दक्षिण पूर्व रेलवे

SOUTH EASTERN RAILWAY



इंजीनियरी विभाग

ENGINEERING DEPARTMENT

संविदा की सामान्य शर्तें

एवं

मानक विनिर्देश

GENERAL CONDITIONS OF CONTRACT

AND

STANDARD SPECIFICATIONS

2001

समाविष्ट

CONTAIN

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PREFACE

1. This manual containing Regulations for Tender and Contracts, General Conditions of Contract and Standard Specifications, on which the Schedule of Labour and Material Rates 1992 is based, is termed as General Conditions of Contract and Standard Specifications 2001 and is issued in supersession to South Eastern Railway Schedule of Rates Volume-II Revised Edition 1994. The Manual covers all instructions issued by Railway Board in Works Hand Book Parts-I & II on General Conditions of Contract. The Standard Specifications in Part-IV remains same as per South Eastern Railway's Standard Specifications 1994. The Manual covers all instructions issued from time to time including correction slip No. 2 & 3 dt. 5.12.97 & 18.03.98.

2. The rates for Labour and Materials as given in the Manual of "Schedule of Labour and Material Rates 1992" should be followed.

3. This is issued for the guidance of all staff in charge of "works" and of Contractors.

4. Each Officer and Supervisor of the rank of Junior Engineer and above or holding an equivalent charge, and in charge of "Works" and "P. Way" shall have a copy of this Manual. They shall be well acquainted with the provisions contained in this book in so far as these concern their duties and responsibilities.

5. All Contractors are advised to purchase a copy of this Manual as the provisions contained herein are binding on them, unless specially modified in writing.

6. No modifications may be made to the provisions made in this Manual without the Chief Engineer's written permission.

7. Staff are requested to report any errors or misprints to their immediate superiors who will bring them to the notice of the Chief Engineer.

8. Suggestions are also invited to make this book more comprehensive and useful to the staff.

9. The General Conditions of Contract and Standard Specifications 2001 will be available for sale to Contractors at the office of the Chief Engineer and Divisional Railway Manager (Engg.) on payment of Rs. 400.00 per copy. Correction slips will also be supplied from these offices free of cost to Contractor possessing a copy of this Mannual, on request.

10. It is the duty of each Official, to whom a copy of this Schedule has been issued, to paste each correction slip as received or to make the corrections notified in it. They will also record the receipt particulars of each correction slip in the register of correction slips at the end of the book.

11. Unless otherwise stipulated, the codes of practice laid down by Indian Standard Institution and given in the National Building Code would be followed in general.

12. This Manual is in bilingual version. In case of any anomaly between the two versions, English version will prevail.

South Eastern Railway,
Kolkata
Dt. 17.02.2001

S. P. S. JAIN
CHIEF ENGINEER

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भाग – II
PART – II

निविदा एवं संविदा के लिए नियम
Regulations For Tenders and Contracts

PART — II

REGULATIONS FOR TENDERS AND CONTRACTS

FOR THE GUIDANCE OF ENGINEERS AND CONTRACTORS FOR ENGINEERING WORKS

MEANING OF TERMS

1.1 These Regulations for Tenders and Contracts shall be read in conjunction with the General conditions of Contract which are referred to herein and shall be subject to modifications, additions or supersession by special conditions of contract and/or special specifications, if any, annexed to the Tender Forms.

1.2 **Definition**—In these Regulations for Tenders and Contracts the following terms shall have the meanings assigned hereunder except where the context otherwise requires :—

(a) "Railway" shall mean the President of the Republic of India or the Administrative Officers of the South Eastern Railway or of the Successor Railway authorised to deal with any matters which these presents are concerned on his behalf.

(b) "General Manager" shall mean the Officer in charge for the general Superintendence and control of the Railway and shall also include the General Manager (Construction) and shall mean and include their successors, of the Successor Railway.

(c) "Chief Engineer" shall mean the Officer incharge of the Engineering Department of South Eastern Railway and shall include the Chief Engineer (Construction), Chief Signal and Telecommunication Engineer, Chief Signal and Telecommunication Engineer (Construction), Chief Electrical Engineer and Chief Electrical Engineer (Construction) and shall mean & include their successors of the Successor Railway.

(d) "Divisional Railway Manager" shall mean the Officer incharge of a Division of the South Eastern Railway and shall mean and include the Divisional Railway Manager of the Successor Railway.

(e) "Engineer" shall mean the Divisional Engineer or the Executive Engineer.

Divisional Signal and Telecommunication Engineer, Divisional Signal & Telecommunication Engineer (Construction), Divisional Electrical Engineer and Divisional Electrical Engineer (Construction), in executive charge of the works and shall include the superior officers of the Engineering, Signal & Telecommunication, and Electrical Department of Railway i.e., the Senior Divisional Engineer/Deputy Chief Engineer/ Chief Engineer/ Chief Engineer (Construction), Senior Divisional Signal and Telecommunication Engineer/Deputy Chief Signal and Telecommunication Engineer/Chief Signal & Telecommunication Engineer/Chief Signal & Telecommunication Engineer (Construction), Senior Divisional Electrical Engineer/Deputy Chief Electrical Engineer/ Chief Electrical Engineer (Construction) and shall mean and include the Engineers of the Successor Railway.

(f) "Tenderer" shall mean the person/the firm/co-operative or company whether incorporated or not who tenders for the works with a view to execute the works on contract with the Railway and shall include their personal representatives, successors and permitted assigns.

(g) "Limited Tenders" shall mean tenders invited from all or some Contractors on the approved or select list of contractors with the Railway.

(h) "Open Tenders" shall mean the tenders invited in open and public manner and with adequate notice.

(i) "Works" shall mean the works contemplated in the drawings and schedules set forth in the tender forms and required to be executed according to specifications.

(j) "Specifications" shall mean the specifications for Materials and works of the South Eastern Railway as specified in Part IV of the General Conditions of Contract and Standard Specifications issued under the authority of the Chief Engineer or as amplified, added to or superseded by special specifications if any, appended to the Tender Forms.

(k) "Schedule of Rates of the South Eastern Railway" shall mean the schedule of Rates issued under the authority of the Chief Engineer from time to time.

(l) "Drawings" shall mean the maps, drawings, plans and tracings or prints thereof annexed to the Tender Forms.

1.3 Words importing the singular number shall also include the plural and vice versa where the context requires.

2.1 **Application for registration.** — Works of construction and of supply of material shall be entrusted for execution to contractors whose capabilities and financial status have been investigated and approved to the satisfaction of the Railway. For this purpose, list of approved contractors shall be maintained in the Railway. The said list shall be revised periodically once in a year or so by giving wide publicity through advertisements etc.

A Contractor including a contractor who is already on the approved list shall apply to the nearest General Manager (Construction), Chief Administrative Officer (Construction), Divisional Railway Manager, Chief Engineer/Chief Engineer (Construction), Chief Signal and Telecommunication Engineer/Chief Signal & Telecommunication Engineer (Construction) and Chief Electrical Engineer/Chief Electrical Engineer (Construction), furnishing particulars regarding :—

(a) his position as an independent contractor specifying Engineering organisation available with details or Partners/Staff/Engineers employed with qualifications and experience;

(b) his capacity to undertake and carry out works satisfactorily as vouched for by a responsible official or firm, with details about the transport equipments, construction tools and plants etc., required for the work, maintained by him;

(c) his previous experience of works similar to that to be contracted for, in proof of which original certificates or testimonials may be called for and their genuineness verified if needs be, by reference to the signatories thereof;

(d) his knowledge from actual personal investigation of the resources of the area/zone or zones in which he offers to work;

(e) his ability to supervise the work personally or by competent and duly authorised agents;

(f) his financial position;

(g) authorised copy of the current income-tax Clearance Certificate.

2.2. An applicant shall clearly state the categories of works for which and the area/zone/ division(s)/ district(s) in which he desires registration in the list of approved contractors.

2.3. The selection of contractors for enlistment in the approved list would be done by a committee for different value slabs as notified by Railway.

2.4 An annual fee as prescribed by the Railway from time would be charged from such approved contractors to cover the cost of sending notices to them and clerkage for tenders etc.

2.5. The list of approved contractors would be treated as confidential office record.

TENDERS FOR WORKS

3. **Tender Form.** — Tender Forms shall embody the contents of the contract documents either directly or by reference and shall be as per specimen form, Annexure I. Tender Forms shall be issued on payment of the prescribed fees to the appropriate contractors on the list of approved contractors. Contractors not on the list of approved contractors, will, on payment of the prescribed fees, be furnished with tender forms and they shall be required to submit evidence regarding their financial status, previous experience and ability to execute the works, and an authorised copy of the current Income Tax Clearance Certificate without which their tenders will not be considered.

4. **Omissions and Discrepancies.** — Should a tenderer find discrepancies in, or omissions from the drawings or any of the Tender Forms of should he be in doubt as to their meaning, he should at once notify the authority inviting tenders who may send a written instruction to all tenderers. It shall be understood that every endeavour has been made to avoid any error which can materially affect the basis of the tender and the successful tenderer shall take upon himself and provide for the risk of any error which may subsequently be discovered and shall make no subsequent claim on account thereof.

5. **Earnest Money.** — The tenderer shall be required to deposit earnest money with the Tender for the due performance of the stipulation to keep the offer open till such date as specified in the Tender, under the conditions of Tender, Annexure-I. The earnest money will be as under :

Contract Value	Earnest money for due performance of stipulation to keep the offer open till the date specified.
(i) For works upto Rs. 5 lakhs	2½% ad valorem subject to a maximum of Rs. 10,000/-
(ii) For works more than Rs. 5 lakhs but upto Rs. 20 lakhs	2% ad valorem subject to a maximum of Rs. 20,000/-
(iii) For works above Rs. 20 lakhs but upto Rs. 50 lakhs	1% ad valorem subject to a maximum of Rs. 35,000/-
(iv) For works above Rs. 50 lakhs	3/4% ad valorem subject to maximum of Rs. 50,000/-

(b) It shall be understood that the tender documents have been sold/issued to the tenderer and the tenderer is permitted to tender in consideration of stipulation on his part, that after submitting his tender he will not resile from his offer or modify the terms and conditions there of in a manner not acceptable to the Engineer. Should the tenderer fail to observe or comply with the said stipulation, the aforesaid amount shall be liable to be forfeited to the Railway.

(c) If his tender is accepted this earnest money mentioned in sub clause (a) above will be retained as part security for the due and faithful fulfillment of the contract in terms of Clause 16 of the General Conditions of Contract. The Earnest Money of other tenderers shall, save as herein before provided, be returned to them, but the Railway shall not be responsible for any loss or depreciation that may happen thereto while in their possession, nor be liable to pay interest thereon.

