goggles etc.
d. Ston breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
e. When worker are employed is sewers and manholes, which are in use, the contractor shall ensure that the man of covers are open and are at least for an hour before the workers are allowed to step into the manhole and the manhols so opened shall be condend of with suitable railing and provided with warning signa so borads to prevent to the public.
f. The contractor shall not employment below the age of 13 and women on the work of painting with products containing lead in any form whenever man above the age of 1 years are employed for the work of lead painting the following precautions should be taken.

1. No paint containing lead or lead products should be used ecept in the form of paste or readymade paint.
2. Suitable face makes should be supplied for the use opf workers when paint is applied in the form of spray or a surface having lead point dry rubbed and scrapped.

3. Overalls shall be supplied by the contractors to the workman and adequate facilitiess shall be provided to enable the working painters to wash during the process of work.
9. When the work is done near any place where there is risk of drawing necessary equipment should be provided and kept ready. Prompt rescue of any person in danger and adquate provision should be made for prompt first and treatment of all injuries likely to be sustain during the course of the risk.
10. Use of hoisting machines and tackle including their attachments anchores and supports shall conform to the following standard or conditions.
1. (a) Those shall be good mechanical construction, sound material and adequate strength and free from patent defect and shall be kept in good working order.
(b) Every rope used in hoisting or lowering materials of as a means of suspensions shall be of durable quality and adequate strength, and free from patent defect.
2. Every crane driver or hoisting appliance operator shall be properly, qualified and no person under the age of 21 years should be in charge of any hoisting machine including andy scaffold which or give signals to the operator.
3. In case of every hoisting machine and of every chain ring hold sharkle swivel and pully block use in hoisting or lowering or as means. Every hoisting machine and all gear referred to above shall be plaintly marged with the safe working load. In case of hoisting machine having a wairable / safe working load of the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
4. In case of departmental machines, the safe working load shall be notified by the Electrical Engineer in charge as regards contractor's machine the contractor shall notify the safe working load of machine to the Engineer in charge. Whenever he brings and machinery to site to work and get verified the Electrical Engineer concerned.
1. Gearing, transmission, electrical wiring and other dangerous part of hoisting appliances should be provided with sufficient safeguard. Hoisting appliances should be provided with such means as will reduce to minimum risk of accidental descent of the load. Adequate precaution should be taken to reduce to the minimum risk of any part of the suspended load becoming accidentally displaced .
When workers employed on electrical installations which are already energized , nsulating mats wearing apparels such as gloves, sleeves and boots as may be necessary should be provided. the workers should not wear rings, watches and carry keys or other materials, which are good conductors of electricity.
11. All scaffolds, ladders and other safety devices mentioned or described herein shall be mentioned in safe conditions and no scaffold, ladder or equipment shall be attered or removed shile it is used. Adequate washing facilities shall be provided at or near places of work.
13. These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. The persons responsible for compliance of the safety codes shall be named there in by the contractor.
14. To ensure effective enforcement of the rules regulations relating to safety precautions, the arrangements made by the contractor shall be open to inspection by the Labour Officer, Engineer Incharge of the department or their representatives.
15. Not withstanding the above clause from (i) to (xv) there is nothing in those to exempt the contractor from the operations of any other Act or rules in force in Republic of India.

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MORT&H SPECIFICATIONS FOR BLACK TOPPING

Base and Surface Courses (Bituminous)

500

501. GENERAL REQUIREMENS FOR BITUMINOUS PAVEMENT LAYERS

501.1. General

Bituminous pavement courses shall be made using the materials described in the following Specifications.

The use of machinery and equipment mentioned in various Clauses of these Specifications is mandatory. Details of the machinery and equipment are available in the Manual for Construction and Supervision of Bituminous Works. Equipment mandatory for any particular project shall be in accordance with the Contract Specification for that project.

501.2. Materials

501.2.1. Binder: The binder shall be an appropriate type of bituminous material complying with the relevant Indian Standard (IS), as defined in the appropriate Clauses of these Specifications, or as otherwise specified herein. The choice of binder shall be stipulated in the Contract or by the Engineer. Where penetration grades of bitumen are specified, they are referred to by a single-figure designation in accordance with IS: 73. Thus bitumen grade 35 refers to a bitumen in the penetration range 30 to 40. Where modified Binder is specified, the Clause 521 of these Specifications shall apply.

501.2.2. Coarse Aggregates: The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material 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 the Contractor's selected source of aggregates have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with approved anti-stripping agents, as per the manufacturer's recommendations, without additional payment. Before approval of the source the aggregates shall be tested for stripping.

The aggregates shall satisfy the physical requirements set forth in the individual relevant clause for the material in question.

Where crushed gravel is proposed for use as aggregate, not less than 90% by weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces.

501.2.3. Fine Aggregates: Fine aggregates shall consist of crushed or naturally occurring material, or a combination of the two, passing 2.36 mm sieve and retained on the 75 micron sieve. They shall be clean, hard, durable, dry and free from dust, and soft or friable matter, organic or other deleterious matter.

501.2.4. Source of material: The source of all materials to be used on the project must be tested to the satisfaction of and be expressly approved by the Engineer. The Engineer may from time to time withdraw approval of a specific source, or attach conditions to the existing approval. Any change in aggregate source for bituminous mixes, will require a new mix design, and laying trials, where the mix is based on a job mix design. Stockpiles from different sources, approved or otherwise, shall be kept separate, such that there is no contamination between one material and another. Each source submitted for approval shall contain sufficient material for at least 5 days work.

501.3.Mixing Pre-mixed bituminous materials, including bituminous macadam, dense bituminous macadam, semidense bituminous concrete and bituminous concrete, 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. Appropriate mixing temperatures can be found in Table 500-5 of these Specifications; the difference in temperature between the binder and aggregate should at no time exceed 14 ºC. 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.

If a continuous missing plant is to be used for mixing the bituminous bound macadam, the Contractor must demonstrate by laboratory analysis that the cold feed combined grading is within the grading limits specified for that bituminous bound material. In the case of a designed job mix, the bituminous and filter content shall be derived using this combined grading. Further details are available in the Manual for Construction and Supervision of Bituminous Works.

501.4. Transporting

Bituminous materials shall be transported in clean insulated vehicles, and unless otherwise agreed by the Engineer, shall be covered while in transit or awaiting tipping. Subject to the approval of the Engineer, a thin coating of diesel or lubricating oil may be applied to the interior of the vehicle to prevent sticking and to facilitate discharge f the material.

501.5. Laying

501.5.1. Weather and seasonal limitations: Laying shall be suspended while free-standing water is present on the surface to be covered, or during rain, fog and dust storms. After rain, the bituminous surface, prime or tack coat, shall be flown off with a high pressure air jet to remove excess moisture, or the surface left to dry before laying shall start. Laying of bituminous mixtures shall not be carried out when the air temperature at the surface on which it is to be laid is below 10ºC or when the wind speed at any temperature exceeds 40km/h at 2m height unless specifically approved by the Engineer.

501.5.2. Cleaning of surface: The surface on which the bituminous work is to be laid shall be cleaned of all loose and extraneous matter by means of a mechanical broom or any other approved equipment/method as specified in the contract. The use of a high pressure air jet from a compressor to remove dust or loose matter shall be available full time on the site, unless otherwise specified in the Contract.

501.5.3. Spreading: Except in areas where a mechanical paver can not access, bituminous materials shall be spread, levelled 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 paver and laid without delay.

The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously. The travel rate of the paver, and its method of operations, shall be adjusted to ensure an even and uniform flow of bituminous material across the screed, free from dragging, tearing and segregation of the material. In areas with restricted space where a mechanical paver can not be used, the material shall be spread, raked and levelled with suitable hand tools by experienced staff, and compacted to the satisfaction of the Engineer.

The minimum thickness of material laid in each paver pass shall be in accordance with the minimum values given in the relevant parts of these Specifications. When laying, binder course or wearing course approaching an expansion joint of a structure, machine laying shall stop 300mm short of the joint.

The remainder of the pavement up to the joint, and the corresponding area beyond it, shall be laid by hand, and the joint or joint cavity shall be kept clear of surfacing material.

Bituminous material, with a temperature greater than 145ºC, shall not be laid or deposited on bridge deck waterproofing systems, unless precautions against heat damage have been approved by the Engineer.

Hand placing of pre-mixed bituminous materials shall only be permitted in the following circumstances:

i) For laying regulating courses of irregular shape and varying thickness.
ii) In confined spaces where it is impracticable for a paver to operate.
iii) For footways.
iv) At the approaches to expansion joints at bridges, viaducts or other structures.
v) For laying mastic asphalt in accordance with Clause 515.
vi) For filling of potholes.
vii) Where directed by the Engineer.

Manual spreading of pre-mixed wearing course material or the addition of such material by hand spreading to the paved area, for adjustment of level, shall only be permitted in the following circumstances:

i) At the edges of the layers of material and at gullies and manholes.
ii) At the approaches to expansion joints at bridges, viaducts or other structures.
iii) As directed by the Engineer.

501.5.4. cleanliness and overlaying: Bituminous material shall be kept clean and uncontaminated. The only traffic permitted to run on bituminous material to be overlaid shall be that engaged in laying and compacting the next course

or, where a binder course is to be sealed or surface dressed, that engaged on such surface treatment. Should any bituminous material become contaminated the Contractor shall make it good to the satisfaction of the Engineer, in compliance with Clause 501.8. Binder course material shall not remain uncovered by either the wearing course or surface treatment, whichever is specified in the Contract, for more than three consecutive days after being laid. The Engineer may extend this period, by the minimum amount of time necessary, because of weather conditions or for any other reasons. If the surface of the base course is subjected to traffic, or not covered within three days, a track coat shall be applied, as directed by the Engineer.

501.6 **Compaction:**

Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface level, regularity 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 these Specifications. 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 the 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 commenced. The initial or breakdown rolling shall be done with 8-10 tonnes dead weight smooth-wheeled rollers. The intermediate rolling shall be done with 8-10 tonnes dead weight or vibratory roller or with a pneumatic tyred roller of 12 to 15 tonnes weight having nine wheels, with a tyre pressure of atleast 5.6 kg/sq.cm. The finish rolling shall be done with 6 to 8 tonnes 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 shall nominate the plant, and the method by which he intends to achieve the specified level of compaction and finish at temperatures above the minimum specified rolling temperature. Laying trials shall then demonstrate the acceptability of the plant and method used.

Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the rear roll or, in the case of a pneumatc-tyred roller, at least the nominal width of 300mm.

In portions with super-elevated and uni-directional camber, after the edge has been rolled, the roller shall progress from the lower to the upper edge.

Rollers should move at a speed of not more than 5 km per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement either when the rollers are operating or standing. The wheels of rollers shall be kept moist with water, and the spray system provided with the machine shall be in good working order, to prevent the mixture from adhering to the wheels. Only sufficient moisture to prevent adhesion between the wheels of rollers and the mixture should be used. Surplus water shall not be allowed to stand on the partially compacted pavements.

501.7.Joints

Where longitudinal joints are made in pre-mixed bituminous materials, the materials shall be fully compacted and the joint made flush in one of the following ways; only method(iii) shall be used for transverse joints.

(i) by heating the joints with an approved joint heater when the adjacent width is being laid, but without cutting back or coating with binder. The heater shall raise the temperature of the full depth of material, to within the specified range of minimum rolling temperature and maximum temperature at any stage for the material, for a width not less than 75mm. The Contractor shall have equipment available, for use in the event of a heater breakdown, to form joints by method(iii):

(ii) by using two or more pavers operating in echelon, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling.

(iii) by cutting back the exposed joint, for a distance equal to the specified layer thickness, to a vertical face, discarding all loosened material and coating the vertical face completely with 80/100 penetration grade hot bitumen, or

cold-applied bitumen or polymer modified adhesive bitumen tape with a minimum thickness of 2mm, before the adjacent width is laid.

All joints shall be offset at least 300mm from parallel joints in the layer beneath or as directed, and in a layout approved by the Engineer. Joints in the wearing course shall coincide with either the lane edge or the lane marking, which ever is appropriate. Longitudinal joints shall not be situated in wheel track zones.

501.8.Preparation of surface

501.8.1.scope: This work shall consist of preparing an existing granular or black toopped surface bituminuous course. The work shall be performed on such widths and lengths as shown in the drawings or as instructed by the Engineer. The exisiting surface shall be firm and clean, and treated with primer or tack coat as shown in the drawing or otherwise stated in the contract.

501.8.2 Materials

501.8.2.1 For scarifying and re-laying the granular surface:

The materials used shall be coarse aggregates salvaged from scarification of the existing granular base course supplemented by fresh coarse aggregates and screenings so that aggregates and screenings thus supplemented correspond to Clause 404 : Water Bound Macadam or Clause 406 : Wet Mix Macadam.

501.8.2.2 For patching potholes and sealing cracks :
Where the exisiting surface to be over laid is bituminous,any exisiting pot holes and cracks shall be repaired and sealed in accordance with clauses 3004.2 and 3004.3, or as directed by the Engineer .

501.8.2.3. For profile corrective course : The profile corrective course for correcting the existing pavement profile shall be laid to varying thickness as shown on the drawings,or as indicated in the contract documents. The profile corrective course shall be laid to tolerancesand desities as specified for wearing course,if a single layer, or base course, if it isto be covered with a wearing course layer .

501.8.2.4 Profile corrective course and its application : The type of material for profile corrective course shall be as shown on the drawing or as directed by the Engineer. Where it is to be laid as part of the overlay/strengthening course, the profile corrective course material shall be of the same specification as that of the overlay/strengthening course. However, if provided as a separate layer, it shall be of the specification
and detailes given in the contract Drawings

(i) Any high spots in the existing surface shall be removed by milling machine or other approved method, and all loose material shall be removed to the satisfaction of the Engineer..

(ii) Where the maximum thickness of the profile corrective course shall not be more than 40 mm, the profile corrective course shall be constructed as an integral part of the overlay course. In other **cases,** the profile corrective course shall be constructed as a separate layer adopting such construction procedures and using such equipment as approved by the Engineer to lay the specified type of material to thickness and tolerance as specified for the course , to be provided.

501.8.3. Construction Operations

501.8.3.1. Preparing existing granular surface : Where the existing surface is granular, all loose materials shall be removed and the surface lightly watered where the profile corrective course to be provided as a separate layer is also granular. Where the profile corrective course of bituminous material is to be laid, over the existing granular surface , the later shall, after removal of all loose material , be primed in accordance with Clause 502.

The surface finish of all granular layers on which bituminous works are to be palced ,shall , unless otherwise specifically instructed by the Engineer, be free from dust. All such layers must be capable of being swept, after removal of any non-integral loose material, by means of a mechanical broom ,without shedding ignificant quantities of material and dust removed by air jet ,washing ,or other means approved by the Engineer.

After cleaning the surface shall be correct to line and level, within the tolerances specified for base course.

501.8.3.2. Scarifying existing bituminous surface **:** Where specified or shown in the drawings, the existing bituminous layer in the specified width shall be removed with care without causing undue disturbance to the underlying layer by a suitable method approved by the Engineer. After removal , all loose and disintegrated materials , the underlying layers which might have been disturbed should be suitably reworked and compacted to line and level. After supplementing the base material with as necessary fresh stone ; the compacted finished surface shall be primed in accordance with Clause no. 502. Reusable materials shall be stacked as directed by the Engineer with all lift and lead of 1000 m of their Origin..

501.8.3.3. Patching of potholes and sealing of cracks : Where the existing surface to be overlaid is bituminous, any existing pot holes and cracks shall be repaired and sealed in accordance with clauses no.3004.2 and 3004.3 ,or as directed by the Engineer.

501.8.3.4. Laying the profile corrective course

501.8.3.4.1. Laying on granular base: After preparing the granular surface in accordance with Clauses 501.8.3.1 and 501.8.3.2, the profile corrective course shall be laid using materials as described in Clauses 501.8.2.3and 501.8.2.4 or otherwise described in the contract and compacted to the requirements of the particular specification .

501.8.3.4.2. Laying on existing Bituminous surface: The existing bituminous surface shall be prepared in accordance with Clause 501.8.3.3. and after applying a tack coat conforming to Clause 503, the bituminous profile corrective course shall be laid and compacted to the requirement of the particular Specification .

501.8.3.4.3. Correction of local depression: Where local sags or depressions occurs in the existing pavement, a specific filling operation shall be instructed by the Engineer, which should be laid in accordance with Figure 500 -1. Normally, the maximum layer thickness at any point should not exceed 100 mm. In placing Multiple lifts,they should be arranged according to the correct method illustrated . For correction of camber or super elevation of the existing carriageway, method as shown in the Fig. 500-2 shall be adopted depending on the profile of the existing carriageway.

501.8.3.5.Covering the profile corrective course: Profile Corrective Course particularly shall be so planned that the layer shall be covered by the designed base/wearing course at the earliest opportunity , before opening to regular traffic.

501.8.4. Surface Finish and Quality Control of Work

The Relevant provisions of Section 900 shall apply.

501.8.5. Arrangements for Traffic

During the construction operations, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

501.8.6. **Environmental protection:**The provisions of clause 111 and the provision of ***Annexure A to clause 501*** shall apply.

501.8.7. **Measurements for Payment**

501.8.7.1. Pot holes and cracks: The work of filling pot holes shall be measured separately and be paid for in square metres. The work of filling cracks by applying fog spray or emulsion slurry seal shall be measured in square metres, for the area covered by the spray. The work in filling cracks larger than 3 mm in width shall be made measured and paid for on a linear metre basis.

501.8.7.2.Scarifying: Scarifying the existing bituminous surface shall be measured on a square metre basis.