(d) The Contractors approved for the works in various categories will have the option to deposit the Earnest Money for each individual works or furnish standing Earnest Money at the rates indicated below :-

Contract value	Amount of lumpsum Earnest Money
Upto Rs. 5 lakhs	Rs. 10,000/-
Above Rs. 5 lakhs but upto Rs. 20 lakhs	Rs. 20,000/-
Above Rs. 20 lakhs but upto Rs. 50 lakhs	Rs. 50,000/-
Above Rs. 50 lakhs	Rs. 1,00,000/-

(2) No part of this fixed lumpsum deposit as Earnest Money can be accounted against the Security Deposit a contractor has to make on the acceptance of his tender and on execution of an agreement. It may however, be noted by the Contractors that this Earnest Money deposited by them is available for forfeiture to the extent specified, in cases where they tender but due to any circumstances fail to keep the offer open for the period specified in the tender documents. The earnest money should be in cash or in any of the following forms :-

(i) Deposit receipts, pay orders, demand drafts. These forms of earnest money could be either of the State Bank of India or of any of the nationalised banks. No confirmator advice from the Reserve Bank of India will be necessary.

(ii) Deposit receipt excuted by the Scheduled banks (other than the State Bank of India and the Nationalised Banks) approved by the Reserve Bank of India for this purpose. The Railways will not, however, accept deposit receipt without getting in writing the concurrence of the Reserve Bank of India.

(b) Standing or permanent earnest money may be accepted in the following forms :-

(i) A deposit in cash.

(ii) Government securities at 5% below the market value.

(iii) Deposit receipts or demand drafts of the Nationalised Bank.

(iv) A deposit in the Post Office Saving Bank.

(v) National Savings Certificates.

(vi) Twelve Year National Defence Certificates.

(vii) Ten Year Defence Deposits.

(viii) National Defence Bonds.

(ix) National Saving Certificates.

(x) Time Deposit Account which came into force on 16-3-1970 and notified under Ministry of Finance, Notification No. F3(7)NS/70, dated 28-2-70.

(xi) IRFC Bonds.

Note.- (vi) to (viii) These certificates/bonds may be accepted at their surrender value.

6. **Care in Submission of Tenders.** — (a) Before submitting a tender, the tenderer will be deemed to have satisfied himself by actual inspection of the site and locality of the works, that all conditions liable to be encountered during the execution of the works are taken into account and that the rates he enters in the tender forms are adequate and all inclusive to accord with the provisions in Clause-37 of the General Conditions of Contract for the completion of works to the entire satisfaction of the Engineer.

(b) When work is tendered for by a firm or company of contractors, the tender shall be signed by the individual legally authorised to enter into commitments on their behalf.

(c) The Railway will not be bound by any power of attorney granted by the tenderer or by changes in the composition of the firm made subsequent to the execution of the contract. It may, however, recognise such power of attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor.

7. **Right of Railway to deal with Tenders.** — The Railway reserves the right of not to invite tenders for any of Railway work or works or to invite open or limited tenders and when tenders are called to accept a tender in whole or in part or reject any tender or all tenders without assigning reasons for any such action.

CONTRACT DOCUMENTS

8. **Execution of Contract Document.** — The tenderer whose tender is accepted shall be required to appear in person at the office of the General Manager/General Manager (Construction), Chief Administrative Officer (Construction), Divisional Railway Manager or concerned Engineer, as the case may be, or if a firm or corporation, a duly authorised representative shall so appear and execute the contract documents within 7 days after notice that the contract has been awarded to him. Failure to do sc shall constitute a breach of the agreement affected by the acceptance of the tender in which case the full value of the earnest money accompanying the tender shall stand forfeited without prejudice to any other rights or remedies.

In the event of any tenderer whose tender is aocepted shall refuse to execute the contract documents as here-in-before provided, the Railway may determine that such tenderer has abandoned the contract and there upon his tender and acceptance therecf shall be treated as cancelled and the Railway shall be entitled tc forfeit the full amount of the Earnest Money and to recover the damages for such default.

9. **Form of Contract Document.**— Every contract shall be complete in respect of the document it shall so constitute. Not less than 2 copies of the contract documents shall be signed by the competent authority and the contractor and one copy given to the contractor.

(a) For Zone contracts, awarded on the basis of the percentage above or below the Schedule of Rates South Eastern Railway for the whole or part of financial year, the contract agreement required to be executed by the tenderer whose tender is accepted shall be as per specimen form, Annexure II. During the currency of the Zone contract, work orders as per specimen form Annexure III or IV, for works not exceeding Rs. 10,000/- each, shall be issued by the Divisional Railway Manager/Executive Engineer under the agreement for Zone Contract.

(b) For contracts for specific works, valued at more than Rs. 10,000/- the contract documents required to be executed by the tenderer whose tender is accepted shall be either an Agreement as per specimen form Annexure IV, or a work order as per specimen form Annexure V as may be prescribed by the Railway.

ANNEXURE I

SOUTH EASTERN RAILWAY

TENDER FORMS *(FIRST SHEET)*

Tender No.....

Name of Work.....

To
The President of India,
Acting through the.....

.....

South Eastern Railway

I/We ..... have read the various conditions to tender attached here-to and agree to abide by the said conditions. I/We also agree to keep this tender open for acceptance for a period of..... ..... days from the date fixed for opening the same and in default thereof, I/We will be liable for forfeiture of my/our "Earnest Money". I/We offer to do the work for South Eastern Railway, at the rates quoted in the attached schedule and hereby bind myself/ourselves to complete the work in all respects within..... months from the date of issue of letter of acceptance of the tender.

2. I/We also hereby agree to abide by the General Conditions of Contract corrected upto printed/advance correction slip No..... dated..... and to carry out the work according to the Special Conditions of Contract and Specifications of materials and works as laid down by Railway in the annexed Special Conditions/Specifications and the South Eastern Railway General Conditions of Contract and Standard Specifications part IV corrected upto printed/advance correction slip No..... dated,..... General Conditions of Contract and Standard Specifications corrected upto printed/advance correction slip No..... dated..... for the present contract.

3. A sum of Rs..... is herewith forwarded as Earnest Money. The full value of the Earnest Money shall stand forfeited without prejudice to any other right or remedies in case my/our Tender is accepted and if :—

(a) I/We do not execute the contract documents within seven days after receipt of notice issued by the Railway that such documents are ready; and

(b) I/We do not commence the work within fifteen days after receipt of orders to that effect.

4. Until a formal agreement is prepared and executed, acceptance of this tender shall constitute a binding contract between us subject to modifications, as may be mutually agreed to between us and indicated in the letter of acceptance of my/our offer for this work.

Signature of Witnesses :

(1) .....

(2) .....

.....
Signature of Tenderer(s)

Date.....

Address of the Tenderer(s)

ANNEXURE I

TENDER FORM *(SECOND SHEET)*

1. **Instructions to tenderers and conditions of tender.** — The following documents form part of Tender/Contract :—

(a) Tender forms — First Sheet and Second Sheet.

(b) Special Conditions/Specifications (enclosed)

(c) Schedule of approximate quantities (enclosed)

(d) General Conditions of Contract and Standard Specifications for materials and works as laid down in Part III & IV of the Schedule of Rates of South Eastern Railway, as amended/ corrected upto correction slips mentioned in First Sheet of Tender Form, copies of which can be seen in the office of Senior Divisional/Divisional/District/Deputy Chief/Executive Engineer or obtained from the office of the Chief Engineer, South Eastern Railway, ... on..... payment of Rs....., Rs.....& Rs..... respectively.

(e) Schedule of Rates, Part I and General Conditions of Contract and Standard Specifications as amended/corrected upto correction slip as mentioned in First sheet of Tender sheet of tender form, copies of which be seen in the office of Senior Divisional/Divisional/District/ Deputy Chief/Executive Engineer or obtained from the Chief Engineer, South Eastern Railway on payment of Rs.....& Rs.....respectively.

(f) All general and detailed drawings pertaining to this work which will be issued by the Engineer or his reprsentatives (from time to time) with all changes and modifications.

2. **Drawings for the work.**— The Drawings for the work can be seen in the office of the Senior Divisional/Divisional/District/Deputy Chief/Executive Engineer and/or Chief Engineer/Chief Administrative Officer (Construction) at any time during the office hours. The drawings are only for the guidance of Tenderer(s). Detailed working drawings, (if required) based generally on the drawing mentioned above, will be given by the Engineer or his representative from time to time.

3. The Tenderer(s) shall quote his/their rates as a percentage above or below the Schedule of Rates of the South Eastern Railway.....as.....applicable to..... Division except where he/they are required to quote item rates and must tender for all the items shown in the schedule of approximate quantities attached. The quantities shown in the attached schedule are given as a guide and are approximate only and are subject to variation according to the needs of the Railway. The Railway does not guarantee work under each item of the schedule.

4. Tenders containing erasures and/or alterations of the tender documents are liable to be rejected. Any correction made by Tenderer(s) in his/their entries must be attested by him/them.

5. The works are required to be completed within a period of.....months from the date of issue of acceptance letter.

6. **Earnest Money.** — (a) The tender must be accmpanied by a sum of Rs.....as earnest money deposited in cash or in any of the forms as mentioned in Regulations for tenders and Contracts for the guidence of the Engineers and Contractors, failing which the tender will not be considered.

(b) The Tenderer(s) shall keep the offer open for a minimum period of ..... days from the date of opening of the Tender. It is understood that the tender documents has been sold/issued to the Tenderer(s) and the Tenderer(s) is/are permitted to tender in consideration of the stipulation on his/their part that after submitting his/their tender subject to the period being extended further if required by mutual agreement from time to time, he will not resile from his offer or modify the terms and conditions thereof in a manner not acceptable to the.....of South Eastern Railway. Should the Tenderer fail to observe or comply with the foregoing stipulation, the amount deposited as Earnest Money for the due performance of the above stipulation shall be forfeited to the Railway.

(c) If the tender is accepted, the amount of Earnest Money will be retained and adjust as Security Deposit for the due and faithful fulfilment of the contract. This amount of Security Deposit shall be forfeited if the tenderer(s)/contractor(s) fail to execute the Agreement Bond within 7 days after receipt of notice issued by Railway that such documents are ready or to commence the work within 15 days after receipt of the orders to that effect.

(d) The Earnest Money of the unsuccessful tenderer(s) will, save as here-in-before provided, be returned to the unsuccessful tenderer(s) within a reasonable time but the Railway shall not be responsible for any loss or depreciation that may happen to the Security for the due performance of the stipulation to keep the offer open for the period specified in the tender documents or to the Earnest Money while in their possession nor be liable to pay interest thereon.

7. **Rights of the Railway to deal with tender.** — The authority for the acceptance of the tender will rest with the Railway. It shall not be obligatory on the said authority to accept the lowest tender or any other tender and no tenderer(s) shall demand any explanation for the cause of rejection of his/their tender not the Railway undertake to assign reasons for declining to consider or reject any particular tender or tenders.

8. If the tenderer(s) deliberately gives/give wrong information in his/their tender or creates/ create circumstances for the acceptance of his/their tender, the Railway reserves the right to reject such tender at any stage.

9. If the tenderer(s) expires after the submission of his/their tender or after the acceptance of his/their tender, the Railway shall deem such tender cancelled. If a partner of a firm expires after the submission of their tender or after the acceptance of their tender, the Railway shall deem such tender as cancelled, unless the firm retains its character.

10. **Income Tax clearance certificate.** — The tenderer(s) is/are required to produce alongwith his/their tender an authorised copy of the Income-Tax Clearance certificate or a sworn affidavit duly countersigned by the Income-Tax Officer to the effect that he has/they have no taxable income.

11. **Tenderer's Credentials.** — Documents testifying tenderer's previous experience and financial status should be produced alongwith the tender or when desired by competent authority of the South Eastern Railway.

Tenderer(s) who has/have not carried out any work so far on this Railway and who is/are not borne on the approved list of the Contractors of South Eastern Railway should submit alongwith his/ their tender credentials to establish.

(i) His capacity to carry out the works satisfactoriiy.

(ii) His financial status supported by Bank reference and other documents.

(iii) Certificates duly attested and testimonials regarding contracting experience for the type of job for which tender is invited with list of works carried out in the past.

12. Tender must be enciosed in a seaied cover, superscribed "Tender Nc..... and must be sent by registered post to the address of..... Railway so as to reach his office not later than ..... hours on the ..... or deposited in the special box ailotted for the purpose in the office of..... Railway..... This speoial box will be sealed at.....hours on ..... The tender will be opened at..... hours on the same day. The tender papers will not be sold after.....hours on..... .

13. Non-compiiance with any of the conditions setforth there in above is liabie to result in the tender being rejected.

14. **Execution of Contract Documents.** — The successful tenderer(s) shall be required to execute an agreement with the President of India acting through the South Eastern Railway for carrying out the work according to General Conditions of Contract, Special Conditions/Specifications annexed to the tender and specifications for work and materiais as laid down in General Conditions of Contract and Standard Specifications, Part IV of South Eastern Railway as amended/ corrected upto correction slip mentioned in tender form (First Sheet).

15. **Partnership deeds, Power of Attorney Etc.** — The tenderer shall clearly specify whether the tender is submitted on his own or on behalf of a partnership concern. If the tender is submitted on behalf of a partnership concern, he shouid submit the certified copy of partnership deed alongwith the tender and authorisation to sign the tender documents on behaif of partnership firm. If these documents are not enciosed alongwith tender documents, the tender will be treated as having been submitted by individual signing the tender documents. The Railway will not be bound by any power of attorney granted by the tenderer or by changes in the composition of the firm made subsequent to the execution of the contract. It may, however recognise such power of attorney and changes after obtaining proper iegai advice, the cost of which will be chargeabie to the contraotor.

16. The tenderer whether sole proprietor, a limited company or a partnership firm if they want to act through agent or individual partner(s) should submit alongwith the tender or at a later stage, a power of attorney duiy stamped and authenticated by a Notary Public or by Magistrate in favour of the specific person whether he/they be partner(s) of the firm or any other person specifically authorising him/them to submit the tender, sign the agreement, receive money, witness measurements, sign measurement books, compromise, settle, reiinguish any claim(s) preferred by the firm and sign "No Claim Certificate" and refer all or any disputes to arbitration.

17. **Employment/Partnership, etc., of Retired Railway Employees.** — (a) Should a tenderer be a retired engineer of the Gazetted rank or any other Gazetted officer Working before his retirement, whether in the executive or administrative capacity, or whether holding a pensionabie post or not, in the Engineering department of any of the Railways owned and administered by the

President of India for the time being, or should a tenderer being partnership firm have as one of its partners a retired engineer or retired Gazetted Officer as aforesaid, or should a tenderer being an incorporated company have any such retired engineer or retired officer as one of its Directors, or should a tenderer have in his employment any retired Engineer or retired Gazetted Officer as aforesaid, the full information as to the date of retirement of such Engineer or Gazetted Officer from the said service and in case where such Engineer or Officer had not retired from Government service at least 2 years prior to the date of submission of the tender as to whether permission for taking such contract, or if the contractor be a partnership firm or an incorporated company, to become a partner or Director as the case may be, or to take the employment under the contractor, has been obtained by the tenderer or the Engineer or Officer, as the case may be from the President of India or any officer, duly authorised by him in this behalf, shall be clearly stated in writing at the time of submitting the tender. Tenders without the information above referred to or a statement to the effect that no such retired Engineer or retired Gazetted Officer is so associated with the tenderer, as the case may be, shall be rejected.

(b) Should a tenderer or contactor being an individual on the list of approved Contractors, have a relative(s) or in the case of partnership firm or company of contractors one or more of his shareholder(s) or a relative(s) of the shareholder(s) employed in gazetted capacity in the Engineering department of the South Eastern Railway, the authority inviting tenders shall be informed of the fact at the time of submission of tender, failing which the tender may be disqualified/rejected or if such fact subsequently comes to light, the contract may be rescinded in accordance with the provision in clause 62 of the General Conditions of Contract.

.....
(Signature)

.....
(Designation)

.....
Signature of Tenderer(s)

Date.....

South Eastern Railway

ANNEXURE I (Contd.)

TENDER FORM *(THIRD SHEET)*

Name of work .....

.....

SCHEDULE OF RATES AND QUANTITIES

Sr. No.	Item No.	Description of item of work	Approximate Quantity	Unit	Rates in figures and in words Rs. P.	Amount Rs. P.
1	2	3	4	5	6	7

The quantities shown in above schedule are approximate and are as a guide to give the tenderer(s) an idea of quantum of work involved. The Railway reserves the right to increase/ decrease and/or delete or include any of the quantities given above and no extra rate will be allowed on this account.

I/We undertake to do the work at..... % above/below the Schedule of Rates of the South Eastern Railway as applicable to.....Division or at the rates quoted above for each item.

Dated.....

.....
Signature of theTenderer(s)

Note.— Column 1 to 5 shall be filled by the office of the Authority inviting tender. Column 6 & 7 shall be filled by the Tenderer(s) only when percentage tenders are not invited.

ANNEXURE II

AGREEMENT FOR ZONE CONTRACT

CONTRACT AGREEMENT NO.....DATED.....20

ARTICLES OF AGREEMENT made this.....day of 20.....between the President of India acting through the South Eastern Railway hereinafter called the "Railway" of the one part and ..... hereinafter called the "Contractor" of the other part.

WHEREAS the Contractor has agreed with the Railway during the period of..... months from.....to.....for the performance of :—

(a) New Works, additions and alterations to existing structures, special repair works and supply of building materials subject to the contract value for such works not exceeding Rs.....

(b) All ordinary repair and maintenance works at any site between Kilometre ..... and Kilometre ..... as will be setforth in the work orders (which work orders shall be deemed and taken to be part of this contract) that will be issued during the said period at.....% above/below the Schedule of Rates of the South Eastern Railway, Part I, corrected upto Printed/Advance Correction Slip No..... dated.....and General Conditions of Contract and Standard Specifications corrected upto Printed/Advance Correction Slip No.....dated..... and Standard Specifications of the South Eastern Railway contained in General Conditions of Contract and Standard Specifications Part IV corrected upto Printed/Advance Correction Slip No..... dated..... and the special conditions and special specifications if any in conformity with the drawings (if any) that will be issued with the work order, aforesaid AND WHEREAS the performance of the said work is an act in which the public are interested.

NOW THIS INDENTURE PRESENTS WITNESSETH that in consideration of the payments to be made by the Railway, the Contractor will duly perform the works setforth in the said Work Order and shall execute the same with great promptness, care and accuracy, in a workman like manner to the satisfaction of the Railway and will complete the same on or before the respective dates specified therein in accordance with the said specifications and said drawings (if any) and said conditions of contract and will observe, fulfil and keep all the conditions therein mentioned (which shall be deemed and taken to be part of this contract as if the same had been duly setforth herein), AND the Railway both here-by agree that if the Contractor shall duly perform the said work in the manner aforesaid and observe and keep the said terms and conditions, the Railway will pay or cause to be paid to the Contractor for the said works on the completion thereof the amount due in respect thereof at the rates specified above.

Contractor.....

Address.....

Date.....

(Designation) South Eastern Railway
(for President of India)

Date.....

Signature of witnesses with address to signature of contractor

Witnesses.....

ANNEXURE III

WORK ORDER UNDER ZONE CONTRACT

WORK ORDER NO..... DATED.....20.....
UNDER CONTRACT AGREEMENT NO.....DATED.....

Name of work..... (site).....

Schedule of drawings.....

Authority.....Allocation.....

The Contractor(s) ..... is/are hereby ordered to carryout the following works at .....% above/below the Schedule of Rates of the South Eastern Railways, Part I corrected upto Printed/Advance Correction Slip No..... dated.....and, General Conditions of Contract and Standard Specifications corrected upto Printed/Advance Correction Slip No..... dated..... of..... Division under Zone Contract Agreement here-in-before referred to :-

Sr. No.	Item No.	Description of item of work	Approximate Quantity	Unit	Rates in figures and in words Rs. P.	Amount Rs. P.
1	2	3	4	5	6	7

Total approximate value of work.....

*This should be rate of Division concerned.

The works herein mentioned are required to be completed on or before..... (date). The quantities provided herein are approximate and subject to variation under Clause 42 of the General Conditions of Contract corrected upto Printed/Advance Correction Slip No..... dated.....

Divisional Railway Manager/Divisional.....Engineer

Dated.....

.....Division

South Eastern Railway

For PRESIDENT OF INDIA

I agree to complete the works herein setforth on or before the date specified under the Zone Contract Agreement herein before referred to in conformity with the drawings here to annexed and in accordance with the General and Special (if any) Conditions of Contract corrected upto Printed/ Advance Correction Slip No..... dated..... and the Standard Specifications of South Eastern Railway contained in General Conditns of Contract and Standard Specifica-

tions Part IV corrected upto Printed/Advance Correction Slip No.....dated.....
I also agree to maintain such works for the period specified below from the date of completion.

(a) Repair and maintainance work including white/colour washing Three calender months from date of completion.

(b) All new works except earth work-Six calender months from date of completion.

Contractor.....

Address.....

Date.....

Signature of witnesses with
address to signature of contractor

(Designation) South Eastern Railway
(for President of India)

Date.....

Witnesses.....

ANNEXURE IV

SOUTH EASTERN RAILWAY

CONTRACT AGREEMENT NO..... DATED.....

ARTICLES OF AGREEMENT made this.....day of..... 20..... between the President of India acting through the Railway Administration hereafter called the "Railway" of the one part and hereinafter called the "Contractor" of the other part.