501.8.7.3. Profile Corrective Course: Profile Corrective Course shall be measured as the volume instructed and compacted in position and measured in cubic metres or in tonnages, as stipulated in the contract. The volume shall be calculated by plotting the exact profile of Profile Corrective Course as required,and laid, superimposed on the existing pavement profile. Cross- sectional areas of the profile corrective course shall be measured at intervals as used in the design , or as determined by the Engineer , and the volume shall be calculated using the method of end areas.

501.8.7.4.Prime coat: Prime coat is to be measured and paid for on a per square metre basis.

501.8.7.5,Tack coat : This is to be a **PROVISIONAL** item ,which may be used in–part or not at all ,at the Engineers direction,and is to be measured and paid for, if used ,on a square metre basis.

501.8.8. Rates

501.8.8.1.Rate for scarifying: The Contract unit rate for scarifying exisiting bituminous surfaces, including repairing/reworking disturbed underlying layers and removing and stacking reusable/unusable materials, shall include for but not necessarily be limited to the cost of all labour, supply of materials needed for epair/reworking, hire charges of tools and plant and transportation of scarified materials within 1000 m of their origin.

501.8.8.2.Rate for premixed bituminous material: The contract unit rate for premixed bituminous material shall be payment in full for carrying out the required operations including full compensation for, but not necessarily limited to::

(i) Making arrangements for traffic to Clause 112 except for initial treatment to verge, shoulders and construction of diversions;

(ii) Preparation of the surface to receive the material.

(iii) Providing all materials to be incorporated in the work including arrangement for stock yards , all royalties , fees, rents where necessary and all leads and lifts,

(iv) Mixing ,transporting,laying and compacting the mix,as specified.

(v) All labour, tools, equipment, plant including installations of Hot mix plant ,power supply units and all mechinary ,incidental to complete the work, to these Specifications;

(vi) Carrying out the work in part widths of the road where directed;

(vii). Carrying out all tests for control of quality ;and

(viii) The rate shall cover the provision of bitumen at the rate specified in the contract, with the provision that the variation in actual percentage of bitumen used will be assessed and the payment adjusted accordingly.

(ix) The rate for premixed materials are to include for all wastage in cutting of joints etc.

(x) The rates are to include for all necessary testing, mix design ,transporting and testing of samples ,and cores. if there is not a project specific laboratory, the contractor must arrange to carry out all necessary testing at an outside laboratory, approved by the Engineer , and all costs incurred are deemed to be included in the rate quoted for the material.

(xi) The cost of all plant and laying trials as specified to prove the mixing and laying methods is deemed to be included in the contractor's rates for the material.

501.8.8.3.Rate for pot holes and crack sealing: The rate for patching pot holes shall include for breaking out, trimming edges, cleaning out, painting edges and bottom with bitumen ,and filling and compacting the excavation with the specified material. The rate should be inclusive of all plant tools ,labour and materials ,transport, and disposal of surplus material.

The contract unit rate for sealing cracks by applying fog spray shall be inclusive of providing all materials, tools, labour and plant and carrying out the work. The contract unit rate for sealing cracks by providing emulsion slurry seal shall be as set forth in Clause 516.9.

The Contract unit rate for crack sealing 3 mm to 6 mm cracks with straight run or other specified bitumen, shall be based on either a square metre basis, or linear metre of cracks as measured , as stipulated by the contract.

The Contract unit rate for cracks between 6 mm and 15 mm is to be measured on a linear mtre basis, and the rate is to include for all materials ,tools, plant, labour and transport.

Annexure 'A' to Clause 501

ANNEXURE "A"
PROTECTION OF THE ENVIRONMENT.

1. General

1.1. This section of the Specification sets out limitations on the Contractor's activities specifically intended to protect the environment.

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1.2. The Contractor shall take all necessary measures and precautions and otherwise ensure that the execution of the works and all associated operation on the site or off-site are carried out in conformity with statutory and regulatory environmental requirements including those prescribed elsewhere in this document.

1.3. The Contractor shall take all measures and precautions to avoid any nuisance or disturbance arising from the execution of the Works. This shall wherever possible be achieved by suppression of the nuisance at source rather than abatement of the nuisance once generated.

1.4. In the event of any spoil, debris, waste or any deleterious substance from the Site being deposited on any adjacent land, the Contractor shall immediately remove all such material and restore the affected area to its original state to the satisfaction of the Engineer.

2. Water Quality

2.1. The Contractor shall prevent any interference with the supply to or abstraction from, and prevent any pollution of, water resources(including underground percolating water) as a result of the execution of the Works.

2.2. Areas where water is regularly or repetitively used for dust suppression purposes shall be laid to fall to specially-constructed settlement tanks to permit sedimentation of particulate matter. After settlement, the water may be re-used for dust suppression and rinsing,

2.3. All water and other liquid waste products arising on the site shall be collected and disposed of at a location on or off the Site and in a manner that shall not cause either nuisance or pollution.

2.4. The Contractor shall not discharge or deposit any matter arising from the execution of the Works into any waters except with the permission of the Engineer and the regulatory authorities concerned.

2.5. The Contractor shall at all times ensure that all existi*ng* stream courses and drains within, and adjacent to, the site are kept safe and free from any debris and any materials arising from the Works.

2.6. The Contractor shall protect all watercourses, waterways, ditches, canals, drains, lakes and the like from pollutions as a result of the execution of the Works.

3. Air Quality

3.1. The Contractor shall devise and arrange methods of working to minimise dust, gaseous or other air-borne emissions and carry out the Works in such a manner as to minimise adverse impacts on air quality.

3.2. The Contractor shall utilize effective water sprays during delivery manufacture, processing and handling of material when dust is likely to be created, and to dampen stored materials during dry and windy weather. Stockpiles of friable materials shall be covered with clean tarpaulins, with application of sprayed water during dry and windy weather. Stockpiles of material or debris shall be dampened prior to their movement, except where this is contrary to the Specification.

3.3 . Any Vehicle with an open load-carrying area used for transporting potentially dust producing material shall have properly fitting side and tail boards. Materials having the potential to produce dust shall not be loaded to a level higher than the side and tail boards, and shall be covered with a clean tarpaulin in good condition. The tarpaulin shall be properly secured and extend at least 300 mm over the edges of the side and tail boards.

3.4. In the event that the Contractor is permitted to use gravel or earth roads for haulage, he shall provide suitable measures for dust palliation, if these are, in the opinion of the Engineer, necessary. Such measures may include
spraying the road surface with water at regular intervals.

4. Noise

4.1. The Contractor shall consider noise as an environmental constraint in his planning and execution of the Works.

4.2. The Contractor shall take all necessary measures so that the operation of all mechanical equipment and construction processes on and off the Site shall not cause any unnecessary or excessive noise, taking into account applicable environment requirements. The Contractor shall use all necessary measures and shall aintain all plant and silencing equipment in good condition so as to minimise the noise emission during construction works.

5. Control of Wastes

5.1. The Contractor shall control the disposal of all forms of waste generated by the construction operations and in all associated activities. No uncontrolled deposition or dumping shall be permitted. Wastes to be so controlled shall include, but shall not be limited to, all forms of fuel and engine oils, all types of bitumen, cement, surplus aggregates, gravels, bituminous mixtures etc. The Contractor shall make specific provision for the proper disposal of these and any other waste products, conforming to local regulations and acceptable to the Engineer.

6. Emergency Response

6.1 The Contractor shall plan and provide for remedial measures to be implemented in the event of occurrence of emergencies such as spillages of oil or bitumen or chemicals.

6.2. The Contractor shall provide the Engineer with a statement of the measures he intends to implement in the vent of such an emergency which shall include a statement of how he intends to provide personnel adequately trained to implement such measures.

7. Measurement

7.1. No separate measurement shall be made in respect of compliance by the Contractor with the provisions of this Section of the Specification. The Contractor shall be deemed to have made allowance for such compliance with these provisions in the preparation of his prices for items of work included in the Bills of Quantities and full compensation for such compliance will be deemed to be covered by them.

502. PRIME COAT OVER GRANULAR BASE

502.1. Scope

This work shall consist of application of single coat of low viscosity liquid bituminous material to a porous granular surface preparatory to the superimposition of bituminous treatment or mix.

502.2. Materials

502.2.1. Primer : The choice of a bituminous primer shall depend upon the porosity characteristics of **the** surface **to** be primed as classified in IRC:16

These are :

(i) Surfaces of low porosity; such as wet mix macadam and water bound macadam,

(ii) Surfaces of medium porosity; such as cement stabilized soil base,

(iii) Surfaces of high porosity; such as a gravel base.

502.2.2.Primer viscosity: The type and viscosity of the primer shall comply with the requirements of IS 8887, as sampled and tested for bituminous primer in accordance with these standards. Guidance on viscosity and rate of spray is given in table 500-1.

TABLE 500-1. VISCOSITY REQUIREMENT AND QUANTITY OF

LIQUID BITUMINOUS PRIMER

Type of surface	Kinematic viscosity of primer at 60 ° C (Centistokes)	Quantity of liquid Bituminous material per 10 sq.m (kg)
Low porosity	30-60	6 to 9
medium porosity	70-140	9 to 12
High porosity	250-500	12 to 15

502.2.3 Choice of Primer: The primer shall be bitumen emulsion , complying with IS : 8887of a type and graded as specified in the Contract or as directed by the Engineer.The use of medium curing cut back as per IS 217 shall be restricted only for sites at sub – zero Temperatures or for emergency applications as directed by the Engineer.

502.3. Weather and Seasonal Limitations

Bituminous primer shall not be applied on a wet surface (see 502.4.2) or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10^0 C. Surfaces which are to receive emulsion primer should be damp but no free or standing water shall be present.

502.4. Construction

502.4.1. Equipment: The primer distributor shall be self-propelled or towed bitumen pressure sprayer equipped for spraying the material uniformly at the specified rates and temperatures. Hand Spraying of small areas , inaccessible to the distributor , or in narrow strips shall be sprayed with a pressure hand sprayer , or as directed by the Engineer.

502.4.2. Preparation of road surface: The surface to be primed shall be prepared in accordance with clause 501.8 and 902 as appropriate . Immediately prior to applying the primer the surface shall be carefully swept clean of dust and loose particles, care being taken not to disturb the inter locked aggregate. This is best achived when the surface layer is slightly moist (lightly sprayed with water and the surface allowed to dry) and the surface should be kept moist until the primer is applied.

502.4.3. Application of bituminous primer: The viscosity and rate of application of the primer shall be as specified in the contract, or as determined by site trials carried out as directed by the Engineer. Where a geosynthetic is proposed for use , the requirements of clauses 703.3.2 and 703.4 shall apply. The bituminous primer shall be sprayed uniformly in accordance with clause 501. The method of application of primer will depend on the type of equipment to be used, size of nozzles , pressure at the spray bar and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray , within the tolerances specified.

502.4.4.Curing of primer and opening to traffic. A primed surface shall be allowed to cure for at least 24 hours or such other period as is found to be necessary to allow all volatiles to evaporate before any subsequent surface treatment or mix is laid Any unabsorbed primer shall first be blotted with application of sand, using minimum quantity possible.

502.4.4. Curing of primer and opening to **traffic :**A primed surface shall not be opened to traffic other than that necessary to lay the next course. A very thin layer of clean sand may be applied to the surface of the primer, to prevent the primer picking up under the wheels of the paver and the trucks delivering bituminous material to the paver.

502.4.5 Tack coat : Over the Primed surface , a tack coat shall be applied in accordance with clause no.503.

502.5. Quality Control of Work

For Control of the quality of materials supplied and works carried out , the relevant provision of section 900 shall apply.

502.6. Arrangements for Traffic

During construction operations, arrangements for traffic shall be made, in accordance with Clause 112.

502.7. Measurements for Payment

Prime coat shall be measured in terms **of** surface area of application in square melres.

502.8. Rate

The contract unit rate for prime coat with adjustments as described in clause 502.7 shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 401.8

(i) to (v) and as applicable to the work specified in these Specifications. Payment shall be made on the basis of the provision of prime coat at an application rate of 0.6kg per square metre, with adjustment plus or minus , for the variation between this amount and the actual amount approved by the Engineer after the preliminary trials referred to in clause 502.4.3.

503. TACK COAT

503.1. Scope

This work shall consist of application of a single coat of low viscosity liquid bituminous material to an existing bituminous road surface preparatory to the super imposition of a bituminous mix ,when specified in the contract or instructed by the Engineer .

503.2. Materials

503.2.1.Binder: The binder used for tack coat shall be bituminous emulsion complying with IS 8887 of a type and grade as specified in the Contract or as decided by the Engineer. The use of cut back bitumen as per IS 217 shall be restricted only for sites at sub – zero temperature or as for emergency application as directed by the Engineer.

503.3. Weather and seasonal limitations:

Bituminous material shall not be applied on a wet surface or during dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10^0 C. Where 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.

503.4. Construction

503.4.1. Equipment: The Tack coat distributor shall be a self-propelled or towed bitumen pressure sprayer , equipped for spraying the material uniformly at a specified rate. Hand Spraying of small areas , inaccessible to the distributor , or in narrow strips shall be sprayed with a pressure hand sprayer , or as directed by the Engineer.

503.4.2. Preparation of base: The surface on which tack coat is to be applied shall be clean, free from dust, dirt, and any extraneous material,and be otherwise prepared in accordance with the requirements of clause 501.8 and 902 as appropriate . Immediately before application of the tack coat, the surface shall be swept clean with a mechanical broom,a high pressure air jet, or any other means as directed by the Engineer.

503.4.3. Application of Tack coat: The application of tack coat shall be at the rate specified in the contract,and shall be applied uniformly . If rate of application of the tack coat is not specified in the contract then it shall be at the rate specified in **Table 500-2.** The normal range of spraying temperature for

bituminous emulsion shall be 20℃ to 70℃ and for a cutback 50℃-80℃ if, RC-70/ MC-70 is used. Where a eosynthetic is proposed for use , the requirements of clauses 703.3.2 and 703.4.4 shall apply. The method of pplication of tack coat will depend on the type of equipment to be used, size of nozzles , pressure at the pray bar and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray , within the tolerances specified.

Where the material to receive an overlay is freshly laid bituminous layer, that has not been subjected to traffic, or contaminated by dust ,a tack coat is not mandatory where the overlay is completed within two days.

TABLE 500-2. RATE OF APPLICATION OF TACK COAT

Type of Surface		Quantity of liquid bituminous material in kg per sq. m. area
i)	Normal bituminous surfaces	0.20 to 0.25
ii)	Dry and hungry bituminous surfaces	0.25 to 0.30
iii)	Granular surfaces treated with primer	0.25 to 0.30
iv)	Non bituminous surfaces	
a)	Granular base (not primed)	0.35 to 0.40
b)	Cement concrete pavement	0.30 to 0.35

503.4.4 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 plant or vehicles shall be allowed on tack coat other than those essential for the construction**.**

503.5. Quality Control of work

For Control of the quality of materials supplied and the works carried out , the relevant provisions of Section 900 shall apply.

503.6. Arrangements for Traffic

During the period of construction, the arrangement s for traffic shall be made in accordance with the provisions of Clause 112.

503.7. Measurement for Payment

Tack coat shall be measured in terms of Surface area of application in square metres.

503.8. Rate

The contract unit rate for tack coat shall be payment in full for carrying out the required operations including for all components listed in Clause 401.8 (i) to (v) and as applicable to the work specified in these specifications. The rate shall cover the provision of tack coat at 0.20 kg per square metre, with the provision that variance in actual quantity of bitumen used will be assessed and the payment adjusted accordingly.

504. BITUMINOUS MACADAM

504.1. Scope

This work shall consist of construction, in a single course having 50 mm to 100 mm thickness or in multiple courses , of compacted crushed aggregates premixed with a bituminous binder, on a previously prepared base to the requirement of these Specifications. Bituminous macadam is more open graded than the dense graded bituminous materials described in clause 507,508 and 509.

504.2. Materials

5.4.2.1 Bitumen : The bitumen shall be paving bitumen of penetration grade complying with Indian Standard specifications for “Paving Bitumen” IS:73 and of the penetration indicated in **Table 500-4.**

504.2.2. Coarse Aggregates:

The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve . They shall be clean, hard, durable, of cubical shape and free from dust and soft friable matter , organic or other deleterious matter. Where the Contractors selected source aggregates have poor affinity for bitumen , as a condition for the approval of that source , the bitumen shall be treated with approved anti-stripping agents , as per the manufacturers recommendations, without additional payment, Before approval of the source , the aggregate shall be tested for stripping.

The aggregates shall satisfy the physical requirements set forth in Table 500-3.

Where crushed gravel is proposed for use as aggregate , not less than 90% weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces.

504.2.3 .Fine aggregates: Fine aggregate shall consist of crushed or naturally occuring material , or a combination of the two, passing 2.36 mm sieve,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.

TABLE 500-3. PHYSICAL REQUIREMENTS FOR COARSE AGGREGATES FOR BITUMINOUS MACADAM

Property	Test	Specification
Cleanliness	Grain size analysis1	Max 5% passing 0.075 mm sieve
Particle shape	Flakiness and Elongation Index (combined)2	Max 30%
Strength	Los Angeles Abrasion Value3	Max 40%.
	Aggregate Impact Value 3	Max 30%
Durability	Soundness :4 Sodium sulphate Magnesium sulphate	 Max 12% Max 18%
Water Absorption	Water Absorption5	Max 2%
Stripping	Coating and stripping of Bitumen aggregate mixtures6	Min,retained coating 95%
Water sensitivity7	Retained tensile strength	Min 80%

Notes: 1. IS: 2386 Part 1 4. IS: 2386 Part 5
2. IS :2386 part 1 5. IS : 2386 Part 3
(the elongation test to be done only on non-flaky aggregates in the sample)

3 . IS : 2386 Part 4* 6. IS :6241

7. The water sensitivity test is only to be carried ou if the minimum retained coating in the stripping test is less than 95%.

* Aggregate may satisfy requirements of either of these two tests.