WHEREAS the Contractor has agreed with the Railway for the performance of the works..... setforth in the schedule hereto annexed upon the General Conditions of Contract corrected upto Printed/Advance Correction Slip No..... dated..... and the specifications of the South Eastern Railway contained in the General Conditions of Contract and Standard Specifications Part IV, corrected upto Printed/Advance Correction Slip No..... dated..... and the Schedule of Rates of the South Eastern Railway, Part I, corrected upto Printed/Advance Correction Slip No. dated..... and the special conditions and special specifications, if any, and in conformity with the drawings hereinto annexed AND WHEREAS the performance of the said works is an act in which the public are interested.

NOW THIS INDENTURE WITNESSETH that in consideration of the payments to be made by the Railways, the Contractors will duly perform the said works in the said schedule setforth and shall execute the same with great promptness, care and acouracy in a workman like manner to the satisfaction of the Railway and will complete the same accordance with the said specifications and said drawings and said conditions of contract on or before the.....day of.....20.....and will maintain the said works for a period of ..... Calendar months from the certified date of their completion and will observe, fulfil and keep all the conditions therein mentioned (which shall be deemed and taken to be part of this contract as if the same has been fully setforth herein), AND the Railway both hereby agree that if the Contractor shall duly perform the said works in the manner aforesaid and observe and keep the said terms and conditions the Railway will pay or cause to be paid to the Contractor for the said works on the final completion thereof the amount due in respect thereof at the rates specified in the Schedule hereto annexed.

Contractor..... (Designation) South Eastern Railway
(for President of India)

Address.....

Date..... Date.....

Signature of witnesses with address to
signature of contractor Witnesses.....

ANNEXURE V

WORK ORDER FOR WORKS
(Valued at over Rs. 10,000/-)

WORK ORDER NO..... DATED.....

Name of work..... (site).....

Schedule of drawings.....

Authority..... Allocation.....

Mr./Messres.....Contractor/Contractors having agreed with the Railway is/are hereby ordered to carry out the works setforth in the schedule below in accordance with the General Conditions of Contract corrected upto Printed/Advance Correction Slip No..... dated.....and the Standard Specifications of the South Eastern Railway contained in General Conditions of Contract and Standard Specifications Part IV, corrected upto Printed/Advance Correction Slip No..... dated..... the schedule of rates, Part I, corrected upto Printed/Advance Correction Slip No..... dated..... and General Condition of Contract and Standard Specifications, corrected upto Printed/Advance Correction Slip No..... dated..... and special conditions and special specifications, if any, and in conformity with drawings annexed hereto at the rates specified in the said schedule and to complete the same on or before the.....day of.....20.....and maintain the said works for the period of.....from the certified date of the completion. The quantities setforth in the said schedule shall be considered approximate and subject to variation under clause 42 of the General Conditions of Contract.

CONTRACTOR'S AGREEMENT

I offer to do the work at the rates entered in the schedule of rates on the reverse which I have signed, and I understand that no fixed quantity of work is given to me to do that in starting work I am only given a place to work in or to deposit materials on, and that I have no claim to more than one unit of work as entered in the Scheduled Rates. I agree that all works done and materials delivered shall be subject to the approval of the Engineer in Charge, who may reject and decline to pay for whatever may be in his opinion inferior or defective or either and I agree that the Standard Specifications contained in the General Conditions of Contract and Standard Specifications Part IV, corrected upto Printed/Advance Correction Slip No..... dated..... of South Eastern Railway in so far as they are not over-ruled-by items of this agreement, shall be deemed part of this agreement.

I agree that no work under this work order shall be assigned or sublet without the previous written approval of the Senior Divisional/Divisional/District/Executive Engineer.

I agree that my work may be stopped at any time by the Senior Divisional/Divisional/District/ Executive Engineer on his giving me or my agent on the works seven days notice in writing and I agree that the measurement of my works shall be made by the Engineer at any time appointed by him in writing subsequent to the expiry of the said notice and measurement shall be made by him at the said time whether I am present or not and that on payment for work done and approved materials delivered at site of work as ascertained by the said measurement, I shall have no further claim against the Railway and I agree that any dispute arise on matters connected with this agreement, the same shall be referred to a person to be nominated in this behalf by the..... for the time being of the Railway, whose decision in writing shall be final and binding on both parties.

I agree that any claim I have to make shall be made in writing within seven days of date of measurement taken by the Engineer as aforesaid and that any claims in respect of such measurement made more than seven days after taking of such measurement shall be deemed to have waived by me.

I agree to indemnify the Railway against any claims which may be made under Workmen's Compensation act 1923.

WITNESS

Name.....

Address.....

CONTRACTOR

Name.....

Address.....

Note. — If the agreement is for a work for which a special act of the Legislature exist, e.g. the Indian Mines Act the agreement should include a clause indemnifying the Railway against all claim arising of provision of such Act.

I agree to pay the rates at.....% above/below Schedule of Rates as applicable to..... Division setforth in the schedule of rates herein for finished and approved work.

..... Engineer

..... Division

South Eastern Railway
For PRESIDENT OF INDIA

Date.....

I/We agree to complete the works herein set forth on or before the date specified herein and to maintain the same for a period of..... calendar month from the certified date of their competition and in conformity with the document herein referred to, and all the condition therein mentioned shall be deemed and taken to be part of this contract as if the same had been fully setforth therein.

Signature of witnesses with addresses, to signature of contractor

1. .....
2. .....

Contractor.....
Address.....
Date.....

ANNEXURE VI

WORK ORDER FOR WORKS

.....Division

WORK ORDER No.....Original/Duplicate/Triplicate No.....
dated.....20.....

I/We will carry out the following work according to the agreement at back.

SCHEDULE OF RATES

Particulars	Rates (Rs.)	Per	Remarks

WITNESS

Name.....

Address.....

CONTRACTOR

Name.....

Address.....

I agree to pay the above mentioned rates for finished and approved work.

Dated 20

.....Engineer.

भाग – III
PART – III

संविदा की सामान्य शर्तें
General Conditions of Contract

PART III

STANDARD GENERAL CONDITIONS OF CONTRACT FOR USE IN CONNECTION WITH ENGINEERING WORKS

DEFINITIONS AND INTERPRETATION

1. (1) **Definition.** — In these General Conditions of Contract, the following terms shall have the meaning assigned here under except where the context otherwise requires:—

(a) "Railway" shall mean the President of the Republic of India or the Administrative Officers of the Railway or of the Successor Railway authorised to deal with any matters which these presents are concerned on his behalf.

(b) "General Manager" shall mean the Officer in-charge of the General Superintendence and Control of the Railway and shall also include the General Manager (Construction) and shall mean and include their successors, of the Successor Railway.

(c) "Chief Engineer" shall mean the Officer-in-Charge of the Engineering Department of Railway and shall also include Chief Engineer (Construction), Chief Signal and Telecommunication Engineer, Chief Signal and Telecommunication Engineer (Construction), Chief Electrical Engineer, Chief Electrical Engineer (Construction) and shall mean & include their sucoessors of the Successor Railway.

(d) "Divisional Railway Manager" shall mean the Officer in-charge of a Division of the Railway and shall mean and include the Divisional Railway Manager of the Sucoessor Railway.

(e) "Engineer" shall mean the Divisional Engineer or the Executive Engineer, Divisional Signal & Telecommunication Engineer, Divisional Signal & Telecommunication Engineer (Construction), Divisional Electrical Engineer, Divisional Electrical Engineer (Construction), in executive charge of the works and shall include the superior officers of the Engineering, Signal & Telecommunication, and Electrical Department of Railway i.e., the Senior Divisional Engineer/Deputy Chief Engineer/Chief Engineer/Chief Engineer (Construction), Senior Divisional Signal & Telecommunication Engineer/Deputy Chief Signal & Telecomunication Engineer/Chief Signal & Telecommunication Engineer (Construction)/ Senior Divisional Electrical Engineer/ Deputy Chief Electrical Engineer/Chief Electrical Engineer (Construction) and Chief Administrative Officer (Construction) and shall mean and include the Engineer of the Successor Railway.

(f) "Engineer's Representative" shall mean the Assistant Engineer, Assistant Signal and Telecommunication Engineer and Assistant Electrical Engineer in direct charge of the works and shall include any Sr. Sec./Sec./Jr. Engineer of Civil Engineering/Signal and Telecommunication Engineering/Electrical Engineering Department appointed by the South Eastern Railway and shall mean and include the Engineer's Representative of the Successor Railway.

(g) "Contractor" shall mean the Person/Firm/Co-operative Society or Company whether incorporated or not who enters into the contract with the Railway and shall include their executors, administrators, successors and permitted assigns.

(h) "Contract" shall mean and include the Agreement of Work Order, the accepted schedule of rates or the Schedule of Rates of South Eastern Railway modified by the tender percentage for items of works quantified or not quantified, the General Conditions of Contract, the special conditions of contracts if any, the drawings, the specifications, the special specifications, if any, and tender forms, if any.

(i) "Works" shall mean the works to be executed in accordance with the contract.

(j) "Specifications" shall mean the Standard specifications for materials and works of South Eastern Railway as specified in Part IV of the General Conditions of Contract and Standard Specifications issued under the authority of the Chief Engineer or as amplified, added to or superseded by special specifications, if any.

(k) "Schedule of Rates of the South Eastern Railway" shall mean the Schedule of Rates issued under the authority of the Chief Engineer from time to time.

(l) "Drawings" shall mean the maps, drawings, plans and tracings or prints thereof annexed to the contract and shall include any modifications of such drawings and further drawings as may be issued by the Engineer from time to time.

(m) "Constructional Plant" shall mean all appliances or things of whatsoever nature required for the execution, completion or maintenance of the works or temporary works (as hereinafter defined) but does not include materials or other things intended to form or forming part of the permanent work.

(n) "Temporary Works" shall mean all temporary works of every kind required for the execution, completion and/or maintenance of the works.

(o) "Site" shall mean the lands and other places on, under, in or through which the works are to be carried out and any other lands or places provided by the Railway for the purpose of the contract.

(p) "Period of Maintenance" shall mean the specified period of maintenance from the date of completion of the works as certified by the Engineer.

(2) **Singular and Plural.** — Words importing the singular number shall also include the plural and vice versa where the context requires.

(3) **Headings & marginal headings.** — The headings and marginal headings in these general conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken into consideration in the interpretation or construction thereof or the contract.

GENERAL OBLIGATIONS

2. (1) **Execution Co-relation and Intent of contract Documents.** — The contract documents shall be signed intriplicate by the Railway and the Contractor. The Contract documents are complementary, and what is called for by any one shall be as binding as if called for by all; the intention of the documents is to include all labour and materials, equipments and transportation necessary for the proper execution of work. Materials or work not covered by or properly inferable

iny heading or class of the specifications shall not be supplied by the Railway to the ctors unless distinctly specified in the contract documents. Materials or works described in words which so applied have a well known technical or trade meaning shall be held to refer to such recognised standards.

(2) If a work is transferred from the jurisdiction of one Railway to another Railway or to a Project authority or vice versa while contract is in subsistence, the contract shall be binding on the Contractor and the Successor Railway/Project in the same manner & take effect in all respects as if the Contractor and the Successor Railway/Project were parties thereto from the inception and the corresponding officer or the competent authority in the Successor Railway/Project will exercise the same powers and enjoy the same authority as conferred to the Predecessor Railway/Project under the original contract/agreement entered into.

(3) If for administrative or other reasons the contract is transferred to the Successor Railway the contract shall not with-standing anything contained herein contrary thereto, be binding on the Contractor and the Successor Railway in the same manner and take effect in all respects as if the Contractor and the Successor Railway had been parties thereto from the date of this contract.

3. (1) **Law governing the contract.** — The contract shall be governed by the law for the time being in force in the Republic of India.

(2) **Compliance to regulations and bye-laws.** — The Contractor shall conform to the provision of any statute relating to the works and regulations and bye-laws of any local authority and of any water and lighting companies or undertakings, with whose system the work is proposed to be connected and shall before making any variation from the drawings or the specifications that may be necessitated by so conforming give to the Engineer notice specifying the variation proposed to be made and the reason for making the variation and shall not carry out such variation until he has received instructions from the Engineer in respect thereof. The Contractor shall be bound to give all notices required by statute, regulations or bye-laws as aforesaid and to pay all fees and taxes payable to any authority in respect thereof.

4. **Communications to be in writing.** — All notices, communications, references and complaints made by the Railway or the Engineer or the Engineer's Representative or the Contractor interse concerning the works shall be in writing and no notice, communication, reference or complaint not in writing shall be recognised.

5. **Service of Notices on Contractors.** — The Contractor shall furnish to the Engineer the name, designation and address of his authorised agent and all complaints, notices, communications and references shall be deemed to have been duly given to the Contractor if delivered to the Contractor or his authorised agent or left at or posted to the address so given and shall be deemed to have been so given in the case of posting on day on which they would have reached such address in the ordinary course of post or on the day on which they were so delivered or left. In the case of contract by partners, any change in the constitution of the firm shall be forthwith notified by the Contractor to the Engineer.

6. **Occupation and use of land.** — No land belonging to or in the possession of the Railway shall be occupied by the Contractor without the permission of the Railway. The Contractor shall not use, or allow to be used, the site for any purposes other than that of executing the works.

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7. **Assignment or subletting of contract.** — The Contractor shall not assign or sublet the contract or any part thereof or allow any person to become interested therein in any manner whatsoever without the special permission in writing of the Railway. Any breach of this condition shall entitle the Railway to rescind the contract under clause 62 of these conditions and also render the contractor liable for payment to the Railway in respect of any loss or damage arising or ensuing from such cancellation. Provided always that execution of the details of the work by petty contractor under the direct and personal supervision of the Contractor or his agent shall not be deemed to be sub-letting under this clause. The permitted subletting of work by the Contractor shall not establish any contractual relationship between the sub-contractor and the Railway and shall not relieve the Contractor of any responsibility under the Contract.

8. **Assistance by the Railway for the Stores to be obtained by the Contractor.** — Owing to difficulty in obtaining certain materials (including Tools & Plants) in the market, the Railway may have agreed without any liability therefor, to endeavour to obtain or assist the Contractor in obtaining the required quantities of such materials as may be specified in the Tender. In the event of delay or failure in obtaining the required quantities of the aforesaid materials, the Contractor shall not be deemed absolved of his own responsibility and shall keep in touch with the day to day position regarding their availability and accordingly adjust progress of works including employment of labour and the Railway shall not in any way be liable for the supply of materials or for the non supply thereof for any reasons whatsoever nor for any loss or damage arising in consequence of such delay or non supply.

9. **Railway Passes.** — No free Railway passes shall be issued by the Rly. to the Contractor or any of his employee/worker.

10. **Carriage of materials.** — No forwarding orders shall be issued by the Railway for the conveyance of Contractor's materials, tools and plant by Rail which may be required for use in the works and the contractor shall pay full freight charges at public tariff rates therefor.

11. **Use of ballast trains.** — The Railway may agree to allow the Contractor, the use of the ballast or material trains under such conditions as shall be specially prescribed, provided that the Contractor shall pay for the use thereof charges calculated at public tariff rates on the marked carrying capacity of each vehicle subject to specified minimum charge per day or part of day and provided further that the Contractor shall indemnify the Railway against any claims or damages arising out of the use or misuse thereof and against any liabilities under the Workmen's Compensation Act, 1923 or any statutory amendments thereto.

12. **Representation on Works.** — The Contractor shall, when he is not personally present on the site of the works place and keep a responsible agent at the works during working hours who shall on receiving reasonable notice, present himself to the Engineer and orders given by the Engineer or the Engineer's Representative to the agent shall be deemed to have the same force as if they had been given to the Contractor. Before absenting himself, the Contractor shall furnish the name and address of his agent for the purpose of this clause and failure on the part of the Contractor to comply with this provision at any time will entitle the Railway to rescind the contract under clause 62 of these conditions.

13. **Relics and Treasures.** — All gold, silver, oil and other minerals of any description and all precious stones, coins, treasures, relics, antiquities and other similar things which shall be found in or upon the site shall be the property of the Railway and the Contractor shall duly preserve the same

to the satisfaction of the Railway and shall from time to time deliver the same to such person or persons as the Railway may appoint to receive the same.

14. **Excavated material.** — The Contractor shall not sell or otherwise dispose of or remove except for the purpose of this contract, the sand, stone, clay, ballast, earth, rock or other substances or materials which may be obtained from any excavation made for the purpose of the works or any building or produced upon the site at the time of delivery of the possession thereof but all the substances, materials, buildings, and produce shall be the property of the Railway provided that the Contractor may, with the permission of the Engineer, use the same for the purpose of the works either free of cost or pay the cost of the same at such rates as may be determined by the Engineer.

15. **Indemnity by Contractors.** — The Contractor shall indemnify and save harmless the Railway from and against all actions, suit proceedings, losses, costs, damages, charges, claims and demands of every nature and description brought or recovered against the Railways by reason of any act or omission of the Contractor, his agents or employees, in the execution of the works or in his guarding of the same. All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the actual loss or damage sustained, and whether or not any damage shall have been sustained.

16. (1) **Earnest Money and Security Deposit.** — The Earnest Money deposited by the Contractor with his tender will be retained by the Railways as part of security for the due and faithful fulfilment of the contract by the contractor. The balance to make up the security deposit, the rates for which are given below, may be deposited by the Contractor in cash or in the form of Government Securities or may be recovered by percentage deduction from the Contractor's "on account" bills. Provided also that in case of defaulting contractor the Railway may retain any amount due for payment to the Contractor on the pending "on account bills" so that the amounts so retained may not exceed 10% of the total value of the contract.

(2) Unless otherwise specified in the special conditions, if any, the rates for deposit of security amount by contractors will be as under :—

(i) for contracts up-to Rs.1 lakh.	10% of the value of the contract.
(ii) for contracts more than Rs. 1 lakh and up-to Rs. 2 lakhs.	10% of the first Rs. 1 lakh and $7\frac{1}{2}$% of the balance.
(iii) for contacts more than Rs. 2 lakhs and upto Rs. 2 crores.	10% of the first Rs. 1 lakh, $7\frac{1}{2}$% of the next Rs. 1 lakh and 5% of the balance subject to the maximum of Rs. 3 lakhs;
(iv) for contracts above Rs. 2 crores	5% of the contract value. The amount over and above 3 lakhs to be recovered from the progressive bills of the contractors @ 10% till it reaches 5% of the contract value.

(3) No interest will be payable upon the Earnest Money and Security Deposit or amounts payable to the Contractor under the Contract, but Government Securities deposited in terms of Sub-Clause (1) of this clause will be payable with interest accrued thereon.

17. **Force Majeure Clause.** — If at any time, during the continuance of this contract, the performance in whole or in part by either party of any obligation under this contract shall be prevented or delayed by reason of any war, hostility, acts of public enemy, civil commotion, sabotage, serious loss or damage by fire, explosions, epidemics, strikes, lockouts or acts of God (hereinafter referred to 'events') provided, notice of the happening of any such event is given by either party to the other within twenty-one days from the date of occurrence thereof, neither party shall by reason of such event, be entitled to terminate this contract nor shall either party have any claim for damages against the other in respect of such non-performance of delay in performance, and works under the contract shall be resumed as soon as practicable after such event has come to an end or ceased to exist, and the decision of the Engineer as to whether the works have been so resumed or not shall be final and conclusive, PROVIDED FURTHER that if the performance in whole or in part of any obligation under this contract is prevented or delayed by reason of any such event for a period exceeding sixty days, either party may at its option terminate the contract by giving notice to the other party.

17-A. Subject to any requirement in the contract as to completion of any portion or portions of the works before completion of the whole, the contractor shall fully and finally complete the whole of the works comprised in the contract (with such modifications as may be directed under conditions of this contract) by the date entered in the contract or extended date in terms of the following clauses :—

(i) If any modifications have been ordered which in the opinion of the Engineer have materially increased the magnitude of the work, then such extension of the contracted date of completion may be granted as shall appear to the Engineer to be reasonable in the circumstances, provided moreover that the Contractor shall be responsible for requesting such extension of the date as may be considered necessary as soon as the cause thereof shall arise and in any case not less than one month before the expiry of the date fixed for completion of the works.

(ii) If in the opinion of the Engineer the progress of work has any time been delayed by any act or neglect of Railway's employees or by other contractor employed by the Railway under sub-clause(4) of clause 20 of these conditions or in executing the work not forming part of the contract but on which contractor's performance necessarily depends or by reason of proceeding taken or threatened by or dispute with adjoining or neighbouring owners or public authority arising otherwise through the Contractor's own default etc. or by the delay authorised by the Engineer pending arbitration or in consequences of the contractor not having received in due time necessary instructions from the Railway for which he shall have specially applied in writing to the Engineer or his authorised representative then upon happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer within 15 days of such happening but shall nevertheless make constantly his best endeavours to bring down or make good the delay and shall do all that may be reasonably required of him to the satisfaction of the Engineer to proceed with the works. The contractor may also indicate the period for which the work is likely to be delayed and shall be bound to ask for necessary extension of time. The Engineer on receipt of such request from the contractor shall consider the same and shall grant such extension of time as in his opinion is reasonable having regard to the nature and period of delay and the type and quantum of work affected thereby. No other compensation shall be payable for works so carried forward to the extended period of time, the same rates, terms and conditions of contract being applicable as if such extended period of time was originally provided in the original contract itself.