504.2.4 Aggregate grading and binder content: When tested in accordance with IS 2386 Part 1 (wet sieving method), the combined aggregate grading for the particular mixture shall fall within the limits shown in Table 500-4 for the grading specified in the Contract. The type and quantity of bitumen and appropriate thickness ,are also indicated for each mixture type.

504.2.5. Proportioning of materials: The aggregates shall be proportioned and blended to produce a uniform mixture complying with the requirements of Table 500-4, The binder content shall be within a tolerance of + 0.30 per cent by weight of total mixture when individual specimens are taken for quality control
tests in accordance with the provisions of section 900.

504.3.Construction operations

504.3.1 Weather and seasonal limitations: The provisions of clause 501.5.1 shall apply.

TABLE 500-4. COMPOSITION OF BITUMINOUS MACADAM

Mix designation Nominal aggregate size Layer thickness IS Sieve (mm)	Grading I 40 mm 80 -100mm cumulative % by weight of total aggregate passing	Grading 2 19mm 50 – 75mm
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 mixture1	3.1 – 3.4	3.3 -3.5
Bitumen Grade	**35 to 90**	**35 to 90.**

Notes:-1 .Approximate bitumen contents for conditions in cooler areas of India may be up to 0.50% higher subject to approval of the Engineer.

504.3.2. Preparation of the base: The base on which bituminous macadam is to be laid shall be prepared, shaped and compacted to the required profile in accordance with Clause 501.8 and 902.3 as appropriate, and a prime coat , shall be applied in accordance with clause 502, where specified or as directed by the Engineer.

504.3.3 Tack Coat: A Tack coat in accordance with clause 503 shall be applied as required by the contract documents, or as directed by the Engineer .

504.3.4. Preparation and transport o fthe mixture: The provisions of clauses 501.3 and 501.4 shall apply.

504.3.5. Spreading : The provisions of clauses 501.5.3 shall apply.

TABLE 500-5 MANUFACTURING AND ROLLING TEMPERATURES

Bitumen penetration	Bitumen mixing (℃)	Aggregate mixing (℃)	Mixed material (℃)	Rolling (℃)	Laying (℃)
35	160-170	160-175	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

504.3.6.Rolling; Compaction shall be carried out in accordance with the provisions of clause **501.6 and 501.7.**

Rolling shall be continued until the specified density is achieved, or where no density is specified , until there is no further movement under the roller. The required frequency of testing is defined in clause 903.

504.4. Surface Finish and Quality Control of Work :

The surface finish of construction shall conform to the requirements of Clause 902. For Control of the quality of materials supplied and the works carried out , the relevant provisions of section 900 shall apply .

504.5. Protection of the Laye :

The bituminous 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 to the requirement of Clause 513 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.

504.6. Arrangements of Traffic

During the period of construction, arrangement for traffic shall be made in accordance with the provisions of Clause 112.

504.7. Measurements for Payment

Bituminous macadam shall be measured as finished work in cubic metres or by weight in metric tones ,where used as regulating course,or square metres at the soecified thickness as indicated in the contract or shown on the drawing, or as otherwise directed by the Engineer.

504.

The contract unit rate for Bituminous macadam shall be payment in full for carrying out the required operations including as specified. The rate shall include for all components listed in Clause 501.8.8.2 (i) to (xi) .

505. BITUMINOUS PENETRATION MACADAM

505.1. Scope

The work shall consist of construction of one or more layers of compacted crushed coarse aggregates with alternate applications of bituminous binder and key aggregates in accordance with the requirements of these Specifications to be used as a base course on roads , subject to the requirements of the over all pavement design, in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer. Thickness of an individual course shall be 50 mm or 75 mm, or other as specified .

505.2. Materials

505.2.1. Bitumen: The binder shall be paving bitumen of suitable penetration grade within the range of S-35 to S-90 or A-35 to A-90 (30/40 to80/100) as per Indian Standards Specifications for "Paving Bitumen" IS :73, r approved cutbacks satisfying the requirements of IS: 217 or 454. The actual grade of bitumen or cut backs to be used shall be as specified or as decided by the Engineer.

505.2.2. Aggregates: The aggregates shall satisfy the physical requirements set out in Clause 504.2.2. and Table 500-3.The coarse and key aggregates shall conform to the grading given in Table 500.6.

505.2.3. Quantities of materials: The quantities of materials used for this work shall be as specified in Table 500-6.

505.3. Construction Operations

505.3.1. Weather and seasonal limitations: The provisions of Clause No. 501.5.1 shall apply.

505.3.2. Equipment: A mechanical broom, compressor, self propelled or trailed bitumen heater/distributor, mechanical aggregate spreader and 8 to 10 tonne smooth steel wheel roller or vibrating roller are required for the preparation of Penetration macadam.

505.3.3. Preparation of the base: The base on which the Penetration macadam course is to be laid shall be prepared, shaped and compacted to the specified lines, grades and sections to Clause 501 and 902 as appropriate , or as directed by the Engineer. A prime coat where specified shall be applied over the base in accordance with Clause 502 or as directed by the Engineer. A tack coat as per Clause 503 shall be applied.

505.3.4. Spreading coarse aggregates: The coarse aggregate shall be dry and clean and free from ust and shall be spread uniformly and evenly at the rate specified in Table 500-6 . It shall be spread by a self-propelled or tipper tail mounted aggregate spreader capable of spreading aggregate uniformly at the specified rates over the required widths. The surface of the layer shall be carefully checked with camber templates to ensure correct line and level cross fall. The spreading shall be carried out such that the rolling and penetrating operations can be completed on the same day. Segregated aggregates or aggregates contaminated with foreign material shall be removed and replaced.

TABLE 500-6. COMPOSITION OF PENETRATION MACADAM

IS Sieve designation (mm)	Cumulative per cent by weight of total aggregate passing			
	For 50mm compacted thickness		For 75mm compacted thickness	
	Coarse aggregate	Key aggregate	Coarse aggregate	Key aggregate
63	**-**	**-**	**100**	**-**
45	**100**	**-**	**58-82**	**-**
26.5	**37-72**	**-**	**-**	**100**
22.4	**-**	**100**	**5-27**	**50-75**
13.2	**2-20**	**50-75**	**-**	**-**
11.2	**-**	**-**	**-**	**5-25**
5.6	**-**	**5-25**	**-**	**-**
2.8	**0-5**	**0-5**	**0-5**	**0-5**
Approx.Loose aggregate quantities cu.m/sq.m	**0.06**	**0.015**	**0.09**	**0.018**
Binder quantity (penetration grade)(1)(kg/sq.m)	**5**		**6.8**	

Note: (1) If cutback bitumen is used,adjust binder quantity such that the residual bitumen is equal to the values in this table.

505.3.5. Compaction: After the spreading of coarse aggregates, dry rolling shall be carried out by 8 -10 tonne smooth steel wheel roller.

The requirements given in clause 501.6 and 501.7 shall apply.

After initial dry rolling, the surface shall be checked with a crown template and a 3 metre straightedge. The surface shall not vary more than 10 mm from the template or straightedge. All surface irregularities exceeding the above limit shall be corrected by removing or adding aggregates as required.

The rolling shall continue until the compacted coarse aggregate has firm surface true to the cross section shown on the plans and has a texture that will allow free and uniform penetration of the bituminous material.

505.3.6. Application of bituminous material: After the coarse aggregate has been rolled and checked, the bituminous binder shall be applied at the rate given in Table 500-6 , in accordance with clause 501, and at a temperature as directed by the Engineer.

At the time of applying the binder, the aggregates shall be surface dry for full depth of the layer. In certain circumstances , depending on the type and size of aggregate used, the Engineer may direct the placing of a bed of clean sand or quarry fines, not exceeding 10 mm thickness, on the prepared foundation before placing the coarse aggregate. The sand or fine material shall be slightly wetted , just sufficient for its slurry up during the compaction process. Where cut back is used, if flooding of the binder occurs it should be applied in two operations, or as directed by the Engineer.

505.3.7.Application of key aggregates: Immediately after the first a pplication of bitumen, the key aggregates which shall be clean , dry and free from dust shall be spread uniformly over the surface by means of an approved mechanical spreader or by approved manual methods at the rate specified in Table 500-6.

When directed by the Engineer, the surface shall be swept and the quantity of key aggregate adjusted to ensure uniform application, with all the surface voids in the coarse aggregate being filled without excess. The entire surface shall then be rolled with a 8-10 tonne smooth steel wheel roller (or with vibrating roller operating in non-vibratory mode) in accordance with the procedure specified in Clause 505.3.5.

505.4. Surface Finish and Quality Control

The surface finish of the completed construction shall conform to the requirements of Clause 902. For controls of the quality of materials supplied and works carried out the relevant provisions of Section 900 shall apply.

505.5.Surfacing: The Penetration Macadam shall be provided with a surfacing (binder/wearing course) within a maximum of 48 hours. If there is to be any delay, the penetration macadam shall be covered by a seal coat to the requirements of Clause 513 before opening to traffic . The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

505.6. Arrangements for Trafric

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

505.7. Measurements for Payment

Penetration Macadam Base Course, shall be measured as finished work in square metres.

505.8. Rate

The contract unit rate for Penetration Macadam Course shall be payment in full for carrying out the required operations including, but not necessarily limited to all components listed in Clause 501.8.8.2 (i) to (xi).

506. BUILT-UP SPRAY GROUT

506.1. Scope

This work shall consist of a two-layer composite construction of compacted crushed coarse aggregates with application of bituminous binder after each layer and with key aggregates placed on the top of the second layer, in accordance with the requirements of these Specifications to serve as a base course and in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer. Thickness of the course shall be 75 mm.

Built-up spray grout shall be used in a single course in a pavement structure.

506.2. Materials

506.2.1. Bitumen: Clause 504.2.1 shall apply, Where permitted by the Engineer , an appropriate grade of emulsion complying with IS 8887 may be used.

506.2.2. Aggregates: The coarse aggregate shall conform to Clause 504.2.2.

The aggregate shall satisfy the physical requirements set out in Table 500-3. The coarse and key aggregates for built up spray grout shall confirm to the grading given in table 500-7.

TABLE 500-7. GRADING REQUIREMENTS FOR COARSE AND KEY AGGREGATES FOR BUILT-UP SPRAY GROUT

IS Sieve designation (mm)	Cumulative per cent by weight of total aggregate passing	
	Coarse aggregate	Key aggregate
53	100	-
26.5	40-75	-
22.4	-	100
13.2	0-20	40-75
5.6	-	0-20
2.8	0-5	0-5

506.3.Construction operations

506.3.1Weather and seasonal limitations: The provisions of Clause 501.5.1 shall apply.

506.3.2.Equipment: The provisions of clause 505.3.2 shall apply.

506.3.3 Preparation of base-. The base on which the built-up spray grout course is to be laid shall be prepared, shaped and compacted to the specified lines, grades and cross-sections in accordance with Clause 501 and 902 as appropriate. A priming coat shall be applied in accordance with Clause 502 with approved primer as directed by the Engineer.

506.3.4. Tack coat: A tack coat shall be applied in accordance with the procedure described in Clause 503, as directed by the Engineer.

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506.3.5.Spreading and rolling coarse aggregates for the first layer : Immediately after the application prime or tack coat, the clean, dry and dust free coarse aggregates shall be spread uniformly and evenly by mechanical means at the rate of 0.5 cu.m. per 10 sq.m. area. Immediately after spreading of the aggregates, the entire surface shall be rolled with an 8-10 tonne smooth-wheel steel roller. Rolling shall commence at the edges and progress towards the centre except in super elevated and uni-directional cambered portions where it shall proceed from the lower edge to the higher edge. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass.

The surface of the layer shall be carefully checked ,after rolling, with templates and straight edge and shall be within the tolerances specified ,and any deficiencies corrected by reworking and recompacting the layer.

Care shall be taken not to over-compact the layer.

506.3.6. Application of binder - first spray: The binder shall be heated to the temperature appropriate to grade of bitumen approved by the Engineer and sprayed on aggregate at the rate of 15 kg/ 10 sq. m. (measured in terms of residual bitumen content) at a uniform rate of spray by mechanical sprayers capable of spraying bitumen uniformly at the specified rates and temperatures. Excessive deposits of binder caused by stopping or starting of the sprayers or through leakage or for any other reason
shall be removed and made good.

506.3.7.Spreading and rolling of coarse aggregate for the second layer: Immediately after the first application of the binder, the second layer of coarse aggregates shall be spread and rolled in accordance with the procedure detailed in Clause 506.3.5.

506.3.8. Application of binder-second spray: The second aggregate layer shall then be sprayed with binder at the rate of 15 kg/ 10 sq. m. (measured in terms of residual bitumen contents) in accordance with Clause 506.3.6.

506.3.9. Application of key aggregate: Immediately after second application of the binder, key aggregates shall be spread uniformly and evenly, preferably by mechanical means at the rate of 0.13 cu.m./10 sq. m. so as to cover the surface completely.The key aggregate shall be clean, dry and free from deleterious matter. If necessary, the surface shall be swept to ensure uniform application of the kev aggregates. The entire surface shall then be rolled with a 8-10 tonnes Smooth-wheel steel roller in accordance with Clause 506.3.5. While rolling is in progress, additional key aggregates, where required, shall be spread by hand. Rolling shall continue until the entire course is thoroughly compacted and the key aggregates are firmly in position.

506.4. Surface Finish and Quality Control

The surface finish of construction shall conform to the requirements of Clause 902. all materials shall comply with the requirements of the relevant provisions in Section 900 of the specifications.

506.5. Final surfacing: The built-up-spray-grout shall be provided with final surfacing within a maximum of 48 hours . If there is to be any delay, the course shall be covered by a seal coat to the requirement of Clause 513 before it is open to traffic . Where the seal coat is required as a result of the selected method of performing this operation, then it shall be considered incidental to the work and shall not be paid for separately.

506-6. Arrangements for Traffic

During the period of construction, arrangement of traffic shall be made in accordance with the provisions of Clause 112.

506.7. Measurement for Payment

Built-up spray grout shall be measured as finished work in square metres.

506.8. Rate

The contract unit rate for built-up spray grout shall be payment in full for carrying out the required operations as specified . The rate shall include for , but not necessarily limited to the l components listed in Clause 501.8.8.2 (i) to (xi).

507. DENSE GRADED BITUMINOUS MACADAM

507.1. Scope

This clause specifies the construction of Dense graded bituminous macadam,(DBM), for use mainly, but not exclusively, in base/binder and profile corrective courses. DBM is also intended for use as road base material. This work shall consist of construction in a single or multiple layers of DBM on a previously prepared base or sub-base. The thickness of a single layer shall be c 50 mm to 100 mm.

507.2. Materials

507.2.1. Bitumen: The bitumen shall be paving bitumen of Penetration Grade complying with Indian Standard Specifications for "Paving Bitumen" IS: 73 and of penetration indicated in atable 500-10 for dense Bituminous macadam, or this bitumen as modified by one of the methods provided in clause 521, or as otherwise specified in the contract. Guidance on the selection of an appropriate grade of bitumen is given The manual for construction and supervision of Bituminous works.

507.2.2. Coarse aggregates : The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape , free from dust and soft friable matter , organic or other deleterious substances. Where the contractor's selected source of aggregate have poor affinity for bitumen , as a condition for the approval of that source,the bitumen shall be treated with an approved anti- stripping agent ,as per the manufacturer'srecommendations, without additional payment. Before approval of the source, the aggregates shall be testedfor stripping . The aggregates shall satisfy the physical requirements specified in Table 500-8 for densebituminous macadam..

Where crushed gravel is proposed to be used, not less than 90 per cent by weight of the crushed material retained on 4.75 mm sieve shall have at least two fractured faces.

507.2.3.Fine aggregates: Fine aggregates shall consists of crushed or naturally occurring mineral material, or a combination of the two,passing the 2.36 mm sieve and retained on the 75 micron sieve. They shall be clean, hard, durable, dry and free from dust and soft friable matter , organic or other deleterious matter.

The fine aggregate shall have a sand 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 the 0.425 mm sieve shall not exceed 4,when tested in accordance with IS 2720(Part 5).

TABLE 500-8. PHYSICAL REQIREMENTS FOR COARSE AGGREGATES FOR DENSE GRADED BITUMINOUS MACADAM

Property	Test	specifications
Cleanliness (dust)	**Grain size analysis1**	**Max 5% passing 0.075mm sieve.**
Particle shape	Flakiness and Elongafion Index (Combined)2	**Max 30%**
Strength*	Los Angeles Abrasion value 3 Aggregate impact Value4	**Max 35%** **Max 27%**
Durabilty	**Soundness 5** **Sodium sulpahte** **Magnesium sulphate**	 **Max 12%** **Max 18%**
Water absorption	**Water absorption6**	**Max 2%**
Stripping	**Coating and stripping of Bitumen Aggregate Mixtures 7**	**Minimum retained coating 95%**
Water sensitivity**	**Retained tensile strength 8**	**Min 80%**

Notes: 1. IS: 2386 Part 1 5. IS: 2386 Part 5

2. IS: 2386 Part 1 6. IS :2386 Part 3

(the elongation test to be done only on non-flaky aggregates in the sample)

3. IS: 2386 Part 4* 7. IS: 6241 Part 5

4. IS: 2386 Part 4* 8. AASHTOT2 83**

* **Aggregates may satisfy requirements of either of the two tests.**

** **The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%**

507.2.4. **Filler:** Filler shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement approved by the Engineer.

The filler shall be graded within the limits indicated in Table 500-9.

Table 500-9.GRADING REQUIREMENTS FOR MINERAL FILLER

IS Sieve(mm)	cumulative per cent passing by weight of total aggregate
0.6	**100**
0.3	**95-100**
0.075	**85-100**

The filler shall be free from organic impurities and have a Plasticity Index not greater than 4. The Plasticity Index requirement shall not apply if filler is cement or lime. When the coarse aggregate is gravel, 2 per cent by weight of total aggregate, shall be portland cement or hydrated lime and the percentage of fine aggregate reduced accordingly. Cement or hydrated lime is not required when the limestone aggregate is used.Where the aggregates fail to meet the qualification requirements of the water sensitivity test in Table 500-8, then 2 per cent by total weight of aggregate ,of hydrated lime shall be added without additional cost.

507.2.5. Aggregate gradating : When tested in accordance with IS 2386 Part 1 (wet sieving method), the combined grading of coarse and fine aggregates and added filler for the particular mixture shall fall within the limits shown in Table 500 -10, for dense bituminous macadam grading 1 or 2 as specified in the Contract.The type and quantity of bitumen ,and appropriate thickness , are also indicated for each mixture type..

TABLE 500-10 .COMPOSITION OF DENSE GRADED BITUMINOUS MACADAM PAVEMENT LAYERS

Grading	1	2
Nominal aggregate size	40 mm	25 mm
Layer thickness	80-10 mm	50-75 mm
IS Sieve1(mm)	Cumulative % by weight of total aggregate passing	
45	100	-
37.50	95-100	100
26.5	63-93	90-100
19	-	71-95
13.2	55-75	56-80
9.5	-	-
4.75	38-54	38-54
2.36	28-42	28-42
1.18	-	-
0.6	-	-
0.3	7-21	7-21
0.15	-	-
0.075	2-8	2-8
Bitumen content % by mass of total mix2 Bitumen grade (pen)	Min.4.0 65 or 90	Min.4.5 65 or 90

Notes: 1.The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

2.Detemined by the Marshall method.

507.3. Mixture Design

507.3.1. **Requirement for the mixture:** Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 500-11.

TABLE 5OO-11. REQUIREMENTS FOR DENSE GRADED BITUMINOUS MACADAM.

Minimum stability (kN at 60ºC)	9.0
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 Volts	3-6
	See Table 500-12 below.
Per cent voids in mineral aggregate (VMA)	65-75
Per cent voids filled with Bitumen (VFB)	

The requirements for minimum per cent voids in mineral aggregate (VMA) are set out in Table 500-12

TABLE 500-12. MINMUM PER CENT VOIDS IN MINERAL AGGREGATE (VMA)

Nominal Maximum particle size[1] (mm)	Minimum VMA, Per Cent Related to Design Air Voids, per cent [2]		
	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

Notes: 1. The nominal maximum particle size is one size larger than the first sieve to retain more than 10 per cent.

2. Interpolate minimum voids in the mineral aggregate (VMA) for design air voids values between those listed.

507.3.2. Binder content: The binder content shall be optimised to achieve the requirements of the mixture set out in Table 500-11 and the traffic volume specified in the contract. The Marshall method for detemining the optimum binder content shall be adopted, as described in The Asphalt Institute manual MS- 2, replacing the aggregates retained on the 26.5 mm sieve by the aggregates passing the 26.5 mm sieve and retained on 22.4 mm sieve, where approved by the Engineer.

Where 40 mm dense bituminous macadam mixture is specified , the modified marshal method described in MS-2 shall be used ,This method requires modified equipment and procedures ; particularly the minimum stability values in Tabl 500-11 shall be multiplied by 2.25,and the minimum flow shall be 3 mm..

507.3-3. Job mix formula : The Contractor shall inform the Engineer in writing, atleast 20 days before the start of the work, of the job mix formula proposed for use in the works and shall give the following details:

(i) Source and location of all materials;

(ii) Proportions 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 gradings of the individual aggregate fractions, and the proportion of each in the combined grading .

(v) The results of tests enumerated in Table 500 -11 as obtained by the Contractor;

(vi) Where the mixer is a batch mixer, the individual weight of each type of aggregate , and binder per batch.

(vii) Test results of physical characteristics of aggregates to be used;

(viii) Mixing temperature and compacting temperature.

While establishing the job mix formula, the Contractor shall ensure that it is based on a correct and truly representative sample of the materials that will actually be used in the work and that the mixture and its different ingredients satisfy the physical and strength requirements of these Specifications.

Approval of the job mix formula shall be based on independent testing by the Engineer for which samples of all ingredients of the mix shall be furnished by the Contractor as required by the Engineer.

The approved job mix formula shall remain effective unless and until a revised Job mix formula approved. Should a change in the source of materials be proposed, a new job mix formula shall be forwarded to the Engineer for approval before placing of the material .

507-3.4. 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 as specified in Table 500-13. These variations are intended to apply to individual specimens taken for quality control tests in accordance with section 900.

TABLE 500-13. PERMISSIBLE VARIATION'S FROM THE JOB MIX FORMULA

Description	**Permissible variation**	
	Base/binder course	wearing course
Aggregate passing 19 mm sieve **or larger**	±8%	±7%
Aggregate passing 13.2mm and 9.5 mm :	±7%	±6%
Aggregate passing 4.75 mm	±6%	±5%
Aggregate passing 2.36mm,1.18mm ,06.mm .	±5%	±4%
Aggregate passing 0.3mm and 0.15 mm	±4%	±3%
Aggregate passing 0.075mm	±2%	±1.5%
Binder content	±0.3%	±0.3%
Mixing temperature	±10º C	±10º C

Once the plant trials have demonstrated the capability of the plant , and the trials are approved ,the laying operation may commence. Over the period of the first month of production for laying on the works ,the Engineer shall require additional testing of the product to establish the reliabilty and consistancey of the plant.

507.3.5 Laying trials: Once the plant trials have been sucessfully completed and approved , the Contractor shall carry out laying trials, to demonstrate that the proposed mix can be successfully laid, and compacted all in accordance with clause 501. The laying trials shall be carried out on a suitable area which is not to form part of the works, unless specifically approved in writing by the Engineer .The area of laying trials shall be a minimum of 100 sq.m of construction similar to that of the project road ,and it shall be in all respects,particularly compaction ,the same as the project construction , on which the bituminous material 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 laying plant , compaction plant ,and methodology is capable of producing satisfactory results. The density of the finished paving layer shall be determined by taking cores,no sooner than 24 hours after laying , or by other approved method.

Once the laying trials have 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 trials.

507.4. Construction Operations

507.4.1. Weather and seasonal limitations: The Provisions of Clause 501.5.1. shall apply.

507.4.2. Preparation of base: The base on which Dense graded Bituminous material is to be laid shall be prepared, in accordance with Clause 501 and 902 as appropriate, or as directed by the Engineer. The surface shall be thoroughly swept clean by mechanical broom and the dust removed by compressed air. In locations where mechanical broom cannot access, other approved method shall be used as directed by the Engineer.

507.4.3 Geosynthetics: Where Geosynthetics are specified in the contract, this shall be in accordance with the requirements stated in clause 703.

507.4.4. Stress absorbing layer: Where a stress absorbing layer is specified in the contract this shall be in accordance with the requirements stated in clause 70 3.

507.4.5. Prime coat: Where the material on which the dense bituminous macadam is to be laid is other than a bitumen bound layer, a prime coat shall be applied, as specified, in accordance with the provisions of clause 502, or as directed by the Engineer.

507.4.6. Tack coat: Where the material on which the dense bituminous macadam is to be placed is a bitumen bound surface, a tack coat shall be applied, as specified, in accordance with the provisions of clause **503,** or as directed by the Engineer.

507.4.7.Mixing and transportation of the mixture : The provisions as specified in clause 501.3 and Clause 504.3.4 shall apply.

507.4.8.Spreading: The provisions of cluses 501.5.3 and 501.5.4 shall apply .

507.4.9. Rolling : General provisions of clause 501.6 and 501.7 shall apply, as modified by the approved laying trials .The compaction process shall be carried out by the same plant, and using the same method,as approved in the laying trials, which may be varied only with the express approval of the Engineer in writing .

507.5 .Opening to traffic : The newly laid surface shall not be open to traffic for atleast 24 hours after laying and the completion of compaction , without the express approval of the Engineer in writing.

507.6.Surface finish and quality control of work:

The surface finish of the completed construction shall conform to the requirements of Clause 902 . All materials and workmanship shall comply with the provisions set out in Section 900 of this specification.

507.7.Arrangements for traffic :

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

507.8.Measurements for payment:

Dense graded Bituminous material shall be measured as finished work either in cubic metre ,tons or by the square metre at a specified thickness as detailed on the contract drawings , or documents, or as directed by the Engineer .

507.9. Rates: The contract unit rate for Dese graded Bituminous Macadam shall be payment in full for carrying out the all required operations as specified, and shall include , but not necessarily limited to all components listed in clause 501.8.8.2 (i) to (xi). The rate shall include the provision of Bitumen, at 4.25 per cent, by weight of the total mixture .

The variance in actual percentage of bitumen used will be assessed and the payment adjusted, up or down, accordingly.

508. SEMI - DENSE BITUMINOUS CONCRETE

508.1. Scope

This clause specifies the construction of semi dense bituminous concrete for ,use in binder/wearing and profile corrective course .This work shall consist of construction in a single or multiple layers of semi dense bituminous concrete on a previously prepared bituminous bound surface . A sinfle layer shall be 25 mm to 100 mm in thickness .

508.2 Materials

508.2.1 .Bitumen : The bitumen shall be paving bitumen of Penetration Grade complying with Indian Standard Specifications for "Paving Bitumen" IS: 73 and of the penetration indicated in table 500-15, semi dense bituminous concrete, or this bitumen as modified by one of the methods specified in clause 521, or as therwise specified in the contract. Guidance on the selection of an appropriate grade of bitumen is given in The manual for construction and supervision of bituminous works.

508.2.2 Coarse aggregates : The Coarse aggregate shall be generally as specified in Clause 507.2.2 , except that the aggregates shall satisfy the physical requirements of Table 500-14.

508.2.3 Fine aggregates :The Fine aggregate shall be all as specified in **Clause** 507.2.4 .

508.2.4 Filler : Filler shall **be** generally as specified Clause 507.2.2. Where the aggregates fail to meet the requirements of the water sensitivity test in Table 500-14 then 2 per cent by total weight of aggregate , of hydrated lime shall be added to without additional cost.

508.2.5 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 Table 500-15 for gradings 1 or 2 as specified in the contract.

508.3. MIXTURE DESIGN

508.3.1.Requirements for the mixture: Apart from conformity with the grading and quality requirements for individual ingredients the mixture shall meet the requirements set out in Table 500-16.

TABLE 500-14. PHYSICAL REQIREMENTS FOR COARSE AGGREGATES FOR SEMI DENSE BITUMINOUS PAVEMENT LAYERS.

Property	Test	Specification
Cleanliness(dust)	**Grain size analysis 1**	**Max 5% passing 0.075 mm sieve**
Particle shape	Flakiness and Elongation Index (combined)2	**Max 30%**
Strength*	Los Angeles Abrasion value 3	**Max 35%**
Polishing	**Aggregate impact value4.**	**Max 27%**
	Polished stone value5.	**Min 55**
Durability	**Soundness:6**	
	Sodium sulphate	**Max 12%**
	Magnesium Sulphate	**Max 18%**
Water absorption	**Water absorption7**	**Max 2%**
Stripping	**Coating and stripping of Bitumen Aggregate Mixtures9.**	**Minimum retained Coating 95%**
Water Sensitivity**	**Retained Tensile strength8**	**Min 80%**

Notes: 1. IS :2386 Part I 6. IS :2386 Part 5
2. IS :2386 Part I 7. IS :2386 Part 3
(the elongation test may be done only on non-flaky aggregates in the sample)
3. IS :2386 Part 4* 8. AASHTOT283**

4. IS :2386 Part 4* 9. IS:6241
5. BS:812 Part 114

* Aggregate may satisfy requirements of either of these two tests.

** The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

The requirements for minimum percent voids in mineal aggregate (VMA) are set out in Table 500-12

508.3.2.Binder Content: The binder content shall be optimised to achieve the requirements of the mixture set out in table 500-16 and the traffic volume as specified in the contract. The marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute manual MS- 2, replacing the aggregates retained on the 26.5mm sieve and retained on the 22.4mm sieve, where approved by the Engineer.

Table 500-15. COMPOSITION OF SEMI -DENSE BITUMINOUS CONCRETE PAVEMENT LAYERS

Grading 1 2		
Nominal aggregate size	13 mm	10 mm
Layer thickness	35-40 mm	25-30mm
IS Sieve 1 (mm)	cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	-	-
19	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
0.6	-	-
0.3	9-19	9-19
0.15	-	-
0.075	3-8	3-8
Bitumen content % by mass of total mix2	Min 4.5	Min 5.0
Bitumen grade (pen)	65*	65*

Notes: 1.The combined aggregate grading shall not vary from the Low limit on one sieve to the high limit on the adjacent sieve.
2.Determined by the Marshall method.
* Only in exceptional circumstances, 80/100 penetration grade may be used, as approved by the Engineer.

Table 500-16: Requirements for semi dense Bituminous Pavement layers

Mimum Stability (kN at 60° C.	8.2
Minimum flow(mm)	2
Minimum flow(mm)	4
Compaction level (Number of blows) Per cent air voids	75 blows on each of the two faces of the specimen 3-5
Percent voids in mineral aggregate(VMA)	See Table 500-12
Percent voids filled with bitumen (VFB	65-78

508.3.3. Job Mix Formula: The procedure for formulating the job mix formula shall be generally as specified in clause 507.3.3 and the results of tests enumerated in table 500-16 as obtained by the contractors.

508.3.4.Plant trials - Permissible variation in job Mix formula:

The requirements for plant trials shall be all as specified in clause 507.3.4 and permissible limits for variation as shown in Table 500-13.

508.3.5.Laying trials : The requirements for laying trials shall be all as specified in clause 507.3.5 shall apply.

508.4. Construction operations

508.4.1.Weather and seasonal limitations: The provisions of clause 501.5.1 shall apply.

508.4.2. Preparation of base: The surface on which the semi Dense Bituminous Material is to be laid shall be prepared in accordance with Clause 501 and 902 as appropriate ,or 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 cannot access , other approved methods shall be used as directed by the Engineer.

508.4.3.Geosynthetics: Where geosynthetics are specified in the contract this shall be in accordance with the requirements stated in clause 703.

508.4.4. Stress absorbing layer: Where a stress absorbing layer is specified in the contract , this shall be applied in accordance with the requirements stated in clause 522.

508.4.5Tack coat: Where specified in the contract , or otherwise required by the Engineer **,** a tack coat shall be applied in accordance with the requirements of Clause **503.**

508.4.6. Mix ing and transportation of the mixture : The provisions as specified in clauses 501.3 and 501.4 shall apply.

508.4.7. Spreading: The General provisions of clauses 501.5.3 and 501.5.4 shall apply .

508.4.8Rolling: The General provisions of clauses 501.6 and clause 501.7. shall apply, as modified by the approved laying trials. The compaction process shall be carried out by the same plant and using the same method, as approved in the laying trials , which may be varied only with the express approval of the Engineer in writing .

508.5. Opening to traffic : The newly laid surface shall not be open to traffic for atleast 24 hours after laying and the completion of compaction , without the express approval of the Engineer in writing.

508.6.Surface finish and quality control :

The surface finish of the completed construction shall conform to the requirements of Clause 902 . All materials and workmanship shall comply with the provisions set out in Section 900 of this specification.

508.7.Arrangements for traffic :

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

508.8. Measurements for payment:

The Measurement shall be all as specified in clause 507.8.

508.8. Rates: The contract unit rate shall be all as specified in clause 507.9, except that the rate shall include the provision of Bitumen at 4.75 per cent, by weight of total mixture . The variance in actual percentage of bitumen used will be assessed and payment adjusted up or down, accordingly.

509. BITUMINOUS CONCRETE

509.1. Scope

This clause specifies the construction of bituminous concrete for ,use in wearing and profile corrective course .This work shall consist in a single or multiple layers of bituminous concrete on a previously prepared bituminous bound surface . A single layer shall be 25 mm to 100 mm in thickness .

509.2 Materials

509.2.1 .Bitumen : The bitumen shall be paving bitumen of Penetration Grade complying with Indian Standard Specifications for "Paving Bitumen" IS: 73 and of the penetration indicated in table 500-18, for bituminous concrete, or this bitumen as modified by one of the methods specified in clause 521, or as otherwise specified in the contract. Guidance on the selection of an appropriate grade of bitumen is given in The manual for construction and supervision of bituminous works.

509.2.2 Coarse aggregates : The Coarse aggregate shall be generally as specified in Clause 507.2.2 , except that the aggregates shall satisfy the physical requirements of Table 500 -17.

509.2.3 Fine aggregates : The Fine aggregate shall be all as specified **Clause** 507.2.3 .

509.2.4 Filler : Filler shall **be** generally as specified Clause 507.2.4. Where the aggregates fail to meet the requirements of the water sensitivity test in Table 500-17 then 2 per cent by total weight of aggregate , of hydrated lime shall be added to without additional cost.

509.2.5 Aggregate grading and binder content: When tested in accordance with IS 2386 part-I (wet grading method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in Table 500-18 for gradings 1 or 2 as specified in the contract.

509.3. MIXTURE DESIGN

508.3.1.Requirements for the mixture: Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 500-19. The requirements for minimum percent voids in mineral aggregate (VMA) **are set out in Table 500-12**

508.3.2.Binder Content: The binder content shall be optimised to achieve the requirements of the mixture set out in table 500-19 and the traffic volume as specified in the contract. The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute manual MS- 2, replacing the aggregates retained on the 26.5mm sieve and retained on the 22.4mm sieve, where approved by the Engineer.

509.3.3. Job Mix Formula: The procedure for formulating the job mix formula shall be generally as specified in clause 507.3.3 and the results of tests enumerated in table 500-19 as obtained by the contractors.

TABLE 500-17. PHYSICAL REQIREMENTS FOR COARSE AGGREGATES FOR BITUMINOUS CONCRETE PAVEMENT LAYERS.