(iii) In the event of any failure or delay by the Railway to hand over the Contractor possession of the lands necessary for the execution of the works or to give the necessary notice to commence.

the works or to provide the necessary drawings or instructions or any other delay caused by the Railway due to any other cause whatsoever, then such failure or delay shall in no way affect or vitiate the contract or alter the character thereof or entitle the contractor to damages or compensation therefor but in any such case, the Railway may grant such extension or extensions of the completion date as may be considered reasonable.

Extension of time for delay due to contractor :—

17-B. The time for the execution of the work or part of the works specified in the contract documents shall be deemed to be the essence of the contract and the works must be completed not later than the date(s) as specified in the contract. If the contractor fails to complete the works within the time as specified in the contract for the reasons other than the reasons specified in clause 17 and 17-A, the Railway may, if satisfied that the works can be completed by the contractor within reasonable short time thereafter, allow the contractor such further extension of time (Proforma Annex. I) as the Engineer may decide. On such extension the Railway will be entitled without prejudice to any other right and remedy available on that behalf, to recover from the contractor as agreed damages and not by way of penalty a sum equivalent to 1/2 of 1% of the contract value of the works for each week or part of the week.

For the purpose of this clause, the contract value of the works shall be taken as value of work as per contract agreement including any supplementary work order/contract agreement issued. Provided also, that the total amount of liquidated damages under this condition, shall not exceed the undernoted percentage value or of the total value of the item or groups of items of work for which a separate distinct completion period is specified in the contract.

(i) For contract value up to Rs. 2 lakhs	10% of the total value of the contract.
(ii) For contracts valued above Rs. 2 lakhs	10% of the first Rs. 2 lakhs and the 5% of the balance

Provided further, that if the Railway is 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 the work within further extension of time allowed as aforesaid, the Railway shall be entitled, without prejudice to any other right or remedy available in that behalf, to appropriate the contractor's security deposit and rescind the contract under clause 62 of these conditions, whether or not actual damage is caused by such default.

18. (1)**Illegal Gratification.** — Any bribe, commission, gift or advantage given, promised or offered by or on behalf to the Contractor or his partner, agent or servant or anyone on his behalf, to any officer or employee of the Railway, or to any person on his behalf in relation to obtaining or the execution of this or any other contract with the Railway shall, in addition to any criminal liability which he may incur, subject the contractor to the rescission of the contract and all other contracts with the Railway and to the payment of any loss or damage resulting from such decision and the Railway shall be entitled to deduct the amounts so payable from any moneys due to the Contractor(s) under this contract or any other contracts with the Railway.

(2) The Contractor shall not lend or borrow from or have or enter into any monetary dealings or transactions either directly or indirectly with any employee of the Railway and if he shall do so, the Railway shall be entitled forthwith to rescind the contract and all other contracts with the Railway. Any question or dispute as to the commission or any such offence or compensation payable to the

Railway under this clause shall be settled by the General Manager of the Railway, in such a manner as he shall consider fit and sufficient and his decision shall be final and conclusive. In the event of rescission of the contract under this clause, the Contractor will not be paid any compensation whatsoever except payments for the work done up-to the date of rescission.

EXECUTION OF WORKS

19. (1) **Contractor's understanding.** — It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the progress of the works, the general and local conditions, the labour conditions prevailing therein and all other matters which can in any way affect the works under the contract.

(2) **Commencement of works.** — The Contractor shall commence the works within 15 days after the receipt by him of an order in writing to this effect from the Engineer and shall proceed with the same with due expedition and without delay.

(3) **Accepted programme of work.** — The Contractor who has been awarded the work shall as soon as possible but not later than 30 days after the date of receipt of the acceptance letter in respect of contracts with initial completion period of two years or less or not later than 90 days for other contracts have to submit the detailed programme of work indicating the time schedule of various items of works in the form of Bar Chart/PERT/ CPM. He shall also submit the details of organisation (in terms of labour and supervisors) plant and machinery that he intends to utilise (from time to time) for execution of the work within stipulated date of completion. The programme of work amended as necessary by disoussions with the Engineer, shall be treated as the agreed programme of the work for the purpose of this contract and the contractor shall endeavour to fulfil this programme of work. The progress of work will be watched accordingly the liquidated damages will be with reference to the overall completion date. Nothing stated herein shall preclude the contractor in achieving earlier completion of item or whole of the works than indicated in the programme.

(4) **Setting out of works.** — The Contractor shall be responsible for the correct setting out of all works in relation to original points, lines and levels of reference at his cost. The Contractor shall execute the work true to alignment, grade, levels and dimensions as shown in the drawing and as directed by the Engineer's representative and shall check these at frequent intervals. The Contractor shall provide all facilities like labour and instruments and shall cooperate with the Engineer's representative to check all alignments, grades, levels and dimensions. If, at any time, during the progress of the works any error shall appear or arise in any part of the work, the Contractor, on being required so to do by the Engineer's representative shall, at his own cost rectify such errors, to the satisfaotion of the Engineer's representative. Such checking shall not absolve the Contractor of his own responsibility of maintaining accuracy in the work. The Contractor shall carefully protect and preserve all bench marks, sight rails, pegs and other things used in setting out the work.

20. (1) **Compliance to Engineer's instructions.** — The Engineer shall direct the order in which the several parts of the works shall be executed and the Contractor shall execute without delay all orders given by the Engineer from time to time but the Contractor shall not be relieved thereby from responsibility for the due performance of the works in all respects.

(2) **Alterations to be authorised.** — No alterations in or additions to or omissions or

abandonment of any part of the works shall be deemed authorised, except under instructions from the Engineer, and the Contractor shall be responsible to obtain such instructions in each and every case in writing from the Engineer.

(3) **Extra works.** — Should works over and above those included in the contract require to be executed at the site, the contractor shall have no right to be entrusted with the execution of such works which may be carried out by another contractor or contractors or by other means at the option of the Railway.

(4) **Separate contracts in connection with works.** — The Railway shall have the right to let other contracts in connection with the works. The Contractor shall afford other contractors reasonable opportunity for the storage of their materials and the execution of their works and shall properly connect and coordinate his work with theirs. If any part of the Contractor's work depends for proper exeoution or result upon the work of another contractor(s), the Contractor shall inspect and promptly report to the Engineer any defects in suoh works that render it unsuitable for such proper execution and results. The Contractor's failure so-to inspect and report shall constitute an acceptahce of the other contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the other contractor's work after the execution of his work.

21. **Instructions of Engineer's Representative.** — Any instructions or approval given by the Engineer's representative to Contractor in connection with the works shall bind the Contractor as though it had been given by the Engineer provided always as follows:—

(a) Failure of the Engineer's representative to disapprove any work or materials shall nct prejudice the power of the Engineer thereafter to disapprove such work or material and to order the removal or breaking up thereof.

(b) If the Contractor shall be dissatisfied by reason of any decision of the Engineer's representative, he shall be entitled to refer the matter to the Engineer who shall there-upon confirm or vary such decision.

22. (1) **Adherence to specifications and drawings.** — The whole of the works shall be executed in perfect conformity with the specifications and drawings of the contract. If the Contractor performs any works in a manner contrary to the specifications or drawings or any of them and without such reference to the Engineer, he shall bear all the costs arising or ensuing therefrom and shall be responsible for all loss to the Railway.

(2) **Drawings and specifications on the works.** — The Contractor shall keep one copy of Drawings and Specifications at the site, in good order, and such contract documents as may be necessary, available to the Engineer or the Engineer's Representative.

(3) **Ownership of drawings and specifications.** — All Drawings and Specifications and copies thereof furnished by the Railway to the Contractor are deemed to be the property of the Railway. They shall not be used on other works and with the exception of the signed contract set, shall be returned by the Contractor to the Railway on completion of the work or termination of the Contract.

(4) **Compliance with Contractor's request for details.** — The Engineer shall furnish with reasonable promptness, after receipt by him of the Contractor's request for the same, additional

Instructions by means of drawings or otherwise, necessary for the proper execution of the works or any part thereof. All such drawings and instructions shall be consistent with the Contract Documents and reasonably inferable therefrom.

(5) **Meaning and intent of specification and drawings.** — If any ambiguity arises as to the meaning and intent of any portion of the Specifications and Drawings or as to execution or quality of any work or material, or as to the measurements of the works the decision of the Engineer thereon shall be final subject to the appeal (within 7 days of such decision being intimated to the Contractor) to the Chief Engineer who shall have the power to correct any errors, omissions, or discrepancies in aforementioned items and whose decision in the matter in dispute or doubt shall be final and conclusive.

23. **Working during night** :— The Contractor shall not carry out any work between sun-set and sun-rise without the previous permission of the Engineer.

24. **Damage to Railway property or private life and property.** — The Contractor shall be responsible for all risks to the works and for trespass and shall make good at his own expense all loss or damage whether to the works themselves or to any other property of the Railway or the lives, persons or property of others from whatsoever cause in connection with the works until they are taken over by the Railway and this although all reasonable and proper precautions may have been taken by the Contractor, and in case the Railway shall be called upon to make good any costs, loss or damages, or to pay any compensation, including that payable under the provisions of the Workmen's Compensation Act or any statutory amendments thereof to any person or persons sustaining damages as aforesaid by reason of any act, or any negligence or omissions on the part of the Contractor the amount of any costs or charges including costs and charges in connection with legal proceedings, which the Railway may incur in reference thereto, shall be charged to the Contractor. The Railway shall have the power and right to pay or to defend or compromise any claim of threatened legal proceedings or in anticipation of legal proceedings being instituted consequent on the action or default of the Contractor, to take such steps as may be considered necessary or desirable to ward off or mitigate the effect of such proceedings, charging to Contractor, as aforesaid, any sum or sums of money which may be paid and any expenses whether for reinstatement or otherwise which may be incurred and the propriety of any such payment, defence or compromise, and the incurring of any such expenses shall not be called in question by the Contractor.

25. **Sheds, Storeshouses and Yards.** — The Contractor shall at his own expense provide himself with sheds, store houses and yards in such situations and in such numbers as in the opinion of the Engineer is requisite for carrying on the works and the Contractor shall keep at each such sheds, store-houses and yards a sufficent quantity of materials and plant in stock as not to delay the carrying cut of the works with due expedition and the Engineer and the Engineer's representative shall have free access to the said sheds, store houses and yards at any time for the purpose of inspecting the stock of materials or plant so kept in hand, and any materials or plant which the Engineer may object to shall not be brought upon or used in the works, but shall be forthwith removed from the sheds, storehouses or yards by the Contractor. The Confractor shall at his own expenses provide and maintain suitable mortar mills, soaking vats or any other equipments necessary for the execution of the works.

26. **Provision of efficient and competent staff.** — The Contractor shall place and keep on the works at all times efficient and competent staff to give the necessary directions to his workmen and to see that they execute their work in sound and proper manner and shall employ only such

supervisors, workmen and labourers in or about the execution of any of these works as are careful and skilled in the various trades and callings. The Contractor shall at once remove from the works any agents, permitted sub-contractor, supervisor, workman or labourer who shall be objected to by the Engineer and if and whenever required by the Engineer, he shall submit a correct return showing the names of all staff and workmen employed by him. In the event of the Engineer being of the opinion that the Contractor is not employing on the works a sufficient number of staff and workmen as is necessary for the proper completion of the works within the time prescribed, the Contractor shall forthwith on receiving intimation to this effect take on the additional number of staff and labour specified by the Engineer within seven days of being so required and failure on the part of the Contractor to comply with such instructions will entitle the Railway to rescind the contract under Clause 62 of these conditions.

27. (1) **Workmanship and testing.** — The whole of the works and/or supply of materials specified and provided in the contract or that may be necessary to be done in order to form and complete any part thereof shall be executed in the best and most substantial workman like manner with materials of the best and most approved quality of their respective kinds, agreeable to the particulars contained in or implied by the specifications and as referred to in and represented by the drawings or in such other additional particulars, instructions and drawings may be found requisite to be given during the carrying on of the works and to the entire satisfaction of the Engineer according to the instructions and directions which the Contractors may from time to time receive from the Enginner. The materials may be subjected to tests by means of such machines, instruments and appliances as the Engineer may direct and wholly at the expense of the Contractor.

(2) **Removal of improper work and materials.** — The Engineer or the Engineer's Representative shall be entitled to order from time to time :-

(a) the removal from the site within the time specified in the order of any materials which in his opinion are not in accordance with the specifications or drawings.

(b) the substitution of proper and suitable materials, and

(c) the removal and proper re-execution, notwithstanding any previous tests thereof or "on account" payments there-for, of any work which in respect of materials or workmanship is not in his opinion in accordance with the specifications and in case of default on the part of the Contractor in carrying out such order the Railway shall be entitled to rescind the contract under Clause 62 of these conditions.

28. **Facilities for inspection.** — The Contractor shall afford the Engineer and the Engineer's Representative every facility for entering in and upon every portion of the work at all hours for the purpose of inspection or otherwise and shall provide all labour, materials, planks, ladders, pumps, appliances and things of every kind required for the purpose and the Engineer and the Engineer's Representative shall at all times have free access to every part of the works and to all places at which materials for the works are stored or being prepared.

29. **Examination of work before covering up.** — The Contractor shall give 7 days notice to the Engineer or the Engineer's Representative whenever any work or materials are intended to be covered up in the earth, in bodies or walls or otherwise to be placed beyond the reach of measurements in order that the work may be inspected or that correct dimensions may be taken before being so covered, placed beyond the reach of measurement in default whereof, the same shall at the option of the Engineer or the Engineer's Representative be uncovered and measured at the Contractor's expense or no allowance shall be made for such work or materials.

30. **Temporary works.**—All temporary works necessary for the proper execution of the works shall be provided and maintained by the Contractor and subject to the consent of the Engineer shall be removed by him at his expenses when they are no longer required and in such manner as the Engineer shall direct. In the event of failure on the part of the Contractor to remove the temporary works, the Engineer will cause them to be removed and cost as increased by supervision and other incidental charges shall be recovered from the Contractor. If temporary huts are provided by the Contractor on the Railway land for labour engaged by him for the execution of works, the contractor shall arrange for handing over vacant possession of the said land after the work is completed; if the contractor's labour refuse to vacate, and have to be ejected by the Railway, necessary expenses incurred by the Railway in connection therewith shall be borne by the Contractor.

31. (1) **Contractor to supply water for works.** — Unless otherwise provided in the Contract, the Contractor shall be responsible for the arrangements to obtain supply of water necessary for the works.

(2) **Water supply from Railway System.** — The Railway may supply to the Contractor part or whole of the quantity of the water required for the execution of works from the Railway's existing water supply system at or near the site of works on specified terms and conditions and at such charges as shall be determined by the Railway and payable by the Contractor, provided that the Constractor shall arrange, at his own expense, to effect the connections and lay additional pipe lines and accessories on the site and that the Contractor shall not be entitled to any compensation for interruption or failure of the water supply.

(3) **Water supply by Railway transport.** — In the event of the Railway arranging supply of water to the Contractor at or near the site of works by travelling water tanks or other means, the freight and other charges incurred thereby, including demurrage charges that may be levied, shall be paid by the Contractor in addition to the charges referred to in sub-clause (2) of the clause provided that the contractor shall not be entitled to any compensation for interruption or failure of the water supply.

(4) (a) **Contractor to arrange supply of Electric power for works.** — Unless otherwise provided in the contract, the Contractor shall be responsible for arrangements to obtain supply of Electric Power for the works.

(b) **Electric supply from the Railway system.** — The Railway may supply to the Contractor part or whole of the electric power wherever available and possible, required for execution of works from the Railway's existing electric supply systems at or near the site of works on specified terms and conditions and such charges as shall be determined by the Railway and payable by the Contractor provided the cost of arranging necessary connections to the Railway's Electric Supply systems, and laying of underground/overhead conductor, circuit protection, electric power meters, transmission structure, shall be borne by the Contractor and that the Contractor shall not be entitled to any compensation for interruption or failure of the Electric supply system.

32. **Property in materials and plant.** — The materials and plant brought by the Contractor upon the site or on the land occupied by the Contractor in connection with the works and intended to be used for the execution thereof shall immediately, they are brought upon the site of the said land, be deemed to be the property of the Railway. Such of them as during the progress of the works are rejected by the Engineer under Clause 25 of these conditions or are declared by him not to be

needed for the execution of the works or such as on the grant of the certificate of completion remain unused shall immediately on such rejection, declaration or grant cease to be deemed the property of the Railway and the Contractor may then (but not before) remove them from the site or the said land. This clause shall not in any way diminish the liability of the Contractor nor shall the Railway be in any way answerable for any loss or damage which may happen to or in respect of any such materials or plant either by the same being lost , stolen, injured or destroyed by fire, tempest or otherwise.

33. (1) **Tools, Plant and Materials Supplied by Railway.** — The Contractor shall take all reasonable care of all tools, plant and materials or other property whether of a like description or not belonging to the Railway and committed to his charge for the purpose of the works and shall be responsible for all damage or loss caused by him, his agents, permitted sub-contractor or his workmen or others while they are in his charge. The Contractors shall sign accountable receipts for tools, plants and materials made over to him by the Engineer and on completion of the works shall hand over the unused balance of the same to the Engineer in good order and repair, fair wear and tear excepted, and shall be responsible for any failure to account for the same or any damage done thereto.

(2) **Hire of Railway's Plant,**— The Railway may hire to the Contractor such plant as concrete mixers, compressors and portable engines for use during execution of the works on such terms as may be specified in the special conditions or in a separate agreement for Hire of Plant.

34. (1) **Precaution during progress of works.** — During the execution of works, unless otherwise specified the Contractor shall at his own cost provide the materials for and execute all shoring, timbering and strutting works as is necessary for the stability and safety of all structures, excavations and works and shall ensure that no damage, injury or loss is caused or likely to be caused to any person or property.

(2) **Roads and Water courses.** — Existing roads or water courses shall not be blocked, cut through, altered, diverted or obstructed in any way by the Contractor, except with the permission of the Engineer. All compensations claimed for any unauthorised closure, cutting through, alteration, diversion or obstruction to such roads or water courses by the Contractor or his agent or his staff shall be recoverable from the Contractor by deduction from any sums which may become due to him in terms of contract, or otherwise according to law.

(3) **Provision of access to premises.**— During progress of work in any street or thoroughfare, the Contractor shall make adequate provision for the passage of traffic, for securing self access to all premises approached from such street or thoroughfare and for any drainage, water supply or means of lighting which may be interrupted by reason of the execution of the works and shall erect and maintain at his own cost barriers, lights and other safeguards as prescribed by the Engineer, for the regulation of the traffic, and provide watchmen necessary to prevent accidents. The works shall in such cases be executed night and day if so ordered by the Engineer and with such vigour so that the traffic way be impeded for as short a time as possible.

(4) **Safety of Public.** — The Contractor shall be responsible to take all precautions to ensure the safety of the public whether on public or Railway property and shall post such look-out men as may in the opinion of the Engineer be required to comply with regulations appertaining to the work.

35. **Use of Explosives .** — Explosives shall not be used on the works or on the site by the Contractor without the permission of the Engineer and then only in the manner and to the extent to

which such permission is given. Where explosives are required for the works, they shall be stored in a special magazine to be provided by and at the cost of the Contractor in accordance with the Explosive Rules. The Contractor shall obtain the necessary license for the storage and the use of explosives and all operations in which or for which explosives are employed shall be at the sole risk and responsibility of the Contractor and the Contractor shall indemnify the Railway in respect thereof.

36. (1) **Suspension of works.** — The Contractor shall on the order of the Engineer suspend the progress of the works or any part thereof for such time or times and in such manner as the Engineer may consider necessary and shall during such suspension properly protect and secure the work so far as is necessary in the opinion of the Engineer. If such suspension is :—

(a) Provided for in the contract, or

(b) necessary for the proper execution of the works or by the reason of weather conditions or by some default on the part of the Contractor, and or

(c) necessary for the safety of the works or any part thereof.

(2) The Contractor shall not be entitled to the extra costs, if any, incurred by him during the period of suspension of the works; but in the event of any suspension ordered by the Engineer for reasons other than aforementioned and when each such period of suspension exceeds 14 days, the Contractor shall be entitled to such extension of time for completion of the works as the Engineer may consider proper having regard to the period or periods of such suspensions and to such compensations as the Engineer may consider reasonable in respect of salaries or wages paid by the Contractor to his employees during the periods of such suspension.

(3) **Suspension lasting more than 3 months.** — If the progress of the works or any part thereof is suspended on the order of the Engineer for more than three months at a time, the Contractor may serve a written notice on the Engineer requiring permission within 15 days from the receipt thereof to proceed with the works or that part thereof in regard to which progress is suspended and if such permission is not granted wthin that time the Contractor by further written notice so served may, but is not bound to , elect to treat the suspension where it affects part only of the works as an omission of such part or where it affects the whole of the works, as an abandonment of the contract by the Railway.