Property	Test	Specification
Cleanliness(dust)	**Grain size analysis 1**	**Max 5% passing 0.075 mm sieve**
Particle shape	Flakiness and Elongation Index	**Max 30%** (combined)2
Strength*	Los Angeles Abrasion value 3 **Aggregate impact value4.**	**Max 30%** **Max 24%**
Polishing	**Polished stone value5.**	**Min 55**
Durability	**Soundness:6** **Sodium sulphate** **Magnesium Sulphate**	 **Max 12%** **Max 18%**
Water absorption	**Water absorption7**	**Max 2%**
Stripping	**Coating and stripping of Bitumen Aggregate Mixtures9.**	**Minimum retained Coating 95%**
Water Sensitivity**	**Retained Tensile strength8**	**Min 80%**

Notes: 1. IS :2386 Part I
2. IS :2386 Part I
(the elongation test may be done only on non-flaky aggregates in the sample)
3. IS :2386 Part 4*
4. IS :2386 Part 4*
5. BS:812 Part 114
6. IS :2386 Part 5
7. IS :2386 Part 3
8. AASHTOT283**
9. IS:6241

* Aggregate may satisfy requirements of either of these two tests.
** The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

509.3.4.Plant trials - Permissible variation in job Mix formula:
The requirements for plant trials shall be all as specified in clause 507.3.4 and permissible limits for variation as shown in Table 500-13.

508.3.5.Laying trials : The requirements for laying trials shall be all as specified in clause 507.3.5.

509.4. Construction operations

509.4.1.Weather and seasonal limitations: The provisions of clause 501.5.1 shall apply.

Table 500-18. COMPOSITION OF BITUMINOUS CONCRETE PAVEMENT LAYERS

Grading	1	2
Nominal aggregate size	19 mm	13 mm
Layer thickness	50-65 mm	30-45 mm
IS Sieve 1 (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	100	-
19	79-100	100
13.2	59-79	79-100
9.5	52-72	70-88
4.75	35-55	53-71
2.36	28-44	42-58
1.18	20-34	34-48
0.6	15-27	26-38
0.3	10-20	18-28
0.15	5-13	12-20
0.075	2-8	4-10
Bitumen content % by mass of total	5.0 – 6.0	5.0 –7.0
mix2		
Bitumen grade (pen)	65	65

Notes: 1.The combined aggregate grading shall not vary from the Low limit on one sieve to the high limit on the adjacent sieve.
2.Determined by the Marshall method.

Table 500-19: Requirements for Bituminous Pavement layers

Mimum Stability (kN at 60° C.	9.0
Minimum flow(mm)	2
Minimum flow(mm)	4
Compaction level (Number of blows) Per cent air voids	75 blows on each of the two faces of the specimen 3-6
Per cent voids in mineral aggregate(VMA)	See Table 500 -12
Per cent voids filled with bitumen (VFB) Loss of stability on immersion in water at 60℃ (ASTM D 1075)	65 –75 Min.75 per cent Retained strength

509.4.2. Preparation of base: The surface on which the Bituminous concrete is to be laid shall be prepared in accordance with Clause 501 and 902 as appropriate ,or as directed by the Engineer. The surface shall be thoroughly swept clean by a

mechanical broom and dust removed by compressed air. In locations where a mechanical broom cannot access , other approved methods shall be used as directed by the Engineer.

509.4.3.Geosynthetics: **Where geosynthetics are specified in the contract this shall be in accordance with the requirements stated in clause 703.**

509.4.4. Stress absorbing layer: **Where a stress absorbing layer is specified in the contract , this shall be applied in accordance with the requirements of clause 522.**

509.4.5Tack coat: Where specified in the contract , or otherwise required by the Engineer **,** a tack coat shall be applied in accordance with the requirements of Clause **503.**

509.4.6. Mixing and transportation of the mixture : The provisions as specified in clauses 501.3 and 501.4 shall apply.

509.4.7.Spreading: The General provisions of clauses 501**.**5.3 and 501.5.4 shall apply .

509.4.8.Rolling: The General provisions of clauses 501.6 and clause 501.7. shall apply, as modified by the approved laying trials.

509.5. Opening to traffic : The newly laid surface shall not be open to traffic for atleast 24 hours after laying and the completion of compaction , without the express approval of the Engineer in writing.

509.6.Surface finish and quality control :

The surface finish of the completed construction shall conform to the requirements of Clause 902 . All materials and workmanship shall comply with the provisions set out in Section 900 of this specification.

509.7.Arrangements for traffic :

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of

Clause 112.

509.8.Measurements for payment:

The Measurement shall be all as specified in clause 507.8.

509.9. Rates:

The contract unit rate shall be all as specified in clause 507.9, except that the rate shall include the provision of Bitumen at 5.0 per cent, by weight of total mixture . The variance in actual percentage of bitumen used will be assessed and the payment adjusted up or down, accordingly.

510. SURFACE DRESSING

510.1. Scope

This work shall consist of the application of one coat or two coats of surface dressing, each coat consisting of a **layer of** bituminous binder sprayed on a previously prepared base , followed by a cover of stone chips rolled in to form a wearing course to the requirements of these Specifications.For information on the Design of surface dressing refer to the manual for Construction and supervision of bituminous works.

510.2. Materials

510.2.1. Binder : The binder shall have a kinematic viscosity lying in the range 1 × (10)4 × 7 x (10)5 centistokes at the expected range of road surface temperatures at the construction site during the period of laying . The type of binder to be used will be stated in the Contract documents and shall comply with one of the following ;

Paving Bitumen	IS:73
Bitumen Emulsion	IS:8887

510.2.2. **Aggregates :** The chips shall conform to the requirements of Clause 504.2.2 except that their water absorption shall be restricted to a maximum of I per cent and they shall have a Polished stone Value, as measured **by the method given in** BS 812 (Part 114), of not less than 60. The chips **shall** be single sized , clean, hard ,durable ,of cubical shape , free from dust and soft friable matter, organic or other deleterious matter also conforming to one of thee gradings given in Table 500 –21.

510.2.3. Rates of spread of binder and chips: For the purpose of pricing the bill of quantities the rates of spread given in Table 500-20 shall be priced .

TABLE 500-20: NOMINAL RATES OF SPREAD FOR BINDER AND CHIPPINGS(1)

Nominal chipping size mm	Binder (Penetration grade Bitumen) Kg/m2	Chips Cu.m/m2
19	1.2	0.015
13	1.00	0.010
10	0.9	0.008
6	0.75	0.004

Note:- (1) The rates of spread are for pricing purpose – see clause 510.2.3 and clause 510.8.
(2) – For emulsion , these rates of spread are for the residual bitumen and appropriate adjustment must be made to determine the total quantity.
(3). Refer to manual for Construction and supervision of bituminous works for the procedure of determining the rates of spread of binder and chips.

510.2.4. Anti stripping agent : Where the proposed aggregate fails to pass the stripping test then an approved adhesion agent (Appendix 5 for details) may be added to the binder in accordance with the manufacturer's instructions. The effectiveness of the proposed antistripping agent must be demonstrated by the contractor , before approval by the Engineer.

510.2.5 Pre-coated chips: As an alternative to the use of an adhesion agent the chips may be pre-coated before they are spread except when the sprayed binder film is a bitumen emulsion. Pre-coating the chips may be carried out in any one of the two methods;

a). Mixing them with 0.75 to 1.0 percent of paving bitumen by weight of chips in a suitable mixer, the chips being heated to 160° C and the bitumen to its application temperature. The Pre-coated chips shall be allowed to cure for at least one week or until they become non sticky and can be spread easily.

b). Spraying the chips with a light application of cresote, diesel oil or kerosene at ambient temperature .This spraying can be done in a concrete mixer or on a belt conveying the chips from stockpile to gritting lorries.

510.3. **Construction operations**

510.3.1.Weather and seasonal limitations: Clause 501.5.1 shall apply.

TABLE 500-21. GRADING REQUIREMENTS FOR CHIPS FOR SURFACE DRESSING

IS Sieve Designation mm	Cumulative percent by weight of total aggregate passing for the following nominal sizes (mm)			
	19	13	10	6
26.5	100	-	-	-
19.0	85-100	100	-	-
13.2	0-40	85-100	100	-
9.5	0-7	0-40	85-100	100
6.3	-	0-7	0-35	85-100
4.75	-	-	0-10	-
3.35	-	-	-	0-35
2.36	0-2	0-2	0-2	0-10
0.60	-	-	-	0-2
0.075	0-1.5	0-1.5	0-1.5	0-1.5
minimum 65% by weight of aggregate	passing 19 mm retained 13.2mm	passing 13.2 mm retained 9.5 mm	passing 9.5 mm retained 6.3 mm	passing 6.3 mm retained 3.35 mm

510.3.2. Preparation of base : The base on which the surface dressing is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross-section in accordance with Clause 501 and as directed by the Engineer. Prime coat, where needed, shall be provided as per Clause 502 or as directed by the Engineer. Where the existing surface shows signs of fatting up, the excess bitumen shall be removed by burning off, or manually as specified in the contract or as directed by the Engineer . The bituminous surface to be dressed shall be thoroughly cleaned either by using a mechanical broom / compressed air, or any other approved equipment/ method as specified in the contract or by the Engineer. The prepared surface shall be dust free, clean and dry, (except in the case of cationic emlsion where the surface shall be damp).

510.3.3. Application of binder: The equipment and general procedures shall be in accordance with the manual for construction and supervision of Bituminous works. The application temperature for the grade of binder used shall be as given in Table 500-22 and the rate of spray as given in 510.2.3 .

TABLE 500-22. SPRAYING TEMPERATURES FOR BINDERS

Binder grades	**Whirling spray jets**		**Slot jets**	
	Min° C	**Max °C**	**Min °C**	**Max °C**
Penetration grades				
400/500	**160**	**170**	**140**	**150**
280/320	**165**	**175**	**150**	**160**
180/200	**170**	**190**	**155**	**165**
80/100	**180**	**200**	**165**	**175**

510.3.4. Application of stone clippings: The equipment and general procedures shall be in accordance with the manual for construction and supervision of Bituminous works. For relatively small area of surface dressing, careful application of chips by hand may be acceptable if approved by the Engineer. The rate of application of chips shall be as determined by the procedure given in the manual for construction and supervision of Bituminous works. Immediately after the application of the binder, clean, dry chips (in case of emulsion binder, the chippings may be damp) shall be spread uniformly on the urface so as to cover the surface completely with a single layer of chips

510.3.5. Rolling: Rolling of the chips should preferably be carriedou by a pneumatic tyred roller in accordance with clause 501.6 and clause 501.7. Traditional steel wheeled rollers tend to crush the aggregates and if their use cannot be avoided their weight should be limited to 8 tonnes . Rolling shall commence at the edges and progress towards the centre except in super elevated and uni-directional cambered portions where it shall proceed from the lower edge to the higher edge. Each pass of the roller hall uniformly overlap not less than one-third of the track made in the preceding pass. While rolling is in progress, additional chips shall be spread by hand in necessary quantities required to make up irregularities. Rolling shall continue until all aggregate particles are firmly embedded in the binder and present a uniform closed surface.

510.3.6. Application of second coat of surface dressing Where surface dressing in two coats is specified, the second coat should not be applied until the first coat has been open to traffic for 2 or 3 weeks. The surface on which the second coat is laid must be claen and free of dust. The construction operations for the second coat shall be the same as described in Clauses 510.3.3 to 510.3.5.

510.4. Opening to traffic : Traffic shall not be permitted to run on any newly surface dressed area until the following day. In special circumstances, however, the Engineer may allow the road to be opened to traffic immediately after rolling, but in such cases traffic speed shall be limited to 20 km per hour until the following day.

510.5.Surface finish and quality control of work:

The surface finish of construction shall conform to the requirements of Clause 902.

For Control on the quality of materials supplied and the works carried out , the relevant provisions of Section 900 shall apply.

510.6. Arrangements for traffic :

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 1 12.

510.7. **Measurements for payment:**

Each coat of surface dressing shall be measured as finished work , for the area to be covered , in square

melres.

510.8. Rates: The contract unit rate for surface dressing , based on the notional rates of spread for binder and each size of chippings given in clause 510.2.3, which shall be adjusted ,plus or minus, for the difference between the notional rates of spread and the rates of spread determined as described in the manual for construction and supervision of Bituminous works, and approved by the Engineer , multiplied by the rates entered in the bill of quantities for binder and each size of chipping. The adjusted rate shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2 (i) to (xi).

511. OPEN-GRADED PREMIX SURFACING

511.1. Open-graded Premix surfacing using Penetration Bitumen or cut back.

511.1.1. Scope : This work shall consist of preparation ,laying and compaction of an open-graded pre mix surfacing material of 20 mm thickness composed of small-sized aggregates premixed with a bituminous binder on a previously prepared base, in accordance with the requirements of these Specifications, to serve as a wearing course.

511.1.2. Materials

511.1.2.1. Binder: The binder shall be a penetration bitumen of a suitable grade as specified in the Contract , or as directed by the Engineer and satisfying the requirements of IS : 73,

511.1.2.2. Aggregates: The aggregates shall conform to Clause 504.2.2. except that the water absorption shall be limited to a maximum of I per cent. The polished stone value ,as measured by the test in BS 812 – (Part 114), shall not be less than 55.

511.1.2.3.Proportioning of materials: The materials shall be proportioned in accordance with Table 500- 23.

511.1.3. Construction operations

511.1.3.1. Weather and seasonal limitations: Clause 501.5.1 shall apply.

511.1.3.2 Preparation of base: The underlying surface on which the bituminous surfacing is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and crosssccction in accordance with Clause 501. A prime coat where needed shall be applied in accordance With Clause 502 as directed by the Engineer.

TABLE 500-23. QUANTITIES OF MATERIALS REQUIRED FOR 10 m2 OF ROAD
SURFACE FOR 20 mm THICK OPEN GRADED PREMIX SURFACING USING PENETRATION BITUMEN OR CUT BACK.

		Aggregates
(a)	Nominal Stone size 13.2 mm (passing 22.4 mm sieve and retained on 11.2 mm sieve)	- 0.18 cu.m.
(b).	Nominal Stone size 11.2mm (passing 13.2 mm, sieve and retained on 5.6 mm sieve)	-0.09 cum.
	Total	**- 0.27 cum.**
Binder (quantities in terms of straight run bitumen)		
(a) For 0.18 cu. m of 13.2 mm nominal size stone at 52 kg bitumen /cu. m.		- 9.50kg.
(b) For 0.09cum. of 11.2 mm snominal ize stone at 56 kg bitumen per cum.		- 5.10kg.
	Total	**- 14.60kg.**

511.1.3.3.Tack coat : A Tack coat complying with Clause 503, shall be applied over the base preparatory to laying of the surfacing .

511.1.3.4. Preparation of premix : Hot mix plant of appropriate capacity and type shall be used for the preparation of mix material. The hot mix plant shall have separate dryer arrangement for heating aggregates .
The temperature of binder at the time of mixing shall be in the range of 150° C to 163 ° C and that of the aggregates in the range of 155° C to 163,℃ provided that the difference in temperature between the binder and aggregates at no time exceeds 14° C. Mixing shall be thorough to ensure that a homogeneous mixture is btained in which all particles of the aggregates are coated uniformly and the discharge temperature of mix shall be between 136℃ and 160° C.

The mix shall be immediately transported from the mixer to the point of use in suitable vehicles or hand barrows. The vehicles employed for transport shall be clean and the mix being transported covered in transit if so directed by the Engineer.

511.1.3.5. Spreading and rolling: The pre-mixed material shall be spread by suitable means to the desired thickness, grades and cross full (camber) making due allowance for any extra quantity required to fill up depressions, if any. The cross fall should be checked by means of camber boards and irregularities levelled out. Excessive use of blades or rakes should be avoided. . As soon as sufficient length of bituminous material has been laid, rolling shall commence with 8-10 tonnes rollers, smooth wheel tandem type, or other approved equipment. Rolling shall begin at the edge and progress toward the center longitudinally, except that on the super elevated and unidirectional cambered portions, it shall progress from the lower to upper edge parallel to the center line of the pavement.

When the roller has passed over the whole area once ,any high spots or depressions, which become apparent shall be corrected by removing or adding premixed materials. Rolling shall then be continued until the entire surface has been rolled and all the roller marks eliminated. In each pass of the roller, the preceding track shall be overlapped uniformly by at least 1/3 width. The roller wheels shall be kept damp to prevent the premix from adhering to the wheels . In no case shall fuel /lubricating oil be used for this purpose. Excess use of water for this purpose shall be avoided.

Rollers shall not stand on newly laid material. Rolling operations shall be completed in every respect before the temperature of the mix falls below 100 ^{o}C. Joints along and transverse to the surfacing laid and compacted earlier shall be cut vertically to their full depth so as to expose fresh surface which shall be painted with a thin coat of appropriate binder before the new mix is placed against it.

511.1.3.6. Seal coat: A seal coat conforming to Clause 513 of the type specified in the contract shall be applied to the surface immediately after laying the surfacing.

511.1.4. Opening to traffic: No traffic shall be allowed on the road until the seal coat has been laid. After the seal coat is laid, the road may be opened to traffic according to Clause 513.4.

511.1.5. Surface finish and quality control of work: The surface finish of construction shall conform to the requirements of Clause 902. For control of the quality of materials supplied and the works carried out , the relevant provisions of Section 900 shall apply .

511.1.6. Arrangements for traffic: During the period of construction, arrangement of traffic shall be made in accordance with the provisions of Clause 112.

511.1.7. Measurements for payment: Open graded premix surfacing shall be measured as finished work , for the area instructed to be covered, in square metres. The area will be net area covered , and allowance for wastage and cutting of joints shall be deemed to be included in the rate .

511.1.8. Rate: The contract unit rate for open-graded premix surfacing shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2.(i) to (xi).

511.2 Open graded Premix surfacing using Cationic Bitumen Emulsion

511.2.1. Scope: This work shall consist, of the preparation , laying and compaction of an open graded premix surfacing of 20 mm thickness composed of small sizes aggregates premixed with a Cationic bitumen emulsion on a previously prepared surface, in accordance with the requirements of these Specifications , to serve as a wearing course.

511.2.2. Materials

511.2.2.1. Binder: The binder for premix wearing course shall be Cationic bitumen emulsion of Medium Setting (MS) grade complying with IS: 8887 and having a bitumen content 65 per cent minimum by weight. For liquid seal coat RS grade of Cationic bitumen emulsion shall be used. Where expressly specified in the contract MS grade emulsion shall be used or otherwise directed by the Engineer. Slow Setting (SS) grade Cationic bitumen emulsion shall be used for premix seal coat.

511.2.2.2. Coarse aggregates : The requirements of Clause 511.1.2.2. shall apply

511.2.3. Proportioning of materials: The materials shall be proportioned as quantities given in tables **500-24 and 500-25** .

TABLE 500-24. QUANTITIES OF AGGREGATES FOR 10 m 2 **AREA**

(A)		**Premix Carpet**	
	(a)	Coarse aggregate nominal 13.2mm size; passing IS 22.4 mm sieve and retained on IS 11.2 mm sieve	- 0.18 cum.
	(b)	Coarse aggregate nominal size 11.2 mm ; passing IS 13.2 mm sieve and retained on IS 5.6 mm sieve	- 0.09 cum.
(B).		**For Seal Coat:**	

Refer to clause 513.

Table 500-25. QUNATITIES OF EMULSION BINDER

For 10 M2 area

(A) For Premix carpet: 20 to 23 Kg.

(B). For Seal coat:

(a). for Liquid seal coat 12 to 14 kg

(b). For premix seal coat 10 to 12 Kg.

511.2.4. Construction operations:

511.2.4.1. Weather and seasonal limitations: Clause 501.5.1 shall apply except that the minimum air temperature for laying shall be 10° C . Cationic bitumen emulsions shall not normally be stored below 0° C.

511.2.4.2. Preparation of surface: The underlying surface on which the premix surfacing is to be laid shall be prepared, in accordance with the requirements of Clause 504.3.2 for a newly primed surface and in accordance with clause 507.4.2, where an existing bituminous surface is to be over laid ,

511.2.4.3. Preparation of binder: Before opening, the cationic bitumen emulsion drums shall be rolled at slow speed , to and fro, at least 5 times , for a distance of about 10 metres, to distribute any storage sedimentation.

511.2.4.4. Tack coat: A tack coat complying with Clause 503 , shall be applied over the surface preparatory to laying of the surfacing where specified in the contract , or directed by the Engineer.

511.2.4.5. Preparation of premix: Premixing of Cationic bitumen emulsion and aggregates can be carried in a suitable mixer such as cold mixing plant as per IS: 5435 (Revised) or concrete mixer or by pay loaders in exceptional cases where approved by the Engineer. Where specified in the contract , continuous mixing Operation shall be done either in batch or continuousHot mix plant suitable for-emulsion mixes. When using concrete mixer for preparing the premix, 0.135 cum.. (0-09 cu.m. of 13.2 min size and 0.045 cu.m. of 11.2 mm size) of' aggregates per batch shall be used which quantity will cover 5 sq.m. of road surface with 20 mm average thickness.

The aggregates required for one batch shall be prepared adjacent to the mixer.

First the coarse aggregates of 13.2 mm size shall be placed into the mixer followed by 5 to 6.5 kg of Cationic bitumen emulsion and then 11.2 mm size aggregates shall be added, followed by 5 to 6.5 kg of Cationic bitumen emulsion. After the materials have been mixed thoroughly, the mix shall be immediately transported to the laying Site in suitable vehicles. Too much mixing shall be avoided . When mixed manually by shovels, with the approval of the Engineer. 0.06 cum. of aggregates can be conveniently mixed in one heap, with appropriate quantity of emulsion. It is preferable to make the aggregates damp before mixing as it reduces the effort required for mixing and also helps to get better coating of aggregates.The 13.2 mm size aggregates and emulsion are mixed first and then the 11.2 mm size aggregate and remaining quantity of emulsion are added and mixed. Too much mixing shall be avoided .

511.2.4-6. Spreading and rolling: The premixed cationic bitumen emulsion and aggregates shall be spread within 10 minutes of applying the tack coat. All levelling, raking, etc., should be completed within 20 minutes of the time of mixing. The mix should be spread uniformly to the desired thickness, grades and crossfall (camber) making due allowance for any extra quantity required to fill up depressions, if any. The cross fall should be checked by means of camber boards and irregularities levelled out. Too much raking is to be avoided. The rolling shall start immediately after laying the premix. A Smooth wheeled tandem roller of 8-10 tonnes shall be used, unless other compaction methods are approved by the Engineer, based on the results of laying trials, if necessary. While rolling, wheels of roller should be clean and kept moist to prevent the premix from adhering to the wheels . In no case shall fuel/lubricating oil be used for this purpose. Use of Water for this purpose shall be strictly limited to absolute minimum .

Rolling shall commence at the edges and progress towards the cenlre longitudinally except in case of super elevated and unidirectional cambered sections where rolling shall be carried out from lower edge towards the higher edge parallel to the centre line of the road.

After one pass of roller over the whole area, depressions or uncovered spots should be corrected by adding premix material. Rolling shall be continued until the entire surface has been rolled to compaction and all the roller marks eliminated. In each pass of the roller,the preceding track shall be overlapped uniformly by at least 1/3 width. Roller(s) shall not stand on newly laid material . Joints both longitudinal and transverse to the road sections laid and compacted earlier ,shall be cut vertically to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of binder before the new mix is placed against it.

511.2.4.7. Seal coat: A Seal coat, conforming to clause 510 or clause 513, as specified in the contract , shall be applied 4 to 6 hours after laying the premix carpet.

511.2.5 Opening to traffic : Traffic should not be allowed over the premix surface with or without seal coat, for 6 to 8 hours after rolling. In case of single lane roads, traffic shall be allowed on to the surface once it has reached ambient temperature , but speed must be rigorously restricted to not more than 16 km per hour. If any premix material is picked up by vehicle tyres, the spot shall be filled up by new mix. If traffic conditions permit, the road shall not be opened until a full 24 hours after laying**.**

511. **Surface finish and quality control :** The surface finish of construction shall conform to the requirements of Clause 902.
For control of the quality of materials supplied and the works carried out , the relevant provisions of Section 900 shall apply .

511.2.7. Arrangements for traffic : During the period of construction, arrangement of traffic shall be made in accordance with the provisions of Clause 112.

511.2.8. Measurements for payment : Open graded premix carpet shall be measured as finished work , for the area specified to be covered, in square metres at the specified thickness , in cubic metres or in tones weight as specified in the Contract. The area will be net area covered , and all allowance for wastage and cutting of joints shall be deemed to be included in the rate .

511.2.9. Rate: The contract unit rate for premix carpet and seal coat shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2 (i) to (xi). Bitumen quantities are to be as stated in Table 500-23 for premix, 3.0 kg per 10 sq.m , for tack coat , 13 kg per 10 sq.m for liquid seal coat and 11 kg per 10 sq.m for pre mix seal coat. The rate will be adjusted according to actual materials used.

512. CLOSE-GRADED PREMIX SURFACING / MIXED SEAL SURFACING

512.1. Scope

512.1.1. This work shall consist of the preparation, laying and compaction of a close graded premix surfacing material of 20 mm thickness composed of graded aggregates premixed with a bituminous binder on a previously prepared surface , in accordance with the requirements of these Specifications, to serve as a wearing course.

512.1.2. Close graded premix surfacing shall be of Type A or Type B as specified in the contract documents.

512.2. Materials

512.2.1. Binder: The provisions of Clause 511.1.2.1 shall apply.

512.2.2. Coarse aggregates: The provisions of Clause 511.1.2.2 shall apply.

512.2.3. Fine aggregates: The fine aggregates shall consist of crushed rock quarry sands, natural gravel/sand or a mixture of both. These shall be clean, hard, durable, uncoated, mineral particles , dry and free from injurious, soft or flaky particles and organic or deleterious substances.

512.2.4. Aggregates gradation: The coarse and fine aggregates shall be so graded or combined as to conform to one or the other gradings shown in Table 500-26 ,as specified in the contract.

TABLE 500-26. AGGREGATES GRADATION

IS Sieve Designation mm	Cumulative percent by weight of total aggregate passing	
	TYPE A	TYPE B
13.2 mm	-	100
11.2 mm	100	88 – 100
5.6 mm	52 – 88	31 – 52
2.8 mm	14 – 38	5 – 25
0.090 mm	0 - 5	0 - 5

512.2.5 Proportioning of materials : The total quantity of aggregates used for Type A or B close graded premix surfacing shall be 0.27 cubic meter per 10 square meters area. The quantity of binders used for premixing in terms of straight-run bitumen shall be 22.0 kg and 19.0 kg per 10 square metre area for Type A and Type B surfacing respectively.

512.3. Construction Operations

The provisions of Clause 511.1.3.1 through 511.1.3.5 shall apply.

512.4. Opening to traffic : Traffic may be allowed after completion of the final rolling when the mix has cooled down to the surrounding temperature. Excessive traffic speeds should not be permitted

512.5. Surface finish and quality control of the work: The surface finish of construction shall conform to the requirements of Clause 902. For control on the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply .

512.6. Arrangements for traffic : During the period of construction, arrangements of traffic shall be in accordance with the provision of Clause 112.

512.7. Measurements for payment : The close graded premix surfacing , Type A or Type B shall be measured as finished work , for the area specified to be covered, in square metres at a specified thickness. The area will be the net area covered , and all allowance for wastage and cutting of joints shall be deemed to be included in the rate .

512.8 Rate: The contract unit rate for close graded premix surfacing Type A or B shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2 (i) to (xi).

513. SEAL COAT

513.1. Scope

513.1.1. This work shall consist of the application of a seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall (camber).

513.1.2. Seal coat shall be of either of the two types specified below:

(A) Liquid seal coat comprising of an application of a layer of bituminous binder followed by a cover of stone chips.
(B) Premixed seal coat comprising of a thin application of fine aggregate premixed with bituminous binder.

513.2. Materials

513.2.1. Binder: The requirements of Clauses 511.1.2.1 and 511.2.2.1. shall apply. The quantity of bitumen per 10 square metres, shall be 9.8 kg.for Type A and 6.8 kg. for Type B seal coat. Where bituminous emulsion is used as a binder the quantities for Type A and Type B seal coats shall be 15 kg. and 10.5 kg. respectively.

513.2.2. Stone chips for Type A seal coat: The stone chips shall consist of angular fragments of clean, hard, tough and durable rock of uniform quality throughout. They should be free of soft or disintegrated stone, organic or other deleterious matter. Stone chips shall be of 6.7mm size defined as 100 per cent passing through 11.2mm sieve and retained on 2.36mm sieve. The quantity used for spreading shall be 0.09 cubic meter per 10 square meter area. The chips shall satisfy the quality requirements in Table 500-3 except that the upper limit for water absorption value shall be 1 per cent.

513.2.3. Aggregate for Type B seal coat: The aggregate shall be sand or grit and shall consist of clean, hard, durable, uncoated dry particles and shall be free from dust, soft or flaky/elongated material, organic matter or other deleterious substances. The aggregate shall pass 2.36mm sieve and be retained on 180 micron sieve. The quantity used for premixing shall be 0.06 cubic meters per 10 square meters area.

513.3. Construction Operations

513.3.1. Weather and seasonal limitations: The requirements of Clause 501.5.1 shall apply.

513.3.2. Preparation of surface: The seal coat shall be applied immediately after laying the bituminous course which is required to be sealed. Before application of seal coat materials, the surface shall be cleaned free of any dust or other extraneous matter.

513.3.3. Construction of Type A seal coat: Bitumen shall be heated to 150ºC-163ºC and sprayed at the rate specified on the dry surface in a uniform manner with a self-propelled mechanical sprayer as described in the Manual for Construction and Supervision of Bituminous Works.

Immediately after the application of binder, stone chips, which shall be clean and dry, shall be spread uniformly at the rate specified on the surface preferably by means of a self-propelled or towed mechanical grit spreader so as to cover the surface completely. If necessary, the surface shall be brushed to ensure uniform spread of chips.

Immediately after the application of the cover material, entire surface shall be rolled with a 8-10 tonne smooth wheeled steel roller, 8-10 tonne static weight vibratory roller, or other equipment approved by the Engineer after laying trials if required. Rolling shall commence at the edges and progress towards the center except in super-elevated and unidirectional cambered portions where it shall proceed from the lower edge to the higher edge. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. While rolling is in progress, additional chips shall be spread by hand in necessary quantities required to make up irregularities. Rolling shall continue until all aggregate particles are firmly embedded in the binder and present a uniform closed surface.

513.3.4. **Construction of Type B seal coat**: A mixer of appropriate capacity and type pproved by the Engineer shall be used for preparation of the mixed material. The plant shall have eparate dryer arrangements for heating aggregate.

The binder shall be heated in boilers of suitable design, approved by the Engineer to the temperature appropriate to the grade of bitumen or as directed by the Engineer. The aggregates shall be dry and suitably heated to a temperature between 150ºC and 165ºC or as directed by the Engineer before these components are placed in the mixer. Mixing of binder with aggregate to the specified proportions shall be continued until the latter are thoroughly coated with the former. The mix shall be immediately transported from the mixing plant to the point of use and spread uniformly on the bituminous surface to be sealed.

As soon as a sufficient length has been covered with the premixed material, the surface shall be rolled with an 8-10 tonne smooth-wheeled roller. Rolling shall be continued until the premixed material completely seals the voids in the bituminous course and a smooth uniform surface is obtained.

513.4Opening to Traffic

In the case of Type B seal coat, traffic may be allowed soon after final rolling when the premixed material has cooled down to the surrounding temperature. In the case of Type A seal coat. Traffic shall not be permitted to run on any newly sealed area until the following day. In special circumstances, however, the Engineer may open the road to traffic immediately after rolling, but in such cases traffic speed shall be rigorously limited to 16 km. Per hour until the following day.

513.5.Surface Finish and Quality Control of Work.

The surface finish of construction shall conform to the requirements of Clause 902. For control on the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply.

513.6.Arrangement for Traffic.

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

513.7. Measurement for Payment.

Seal coat: Type A or B shall be measured as finished work, over the area specified to be covered, in square meters at the thickness specified in the Contract.

513.8. Rate

The contract unit rate for seal coat Type A or B shall be payment in full for carrying out the required operations including full compensation for all component listed in Clause 501.8.8.2.(i) to (xi).

514. SUPPLY OF STONE AGGREGATES FOR PAVEMENT COURSES

514.1. Scope

This Specifications Clause shall apply to the supply of stone aggregates only. The work shall consist only of collection, transportation and stacking the stone aggregates and stone filler for subsequent use in pavement courses. The actual work of laying the pavement courses shall, however, be governed by the individual Specification Clause for the actual work, given elsewhere in this Specification. The size and quantities of the aggregates to be supplied shall be sp selected by the Engineer that the grading requirements set forth in the individual Specification Clauses for the pavement courses, for which the supply is intended, are satisfied.

All the materials shall be procured from approved sources and shall conform to the physical requirements, specified in the respective Specification Clauses for the individual items given elsewhere in this Specification.

514.2. Sizes of Stone Aggregates.

The stone aggregates shall be designated by their standard sizes in the Contract and shall conform to the requirements shown in Table 500-27.

TABLE500-27.SIZE REQUIREMENTS FOR COARSE STONE AGGREGATES

SL.No.	Nominal size of aggregate	Designation of sieve through which the aggregates shall wholly pass	Designation of sieve on which the aggregates shall be wholly retained
i)	75 mm	106 mm	63 mm
ii)	63 mm	90 mm	53 mm
iii)	45 mm	53 mm	26.5 mm
iv)	26.5 mm	45 mm	22.4 mm
v)	22.4 mm	26.5 mm	13.2 mm
vi)	13. 2mm	22.4 mm	11.2 mm
vii)	11.2 mm	13.2 mm	6.7 mm
viii)	6.7 mm	11.2 mm	2.8 mm

514.3. Stacking

1.Coarse Aggregates:

Only the aggregates satisfying the Specification requirements shall be conveyed to the roadside and stacked. Each size of aggregate shall be stacked separately. Likewise, materials obtained from different quarry sources shall be stacked separately and in such a manner that there is no contamination of one source with another.

2.Fine Aggregate: As stated in the individual relevant Specification Clauses.

The aggregates shall be stacked entirely clear of the roadway on even clear hard ground, or on a platform prepared in advance for the purpose by the Contractor at his own cost and in a manner that allows correct and ready measurement. If the stockpile is placed on ground where the scraping action of the loader can contaminate the material with underlying soil, then the stockpile shall be rejected by the Engineer. Materials shall not be stacked in locations liable to inundation of flooding.

The dimensions of the stockpiles and their location shall be approved by the Engineer. Where the material is improperly stacked, the Engineer shall direct complete re-stacking of the materials in an approved manner at the Contractor's cost.

Stone filler shall be supplied in a dry state in bags or other suitable containers approved by the Engineer and shall be protected from the environment, so as to prevent deterioration in quality.

514.4. Quality Control of Materials

The Engineer shall exercise control over the quality of the materials so as to ascertain their conformity with the Specification requirements, by carrying out tests for the specified properties.

Testing shall be to the following frequencies and the Engineer may, as his discretion, direct these to be modified according to requirements:

Coarse and fine: One test for each specified property per 50m³ of stone aggregates.

Stone filler: One test for each specified property for every five tones, subject to a minimum of one test for each consignment.

Materials shall only be brought to site from a previously tested and approved source, and any materials not conforming to the requirements of the Specification shall be rejected by the Engineer and removed from the work site.

514.5.Measurement for payment

Coarse and fine aggregates supplied to the site shall be paid for in cubic meters. The actual volume of the aggregates to be paid for shall be computed after deducting the specified percentages in Table 500- 28, from the volume computed by stack measurements, to allow for bulking.

Unless otherwise directed by the Engineer, measurements shall not be taken until sufficient materials for use on the road have been collected and stacked. Immediately after measurement, the stacks shall be marked by white wash or other means as directed by the Engineer.

Stone filler as delivered to the site shall be measured in tones.

TABLE 500-28 PERCENT REDUCTION IN VOLUME OF AGGREGATES

S.No.	Standard size of aggregates	Percentage reduction in volume Computed by stack measurements to arrive at the volume to be paid for
1	**75mm and 63mm**	**12.5**
2	**45mm and 26.5mm**	**10.0**
3	**22.4mm,13.2mm, 11.2mmand 6.7mm**	**5.0**
4	**Fine aggregate**	**5.0**

514.6.Rates

The contract unit rates for different sizes of coarse aggregate, fine aggregate and stone filler shall be payment in full for collecting, conveying and stacking or storing at the site including full compensation for:

i) all royalties, fees, rents where necessary,
ii) all leads and lifts; and
iii) all labour, tools, equipment and incidentals to complete the work to the Specifications.
iv) all necessary testing of material, both initial, to approve the source, and regular control testing thereafter.

515. MASTIC ASPHALT

515.1. Scope.

This work shall consist of constructing a single layer of mastic asphalt wearing course for road pavements and bridge decks.

Mastic asphalt is an intimate homogeneous mixture of selected well graded aggregates, filler and bitumen in such proportions as to yield a plastic and void less mass, which when applied hot can be trowelled and floated to form a very dense impermeable surfacing.

515.2. Materials

515.2.1. Binder: Subject to the approval of the Engineer, the binder shall be a paving grade bitumen meeting the requirements given in Table 500-29.

515.2.2. Coarse aggregate: The coarse aggregate shall consist of crushed stone, crushed gravel/shingle or other stones. They shall be clean, hard, durable, of fairly cubical shape, uncoated and free from soft, organic or other deleterious substances. They shall satisfy the physical .

Appendix3

(Clause 402.3.2 and 403.3.2)

METHOD OF SIEVING FOR WET SOILS TO DETERMINE THE DEGREE OF PULVERISATION

1. A sample of pulverized soil approximately 1 Kg in weight should be taken and weighed (W1).
2. It should be spread on the sieve and shaken gently, care being taken to break the lumps of soils as little as possible .Weight of soil retained on the sieve should be recorded (W2).Lumps of finer soils in the retained material should be broken until all the individual particulars finer than the aperture size of the sieve are separated.
3. The soil should again be placed on the sieve and shaken until sieving is complete .The retained material should be weighed (W3).

4. Weight of soil by percent passing the sieve can then be calculated from the expression:

$$\frac{(W1 - W2) \times 100}{(W1 - W3)}$$

Appendix 4

GUIDELINES ON SELECTION OF THE GRADE OF BITUMEN

(Source : Bituminous Road Construction Handbook, Indian Oil Corporation and Central Road Research Institute)

A For bituminous premix carpet, choice is governed by climatic conditions and intensity of traffic.

(i) Grade 30/40 for areas where difference between maximum and minimum atmospheric temperatures is less than 25 °C and traffic intensity is greater than 1500 commercial vehicles per day. For traffic intensity less than 1500 commercial vehicles per day, Grade 50/60 is preferred.

(ii) Where the difference between maximum and minimum atmospheric temperature is more than 25° C and traffic intensity is greater than 1500 commercial vehicles per day, Grade 50/60 may be used. For traffic intensity of less than 1500 commercial vehicles per day, Grade 80/100may be used. For roads with very heavy traffic greater than 4500 commercial vehicles per day, such as metropolitan city roads, Grade 30/40 is preferred.

(iii) Grade 80/100 may be used in high altitude and snow-bound regions, irrespective of traffic intensity consideration.

B For bituminous macadam and penetration macadam as also built-up spray grout, Grade 30/40 (for hot climates) and 60/70 or 80/100 for other climates are suggested.

C For a dense-graded bituminous concrete, a more viscous grade like 60/70 can withstand stresses of heavier wheel loads better than a less viscous grade of 80/100. Similarly paving bitumen grade 60/70 is more advantageous for roads with large number of repetitions of wheel loads like expressways, urban roads, factory roads etc. High stability requirement cannot be met effectively by less viscous bitumen.

D A more viscous grade of bitumen is advantageous in reducing stripping of bitumen film from aggregates in the presence of water..

E With rounded river shingles, a more viscous grade of bitumen compensates to some extent for poor mechanical interlock. A comparison of penetration grades and viscosity grades (AC-2.5 to AC-40) of asphalt cement and AR grades (based on Rolling thin Film Oven test residue) is shown below.

NOTE:- QUALITY CONTROL FOR ROAD WORKS WILL BE AS PER SECTION 900 OF "MORT & H" SPECIFICATIONS .

SCHEDULE 'C'

General Specifications

1. Bricks : (Ref. I.S. : 1077 – 1976)

Bricks manufactured in Bull's patent kiln trench only shall be used unless otherwise specified, ringing sound when struck and should not break when thrown on the ground or against other bricks, They shall be clean, whole and free from flaws, cracks and under burnt lump of any kind, specially lime, and shall have sharp edges and angles and even surface. Bricks which when soaked in water for 24 hours absorb more water than one fifth of their dry weight shall be rejected. The bricks shall be manufactured from carefully selected good firm loam with necessary admixture of sand.

The common burnt cay bricks shall be classified on the basis of average compressive strength as given below :-

Class designation	(Avegage Compressive Strength) Not less than (Kg/cm2)	Less than (Kg/cm2)
75	75	100
50	50	75
35	35	50

The normal size of burnt bricks shall be 9" x 4.5" x 2.75" with usual variation of 1/8" on either side.

2. Bricks Aggregate for Lime Concrete :

The brick aggregate shall be from hard well burnt brick bats and shall not exceed 1½" in size and shall be free from dust, clay, grass or any other foreign matter.

3. Surkhi :

Surkhi shall be made from well burnt and should pass through a sleeve of 1/12" mesh, in no case over burnt bricks to be used for the manufacture of Surkhi.

4. Sand :

Sand shall be clean sharp and course and free all impurities and organic matter and be such as to pass through a 64 mesh five.

5. Lime :

Lime stone shall be used in the work. It shall be slaked just before. All impurities, ashes, or pieces improperly or carelessly burnt shall be screened or picked out before slaking and removed at once from the work. Lime should pass through a screen 12/12 mesh to the square inch and stored in a dry place.

6. Aggregate for Cement Concrete :

Aggregate for cement concrete shall be from trap, quanzite or hard quariz stone which shall pass trough ¾" mesh and on ¼" mesh screens. The aggregate shall be well screened and washed used and shall be free from foreign matters.

7. Cement Morter :

The mortars shall consists of cement and sand mixed in the proportion defined in the relevant schedule item for the various items of work. Only measured quantity shall be used. Sand and cement shall be spread on a clean dry platform in layers one over the other mixture only when morte is required for used, and then only in sufficient quantity to mesh the materials moist.

8. Lime Concrete :
The mixture shall be slaked lime, surkhi and sand in the production defined in the relevant schedule item for the various items of work ground cinder may be used when directed by the Engineer-in-charge. Lime surkhi and sand are to be mixed dry on a platform of masonry and then sprinkled with necessary quantity of water and ground in morter mill.

9. Aggregate for Reinforced Cement Concrete :
Aggregate for R.C.C. shall be from trap, quartze, or hard quartz tone. The aggregates shall pass through mesh and rest on ¼" mesh screens. It shall be well screened and washed before used and free from foreign matters.

10. Earth work in Excavation :
Excavation shall be strictly as shown in the plans. Bottoms of trenches shall be dressed level. All excavated earth will be placed not less than 5 feet from the edge of the foundation trench or directed by the Executive Engineer. All earth filling in the plinth or foundation basement will be done in not more than 6" layers well watered rammed.

11. Lime Concrete :
The concrete shall consist of an aggregate of the proportion mentioned in the schedule of items of approved quantities ½" gauge and down mixed with lime morter. The concrete shall be mixed on a level platform. The aggregate shall be first washed clean thoroughly wetted and placed to an even thickness on platform. Dry morter mixed in proper proportion as specified in schedule of quantities shall than be evenly spread over the aggregate and mixed thoroughly using sufficiently water to make the mortar adherent each piece of the aggregate. When the bed for the concrete is properly wetted, rammed and prepared the concrete shall be laid carefully in position in layer not exceeding 6". The basket etc. shall never been thrown from a high but gently laid with the basket. Each layer shall be well rammed with a heavy wooden hammer or iron hammer till the morter comes to the surface. No water shall be added during ramming but the surface of each completed layer shall be watered and roughened before the next layer is added. The concrete shall be welled rammed and kept wet after the days works for such time till it is set and given more impression of the rammer when dropped over it. When concrete is to be laid under water or in wet location hydraulic lime rendered hydraulic shall be used.

12. Cement Concrete :
The proportion of the concrete will be the same as specified in the schedule of quantities and will be strictly adhered to. The concrete shall be mixed properly in a power driven mixer in such a manner as to avoid loss of water. The concrete shall be mixed for a minimum period of two minutes or until it is of even colour and uniform consistency through out. Hard mixed concrete shall contain 10% extra cement and shall be made on hard, clean and even surface. The cement and sand will be mixed dry until the mixture is uniform in colour. It shall then be spread evenly over the coarse aggregate and mixed thoroughly. The water shall then be added and the hole mixture whole mixed thoroughly untill the mass is uniform in colour and consistency. Concrete shall be handle from the place of mixing to the place of final deposit as rapidly as practicable. The concrete once laid shall not be disturbed and shall be kept thoroughly demand by means of well matting and sand. The aggregate should consist of stone ball as of quantity approved by the Executive Engineer and shall consist of graded size ¾" and down and as per C.P.W.D. specifications.

13. Brick work in Mud Morter :
The mud to be used for morter shall be from selected earth of tenacious nature to which sand shall to be added in much quantity that dried of the mixture shall not show sign of cracking. The mud shall be well trotter and variation in the consistency of paste will be the adding of sufficient water care being to remove all clods and stones.

14. Bricks work Lime Morter :
Shall be done with brick soaked in water for not less than 4 hours before use in works. The proportion of mortar will be the same as per schedule of quantity which will be strictly adhered to. The completed work should be perfectly in accordance with the drawing so for the lime level and verticality is concerned, only mortar mixed properly in bull chakhi to be used.

15. Bricks words in Cement Morter in Foundation plinth & superstructures :
Only selected bricks approved by Executive Engineer shall be used in the masonry. The bricks must be soaked in water for 6 hours before use. There should be proper bonding and shall be carried through the full width of the wall each coarse being truly longitudinal neither horizontal not vertical joints shall be of greater thickness than ¼". The proportion of morter will be as specified in the drawing will be laid over the plinth after cleaning on the brick work thoroughly of all its loose morter stickling on surface as waiting it thoroughly. The concrete shall be with stone ballast of ¾" size graded, in proportion of 1:2:4 (1 cement : 2 Sand : 4 chips). Cement concrete for D.P.C. should be cured for 5 days before a hot coat bitumen is applied on it. The bitumen painted surface should be immediately sealed with sand.

16. Damp proof course :
Damp proof coarse to a thickness as specified in the drawing will be laid over the plinth after cleaning on the brick work thoroughly of all its loose mortar sticking on surface and wetting it thoroughly. The concrete shall be with stone ballast of ¾" size graded, in proportion of 1:2:4 (1 cement : 2 Sand : 4 chips). Cement concrete for D.P.C. should be cured for 5 days before a hot coat bitumen is applied on it. The bitumen painted surface should be immediately sealed with sand.

17. Lime Concrete 3" Thick in Floors and with Brick Ballast :
1½" bricks aggregate and down gauge a specified by the Engineer-in-Charge with 50% of lime mortar consisting of lime and sand shall be used. The aggregate and mortar shall be thoroughly mixed before laying and rammed. Consolidation shall be done until a skin of puse morter covers the surface and completely hide the aggregate. No mortar or water shall be added during ramming the mortar shall be mixed in a Bali Chakey.

18. 1" Patent Stone Flooring 1:2:4 :
The concrete shall consist of 1 cement 2 sand stone ballast ½" down gauge. In all cases only measured quantities shall be used. In all first be mixed dry and then with the aggregate. The whole shall then be laid properly with water and then laid in a layer of 1" thick over prepared sub base and beaten thoroughly with wooden straight edge. The surface be finished with a floating coat of neat cement to the satisfaction of the Engineer-in-charge. The finished floors shall be kept wet for at least 7 days.

19. Reinforced Cement Concrete 1:2:4 slabs, Roofing's Lintels Chajja etc. Reinforcement to be done with a net work of M.S. rods as specified under quality schedule or by the Engineer-in-charge. Rods and netting shall be woven by the contractor at his own cost. Every alternative cross over of M.S. rods shall be tied fast with binding wire of approved gauge. The netting shall be of proper size. The concrete shall be of good clean aggregate properly damped with clean water. The size of the stone aggregate to be used shall be ¾" gauge and below . The proportion shall be 1 cement 2 sand 4 stone ballast. Before laying the concrete the centering and frame works will have to be approved by the Engineer-in-charge or his authorized officer. The concrete shall be well mixed before laying and vibrated properly till morter comes out to the surface and the reinforcing rods are thoroughly embedded in concrete. Care is to be taken that specified covering is there and no reinforcing material are exposed from outside. The laid concrete should not be disturbed and be kept wet for 10 days. The centring will be removed only after 7 days placing the concrete or as directed by the Executive Engineer.

20. Plaster inside and outside :
Prior to the application of plaster the faces of the wall shall be cleaned and the joins of the bricks work rated out to depth of ½" and properly watered for at least 6 hours. The plaster shall be thoroughly smoothened and subbed with strength edges and wooden flats in a proper workman like manner. Watering, shall be continued for 7 days on the finished surface. The mortar will ordinarily consist of cement and in the proportion as specified in the schedule of quantity which should be strictly adhered. Where lime is also specified the cream of lime shall be prepared by thoroughly slaking required quantity of quick lime with the minimum quantity of water in order to get a thick slurry. The slurry of lime shall then be screened through a clean cloth to remove all dirt and any un-slaked like particulars. Sand shall be measured by volume in suitable size measuring boxes while cement shall be measured by weight taking 1 bag as 1.20 cft. Screened cream of lime and screened sand shall be mixed together in requisite proportion and the where than mixed with necessary of cement. The minimum quantity of water to give a working consistency to the mix should only be added and no more. The plaster shall be applied immediately after mixing maintaining the said precautions as for cement mortar.

21. ½" Cement Plaster Dado 1:3.
All the joints of masonry should raked ¾" deep and the walls should be thoroughly wetted at least 6 hours before the plaster in laid. The plaster should be laid on with some what more than the thickness and leveled and finished with a trowel. The plaster should be kept constantly watered for the 3 weeks. The thread lining is to be done. It should be done before the cement takes initial set.

22. White washing three coats :
White washing shall be prepared from burned shall lime thoroughly mixed with water, it should give a thin creamy consistency. It should then be screened through clean cloth. Clean gum dissolved in hot water or good conjee water shall be added in proportion of tounces to 1 Cit. for each coat is allowed to be applied. The new walls shall be well cleared and brushed. Each coat of white wash should be allowed to dry before applying next coats.

23. 5” thick trellis work in cement mortar 1:3 :
5” thick Ist class bricks trellis work in cement mortar 1:3 will be done with bricks soaked in water for into less than 4 hours before in work. Watering to be continued on finished trills work for at least 7 days. Freshly mixed mortar shall be used and ½” thick cement plaster as directed Executive Engineer shall be applied.

24. Colour Washing :
The colour washing shall be prepared applied in accordance with the standard specifications for white washing except that the contractors that provide colouring matter specified and ordered by the Engineer-in-charge during use. The colour wash should be stared continuously during use. The colour should be of even the over the whole surface.

25. Lime Concrete Terracing on Roof :
Bricks aggregate 1” and down gauge with 50% of more consisting of 1 lime : 2 surkhi shall be used. The brick aggregate will be well watered before mixing up with mortar. The lime should be thoroughly screened and made from free from kankars. The mortars should be mixed in prilchakey separately and then mixed thoroughly with the aggregate before laying over roof. The mixture should be properly leveled before besting. The concrete should then the thoroughly consolidated by being beaten with wooden mallets (Thapits). Lime water should be sprinkled at intervals on the terrier to keep it wet while beaten. Proper slopssare to be made towards eaves for flow or the rain water. In no as shall the mixture be allowed to dry until the work is complete. The surface shall be softened by being sprinkled with clean water and the morter which will rise to this surface during beating shall be smoothed and finished off with lime slurry gur and be light treatment complete. No plastering shall on any account be put on the surface watering shall be continued for 10 days after the completion of the work at the cost of contractor(s). Ghoondi to be made of the same mix as in terrace along with junction of the parapets roof to the design as per the instruction of the Engineer-in-charge.

26. Sal Wood and Window Frames :
The frames shall be made of well seasoned sal wood free from sap bends sun crack, shakes on blemishes of any kind. Alternatively kith seasoned and treated Badam or chuglum free from sap bends flaws sun cracks shakes or blemishes of and kind will be acceptable.

27. Door and Windows shutters :
Pannelled and glazed and battened shutter 1 to 11” thick shall be of Ist class Indian teak wood and 1” to 1 ¼” batteneded shutters shall be of wood as specified by Executive Engineer. Kiln seasoned and treated Badam wood or chuglum wood will also be acceptable. They shall be framed and put together, planted smooth in all surfaces and finished in accordance with the best class of joinery.

28. Holfasts :
1” x 1 ½” x 1/8” / 12 x 1 ½” x 1/8” M.S. Flat holfasts shall be set in cement mortar 1: 2 : 4 6Nos. for each door, 4 Nos. for each windows and 2 Nos. for each clearstory window.

29. Pucca Drain :
Earth excavation for cutting trenches for drain shall be done by the contractor and got approved by the Engineer-in-charge. The drain shall be made from well burned brick with cement concrete bed. Size shall be as specified in the schedule. The surface of the top, sides and beds shall cement plaster with smooth surface. Necessary earth fitting by the side of the drain shall also be done.

30. Painting Door and Windows :
Painting two coats over one coat of priming to all doors and windows shall be done. The quality and shade of the paint shall be approved by Engineer-in-charge. The wood surface to be painted shall be thoroughly cleaned and sand paper before painting.

31. Window gratings :
3/4" dia M.S. rounds vertically and ¼" to 1/8" M.S. flats horizontally shall be fixed to windows. The vertical bars shall be 4" center to center.

32. ¼" Cement Plaster ¼ in ceiling :
The surface of the ceiling to be plastered should be thoroughly cleaned and dammed before the plaster laid 1 part of clean cement and 4 parts of screened sand shall be mixed and immediately applied on the surface.

33. Construction brick masonry chullah :
Chullah shall be constructed and 2nd less brick masonry in cement mortar 1:6 with 2 holes and iron gratings complete as per design and finish with sand and gobri plaster.

34. Ventilators :
Wiring melted or R.C.C. Jali ventilators of required size shall be fixed in the walls as per specification and drawing.

35. Absorstors Rain Water Pipe :
In order to facilitate painting all pipes will blocked 1 ½" from the wall. Asbestors leads and shoes shall be provided of the proper size for the size of rain water pipes the shoes being fixed 6" above ground level.

36. Fan Clamps :
5/8 dia M.S. Fan hooks shall be provided and fixed in the ceiling for Electric Fans.

37. Fly – Proof Doors :
Galvanised iron proof webbing 16 x 16 mesh shall be used. The webbing shall be fixed securely to th styles rails and mounting by G.I. stapples at about 6" intervals. The styles rails and mounting around the fly proof webbing shall be moulded.

38. Items not covered by above will be guided by the specification of C.P.W.D. or as decided by the G.M.(Civil) whose interpretation will be final.

ANNEXURES.

ANNEXURE - I

SPECIMEN OF LETTER OF CONTRACTOR'S ACCEPTANCE OF PROVISIONAL REDUCTION OF RATE FOR SUBSTANDARD WORK.

No. dt.

To
…….
…….

Sir,

Subject: (Complete name of work)……

Reference: Your letter No……..

I/We have carefully read the terms and conditions offered in your letter dated…… and they are acceptable to me/us.

Pending the decision of the Engineer in Charge of the final rates of payment against the items of work specified in the statement attached to your above letter, which will be final and binding, I/ We agree to the same being paid at the provisional rates indicated against each of the said item of work for the above work as mentioned in your statement.

Yours faithfully,

Contractor(s)

ANNEXURE II

PROFORMA OF BANK GUARANTEE FOR REMOVAL OF PLANT & EQUIPMENT FROM THE SITE OF COAL INDIA LIMITED/ SUBSIDIARY COMPANY.

In consideration of Coal India Limited/Subsidiary Company (thereafter called "the Company" which expression shall repugnant to the subject or context includes its successors and assigns) having agreed to under the terms & conditions of the Contract No…….. dated…….. entered into between the company and M/s…….. having its Office at……. (hereinafter called "the Contractor") to permit the Contractor to remove the plant & equipment as fully described in the Schedule of the Hypothecation Deed dated…… executed by the Contractor in favour of the Company from the site to any other works of the Contractor on its furnishing the Bank Guarantee for Rs…….. we, the ……. Bank (hereinafter referred to as the said Bank) having its Registered Office at …… do hereby undertake and agree to pay the Company to the extent of Rs. …… on demand stating that the amount claimed by the Company is due and payable by the contractor for its failure in bringing back the said plant & equipment or any part thereof to the site and to unconditionally pay the amount claimed by the company on such demand without any demur to the extent aforesaid.

We, the ……..… Bank agree that the Company shall be the sole judge as to whether the said contractor has failed/neglected in bringing back the plant & equipment to the site and the amount has become due for such failure and the decision of the company in this behalf shall be final and binding on us.

We, the said Bank further agree that the Guarantee herein contained shall remain in full force and effect upto…… and any claim received after the said date shall in no case be bind the Bank.

Notwithstanding anything contained herein the liabilities of the said Bank under this Guarantee are restricted to Rs…… and this Guarantee shall come into force from the date thereof and shall remain in full force and effect till …… unless the written demand or claim under this guarantee is made by the company with us on or before…… all the rights of the Company under this guarantee shall cease to have any effect and we shall be retrieved and discharged our liabilities hereunder.

We, the said Bank lastly undertake not to revoke this guarantee under its currency except with the previous consent of the Company in writing and agree that any change in the constitution of the said Contractor or the said Bank shall not discharge the liabilities hereunder.

This Guarantee is issued by Sri…… who is authorized by the Bank.

Under jurisdiction of ……**....** Court only.

ANNEXURE III

PROFORMA OF BANK GUARANTEE IN LIEU OF SECURITY DEPOSIT.

Bharat Coking Coal Ltd.
Koyla Bhawan , Koyla Nagar
Dhanbad
826005

Dear Sir,

In consideration of M/s. Coal Bharat Coking Coal Ltd.having its Registered Office at Koyla Bhawan Koyla Nagar Dhanbad (hereinafter called "the Company" which expression shall unless repugnant to the subject or context includes its successors and assigns) having agreed under the terms and conditions contained in letter No……. dated……. issued in favour of M/s. ……. for ……..…. (hereinafter referred to as "the contract") to accept the Deed of guarantee as herein provided for Rs…… from the Schedule/ Nationalised Bank in lieu of security deposit to be made by M/s……..... (hereinafter called "the Contractor") or in lieu of deduction to be made from the contractor's bill, for the due fulfillment of the terms and conditions contained in the said contract by the contractor, we the ……. Bank (hereinafter referred to as the said Bank) having its Registered Office at……. do hereby undertake and agreed to pay the company to the extent of Rs…… on demand stating that the amount claimed by the company is due and payable by the contractor for the reasons of failure/negligence in performing the terms and conditions contained in the contract by the buyer and to unconditionally pay the amount claimed by the company on demand without any demur to the extent aforesaid.

We, the…… Bank agree that the company shall be the sole judge as to whether the said contractor has failed/neglected in performing any of the terms and conditions of the said contract and the decision of the company in this behalf shall be final and binding on us.

We, the said Bank further agree that the Guarantee herein contained shall remain in full force and effect upto …….. and any claim received after the said date shall in no case bind the Bank.

The Company shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee or indemnity from time to time vary any of the terms and conditions of the said contract or to extend the time of performance by the said contractor or to postpone any time and from time to time any of the powers exercisable by it against the said contractor and either to enforce or to forbear from enforcing any of the terms and conditions governing the said contract or securities available to the company and the said Bank shall not be released from its liability under these presents.

contd. p/2

Notwithstanding anything contained herein the liability of the said Bank under this guarantee is restricted to Rs…….. and this Guarantee shall come into force from the date hereof and shall remain in full force and effect till ……. Unless the written demand or claim under this guarantee is made by the Company with us on or before …….. all rights of the company under this guarantee shall cease to have any effect and we shall be relieved and discharged from our liabilities hereunder.

We the said Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the company in writing and agree that any change in the constitution of the said contractor or the said bank shall not discharge our liability hereunder.

This guarantee issued by Sri …… who is authorised by the Bank.

Under jurisdiction of …… court only.

ANNEXURE IV

PROFORMA OF BANK GURANTEE FOR PERFORMANCE SECURITY OF THE CONTRACT

To
……..
……..

Re: Bank Guarantee in respect of Contract No……
Dated……. Between …….. (name of the)
and …….…….. (name of the Contractor)

M/s. …….. (Name and address of the Contractor) (hereinafter called "the Contractor" with M/S. …… (name of the Company) (hereinafter called "the Company") to execute ……. (name of the contract and brief description of work) on the terms and conditions contained in the said contract.

It has been agreed that the Contractor shall furnish the Bank Guarantee from a Nationalised/ Schedule bank for a sum of Rs…….. as security for due compliance and performance of the terms and conditions of the said contract.

The …… (name of the Bank) having its Office at……..….. has at the request of the Contractor agreed to give the Guarantor hereinafter contained.

We, the ……. Bank (hereinafter called "the Bank" do hereby unconditionally agreed with the Company that if the contractor shall in any way fail to observe or perform the terms and conditions of the said contract or shall commit any breach of its obligation thereunder, the Bank shall on demand and without any objection or demur to pay to the company the said sum of Rs…… or such portion as shall then remain due with interest without requiring the Company to have recourse to any legal remedy that may be available to it to compel the Bank to pay the sum, or failing on the company to compel such payment by the contractor.

Any such demand shall be conclusive as regards the liability of the Contractor to the company and as regards the amount payable by the Bank under this Guarantee. The Bank shall not be entitled to withhold payment on the ground that the Contractor has disputed its liability to pay or has disputed the quantum of the amount or that any arbitration proceeding or legal proceeding is pending between the company and the Contractor regarding the claim.

We, the …….……. Bank further agree that the Guarantee shall come into force from the date hereof and shall remain in force and effect till the period that will be taken for the performance of the said Contract which is likely to be ……. day of …….. but if the period of Contract is extended either pursuant to the provisions in the said contract or by mutual agreement between the contractor and the company the Bank shall renew the period of the Bank Guarantee failing which it shall pay to the company the said sum of Rs……..… or such lesser amount of the said sum of Rs…… as may be due to the company and as the company may demand.

contd. p/2

This Guarantee shall remain in force until the dues of the company in respect of the said sum of Rs……. and interest are fully satisfied and the Company certifies that the Contract has been fully carried out by the Contractor and discharged the guarantee.

The Bank further agrees with the company that the company shall have the fullest liberty without consent of the Bank and without affecting in any way the obligations hereunder to vary any of the terms and conditions of the said contract or to extend time for performance of the said contract from time to time or to postpone for any time or from time to time any of the powers exercisable by the Company against the contractor and to forebear to enforce any of the terms and conditions relating to the said Contract and the Bank shall not be relieved from its liability by reason of such failure or extension being granted to the Contractor or to any forbearance, act or omissions on the part of the company or any indulgence by the Company to the Contractor or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect or relieving or discharging the Guarantor.

The Bank further agrees that in case this Guarantee is required for a longer period and it is not extended by the Bank beyond the period specified above the Bank shall pay to the company the said sum of Rs…….. or such lesser sum as may then be deemed to the Company and as the Company may require.

Notwithstanding anything contained herein the liability of the Bank under this Guarantee is restricted to Rs…….……. the guarantee shall remain in force till the day …….. of ……..……. and unless the guarantee is renewed or claim is preferred against the bank within six months from the said date all rights of the Company under this guarantee shall cease and the Bank shall be relieved and discharged from all liabilities hereunder except as provided in the preceding Clause.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank has under its constitution power to give this Guarantee and Sri…… who has signed it on behalf of the Bank has authority to do so.

Dated., this ……. day of ……..…….

Signature of the authorized person

For and on behalf of the Bank

Place
Under jurisdiction of …… court only.

(This is applicable for Turn Key Contracts Only)

ANNEXURE. VI

PROFORMA FOR AFFIDAVIT TO BE SUBMITTED BY THE TENDERER

Non Judicial Stamp Paper.

AFFIDAVIT

I, ----------, Partner/Legal Attorney/ Accredited Representative of M/S ---------- ----------, solemnly declare that :

1. We are submitting Tender for the Work ---------- ---------- ---------- against Tender Notice No.---------- ---- dt ----------
2. None of the Partners of our firm is relative of employee of Bharat Coking Coal Ltd.
3. All information furnished by us in respect of fulfillment of eligibility criteria and qualification information of this Tender is complete, correct and true.
4. All documents/ credentials submitted alongwith this Tender are genuine, authentic, true and valid.
5. If any information and document submitted is found to be false/ incorrect any time, department may cancel my Tender and action as deemed fit may be taken against us, including termination of the contract, forfeiture of all dues including Earnest Money and banning / delisting of our firm and all partners of the firm etc.

Signature of the Tenderer

Dated----------

Seal of Notary

ANNEXURE-VII.

PROFORRMA FOR EXECUTION OF AGREEMENT.
STAMP PAPER.

This agreement is made on ……. day of …….. between (Name of Company) having its registered office at …… (hereinafter called the 'COMPANY' which expression shall, unless repugnant to the subject or context, include its successors and assignees) of the one part and (Name of the Contractor) carrying on business as a (partnership/ proprietorship/ Ltd. Co. etc.) firm under the name and style …… (hereinafter called the 'said Contractor' which expression shall, unless the context requires otherwise include them and their respective heirs, executors, administrators and legal representatives) of the other part.

Whereas the Company invited tenders for the work of "…… ……..." and whereas the said Contractor/ Firm submitted tender for the said work and deposited a sum of Rs…….. as Earnest Money and whereas the tender of the said contract has been accepted by the Company for execution of the said work.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1) In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the tender papers hereinafter referred to.
2) The following documents which are annexed to this agreement should be deemed to form and be read and construed as part of this agreement viz.

i) Annexure-A Tender Notice (Page .. to ..)

ii) Schedule –A General Terms & Conditions, Special Conditions and General Technical Specification (Page …. to …)

iii) Schedule-B The probable Quantities and Amount (Page … to …)

iv) Schedule-C Negotiation letters –

iv) Schedule-D Letter of Acceptance/Work Order (Page .. to ..)

v) Schedule-E Drawings (Page .. to ..)

3) In consideration for the payment of the sum of Rs……(W/O Value; both in words and figures) or such other sum as may be arrived at under the clause of the specification relating to Payment by items measurements at unit prices by the Company, the said Contractor shall, subject to the terms & condition contained herein execute and complete the work as described and to the extent of probable quantities as indicated in Schedule B with such variations by way of alteration, addition to or reduction from the said works.
4) The company has received a sum of Rs..... towards Performance Security Deposit (1st part of Security Deposit) in the form of Demand Draft / Certified Cheque/ B.G./ *other form (details to be furnished)* .
5) The said contractor hereby covenants with the company that the company shall deduct at 5% of R/A Bills as Retention Money (2nd part of security deposit) to make the total Security as 10%(ten percent) of contract value, as per the terms & condition of the tender/ contract.

IN WITNESS WHEREOF THE parties herein have set their hands and seals the date and year above written.

1 Partner. Signature

2 Partner Signature

On behalf of M/S……..
The Contractor, as one of the constituted attorney,
In the presence of –
1. Name _____ Signature
Address :

Occupation :

Signed by Sri …….on behalf of Signature
(Name of Company) in presence of –

1. Name : Signature

2. Address: .

D E C L A R A T I O N

I hereby declare that my / our firm has not been banned or delisted by any Government or Quassi Government agencies or PSU's.

Signature of the Tenderer

PART – II

PRICE B I D

BILL OF QUANTITY FOR CONSTRUCTION OF WBM ROAD FROM WORKSHOP TO COAL FACE
AT M.O.C.P., BARORA AREA

Sl. No.	Description of work	Quantity	Unit	Rate	Amount
1	Preparation of subgrade by excavating earth to an average of 22.5cm depth, dressing to camber and consolidating with road roller including making good the undulations etc. and disposal of surplus earth lead upto 50 metres.	11900.00	Sqm	21.50	255850.00
2	Supplying and stacking of locally available fine sand at site.	2040.00	Cum	189.16	385886.40
3	Supplying and stacking of moorum at site.	2446.00	Cum	264.70	647456.20
4	Labour charges for mixing moorum (60%) and sand (40%) and laying the same including consolidation with road roller.	4080.00	Cum	118.43	483194.40
5	Supplying and stacking of graded stone aggregate at site of size range 90 mm to 45 mm	2125.00	Cum	374.65	796131.25
6	Supplying and stacking of graded stone aggregate at site of size range 63 mm to 45 mm	1700.00	Cum	389.65	662405.00
7	Laying water bound macadam with specified stone aggregate stone screening and blinding material including screening, sorting, spreading to template and consolidation with power road roller of 8 to 10 tonne capacity etc. complete (payment for stone aggregate, screenings, kankarm, moorum and red bajri etc. to be made separately) : Subbase with stone aggregate 90mm to 45mm including stone screening 13.2mm size.	674.00	Cum	470.95	317420.30
8	Laying water bound macadam with specified stone aggregate stone screening and blinding material including screening, sorting, spreading to template and consolidation with power road roller of 8 to 10 tonne capacity etc. complete (payment for stone aggregate, screenings, kankar, moorum and red bajri etc. to be made separately) :	1700.00	Cum	128.90	219130.00
9	Laying water bound macadam with specified stone aggregate stone screening and blinding material including screening, sorting, spreading to template and consolidation with power road roller of 8 to 10 tonne capacity etc. complete (payment for stone aggregate, screenings, kankar, moorum and red bajri etc. to be made separately) : Base course with 63mm to 45mm size including stone screening 13.2mm size.	1360.00	Cum	122.00	165920.00
			Total	**Rs.**	**3933393.55**

Synopsis :-

Having gone through the Tender documents & eliments of work in the bill of quantity :-
I / we quote _____% (_____) above / below the estimated cost.
Our quoted offer amounts to Rs. _____ (Rupees_____ _____) including the above percentage.

Signature of contractor

Name of contractor
Seal &
Date

MOCP Road/