37. **Rates for items of works.** — The rates entered in the accepted Schedule of Rates of the Contract are intended to provide for works duly and properly completed in accordance with the general and special (if any) conditions of the contract and the specifications and drawings together with such enlargements, extensions, diminutions, reductions, alterations or additions as may be ordered in terms of Clause 42 of these conditions and without prejudice to the generality thereof and shall be deemed to include and cover superintendence and labour, supply, including full freight of materials, stores, patterns, profiles, moulds, fittings, centerings, scaffoldings, shoring props, timber, machinery, barracks, tackle, roads, pegs, posts, tools, and all apparatus and plant required on the works, except such tools, plant or materials as may be specified in the contract to be supplied to the Contractor by the Railway, the erection, maintenance and removal of all temporary works and buildings, all watching, lighting , bailing, pumping and draining, all prevention of or compensation for trespass, all barriers and arrangements for the safty of the public or of employees during the execution of works, all sanitary and medical arrangements for labour camps as may be prescribed

by the Railway, the setting of all work and of the construction, repair and upkeep of all centre lines, bench marks and level pegs thereon, site clearance, all fees, duties, royalties, rent and compensation to owners for surface damage or taxes and impositions payable to local authorities in respect of land, structures and all material supplied for the work or other duties or expenses for which the Contractor may become liable or may be put to under any provision of law for the purpose of or in connection with the execution of the contract, and all such other incidental charges or contingencies as may have been specially provided for in the specifications.

38. **Demurrage and wharfage dues.**— Demurrage charges calculated in accordance with the scales inforce for the time being on the Railway and incurred by the Contractor failing to load or unload any goods or materials within the time allowed by the Railway for loadings as also wharfage charges of materials not removed in time as also charges due on consignments booked by or to him shall be paid by the Contractor, failing which such charges shall be debited to the Contractor's account in the hands of the Railway and shall be deducted from any sums which may become due to him in terms of the contracts.

39. (1) **Rates for extra items of works.** — Any item of work carried out by the Contractor on the instructions of the Engineer which is not included in the accepted schedules of rates shall be executed at the rates setforth in the "Schedule of Rates, South Eastern Railway" modified by the tender percentage and such items are not contained in the latter, at the rate agreed upon between the Engineer and the Contractor before the execution of such items of work and the contractors shall be bound to notify the Engineer atleast seven days before the necessity arises for the execution of such items of works that the accepted schedule of rates does not include rate or rates for the extra work involved. The rates payable for such items shall be decided at the meeting to be held between the Engineer and Contractor, in as short a period as possible after the need for the special item has come to the notice. In case the Contractor fails to attend the meeting after being notified to do so or in the event of no settlement being arrived at, the Railway shall be entitled to execute the extra works by other means and the contractor shall have no claim for loss or damage that may result from such procedure.

(2) Provided that if the Contractor commences work or incurs any expenditure in regard thereto before the rates as determined and agreed upon as lastly hereonto fore-mentioned, then and in such a case the Contractor shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of determination of the rates as aforesaid according to the rates as shall be fixed by the Engineer. However if the contractor is not satisfied with the decision of the Engineer in this respect he may appeal to the Chief Engineer within 30 days of getting the decision of the Engineer , supported by analysis of the rates claimed. The Chief Engineer's decision after hearing both the parties in the matter would be final and binding on the Contractor and the Railway.

40. (1) **Handing over of works.** — The Contractor shall be bound to hand over the works executed under the contract to the Railway complete in all respects to the satisfaction of the Engineer. The Engineer shall determine the date on which the work is considered to have been completed, in support of which his certificate shall be regarded as sufficient evidence for all purposes. The Engineer shall determine from time to time, the date on which any particular section of the work shall have been completed, and the contractor shall be bound to observe any such determination of the Engineer.

(2) **Clearance of site on completion.** — On the completion of the works the Contractor shall

clear away and remove from the site all constructional plant, surplus materials, rubbish and temporary works of every kind and leave the whole of the site and works clean and in a workman like condition to the satisfaction of the Engineer. No final payment in settlement of the accounts for the works shall be paid, held to be due or shall be made to the Contractor till, in addition to any other condition necessary for final payment, site clearance shall have been affected by him, and such clearance may be made by the Engineer at the expense of the Contractor in the event of his failure to comply with this provision within 7 days after receiving notice to that effect. Should it become necessary for the Engineer to have the site cleared at the expense of the Contractor, the Railway shall not be held liable for any loss or damage to such of the Contractor's property as may be on the site and due to such removal there from which removal may be effected by means of public sales of such materials and property or in such a way as deemed fit and convenient to the Engineer.

VARIATIONS IN EXTENT OF CONTRACT

41. **Modification to contract to be in writing.** — In the event of any of the provisions of the contract requiring to be modified after the contract documents have been signed, the modifications shall be made in writing and signed by the Railway and the Contractor and no work shall proceed under such modifications until this has been done. Any verbal or written arrangement abandoning, modifying, extending, reducing or supplementing the contract or any of the terms thereof shall be deemed conditional and shall not be binding on the Railway unless and until the same is incorporated in a formal instrument and signed by the Railway and the Contractor, and till then the Railway shall have the right to repudiate such arrangements.

42. (1) **Powers of modification to contract.** — The Engineer on behalf of the Railway shall be entitled by order in writing to enlarge or extend, diminish or reduce the works or make any alterations in their design, character, position, site, quantities, dimensions or in the method of their execution or in the combination and use of materials for the execution thereof or to order any additional work to be done or any works not to be done and the contractor will not be entitled to any compensation for any increase/reduction in the quantities of work but will be paid only for the actual amount of work done and for approved materials supplied against a specific order.

(2) (i) Unless otherwise specified in the special conditions of the contract, the accepted variation in quantity of each individual item of the contract would be upto 25% of the quantity originally contracted, except in case of foundation work. The contractor shall be bound to carry out the work at the agreed rates and shall not be entitled to any claim or any compensation whatsoever upto the limit of 25% variation in quantity of individual item of works.

(ii) In case of earthwork, the variation limit of 25% shall apply to the gross quantity of earth work and variation in the quantities of individual classifications of soil shall not be subject to this limit.

(iii) In case of foundation work, no variation limit shall apply and the work shall be carried out by the contractor on agreed rates irrespective of any variation.

(3) **Valuation of variations.** — The enlargements, extensions, diminution, reduction, alterations or additions referred to in sub-clause(2) of this clause shall in no degree affect the validity of the contract but shall be performed by the Contractor as provided therein and be subject to the same conditions, stipulations and obligations as if they had been originally and expressively included and provided for in the specifications and drawings and the amounts to be paid therefor shall be calculated in accordance with the accepted schedule of rates. Any extra items/quantities of work falling outside the purview of the provisions of sub-clause (2) above shall be paid for at the rates determined under clause 39 of these conditions.

CLAIMS

43. (1) **Monthly Statement of Claims.** — The Contractor shall prepare and furnish to the Engineer once in every month an account giving full and detailed particulars of all claims for any additional expenses to which the Contractor may consider himself entitled to and of all extra or additional works ordered by the Engineer which he has executed during the preceding month and no claim for payment for and such work will be considered which has not been included in such particulars.

(2) **Signing of "No Claim" Certificate.** — The Contractor shall not be entitled to make any claim whatsoever against the Railway under or by virtue of or arising out of this contract, nor shall the Railway entertain or consider any such claim, if made by the Contractor, after he shall have signed a "No Claim" Certificate in favour of the Railway in such form as shall be required by the Railway after the works are finally measured up. The Contactor shall be debarred from disputing the correctness of the items covered by "No Claim" Certificate or demanding a clearance to arbitration in respect thereof.

MEASUREMENTS, CERTIFICATES AND PAYMENTS

44. **Quantities in schedule annexed to Contract.** — The quantities set out in the accepted schedule of rates with items of works quantified are the estimated quantities of the works and they shall not be taken as the actual and correct quantities of the work to be executed by the Contractor in fulfiiment of his obligations under the contract.

45. **Measurement of works.** — The Contractor shall be paid for the works at the rates in the accepted schedule of rates and for extra works at rates determined under Clause 39 of these conditions on the measurements taken by the Engineer or the Engineer's representative in accordance with the rules prescribed for the purpose by the Railway. The quantities for items the unit of which in the accepted schedule of rates is 100 or 1000 shall be calculated to the nearest whole number, any fraction below half being dropped and half and above being taken as one; for items the unit of which in the accepted schedule of rates is single, the quantities shall be calculated to two places of decimals. Such measurements will be taken of the work in progress from time to time and at such intervals as in the opinion of the Engineer shall be proper having regard to the progress of works. The date and time on which "on account" or final measurements are to be made shall be communicated to the Contractor who shall be present at the site and shall sign the results of the measurements (which shall also be signed by the Engineer or the Engineer's representative) recorded in the official measurements book as and acknowledgement of his acceptance of the accuracy of the measurements. Failing the Contractor's attendance the work may be measured up in his absence and such measurements shall, not-withstanding such absence, be binding upon the Contractor whether or not he shall have signed the measurement books provided always that any objection made by him to measurement shall be duly investigated and considered in the manner set out below :-

(a) It shall be open to the Contractor to take specific objection to any recordod measurements or Classification on any ground within seven days of the date of such measurements. Any remeasurement taken by the Engineer or the Engineer's representative in the presence of the Contractor or in his absence after due notice has been given to him in consequence of objection made by the Contractor shall be final and binding on the Contractor and no claim whatsoever shall thereafter be entertained regarding the accuracy and classification of the measurements.

(b) If an objection raised by the Contractor is found by the Engineer to be incorrect the Contractor shall be liable to pay the actual expenses incurred in measurements.

46. (1) **"On-Account" Payments.** — The Contractor shall be entitled to be paid from time to time by way of "On-Account" payment only for such works as in the opinion of the Engineer he has executed in terms of the contract. All payments due on the Engineer's or the Engineer's Representative's certificates of measurements shall be subject to any deductions which may be made under these presents and shall further be subject to, unless otherwise required by Clause 16 of these conditions, a retention of ten percent by way of security deposits; until the amount of security deposit by way of retained earnest money and such retentions shall amount to 10% of the total value of the contract provided always that the Engineer may by any certificate make any correction or modification in any previous certificate which shall have been issued by him and that the Engineer may withhold any certificate if the works or any part thereof are not being carried out to his satisfaction.

(2) **Rounding off amounts.** — The total amount due on each certificate shall be rounded off to the nearest rupee i.e., sums less than 50 paise shall be omitted and sums of 50 paise and more upto Re. 1/- will be reckoned as Re. 1/-.

(3) **"On-Account" Payments not prejudicial to final settlement.** — "On -Account" payments made to the Contractor shall be without prejudice to the final making up of the accounts (except where measurements are specifically noted in the Measurement Book as "Final Measurements" and as such have been signed by the Contractor) and shall in no respect be considered or used as evidence of any facts stated in or to be inferred from such accounts nor of any particular quantity of work having been executed nor of the manner of its execution being satisfactory.

(4) **Manner of payment.** — Unless otherwise specified payments to the Contractor will be made by cheque but no cheque will be issued for an amount less than Rs. 100/-.

47. **Maintenance of works.** — The Contractor shall at all times during the progress and continuance of the works and also for the period of maintenance specified in the Tender Form after the date of passing of the certificate of completion by the Engineer or any other earlier date subsequent to the completion of the works that may be fixed by the Engineer be responsible for and effectively maintain and uphold in good substantial, sound and perfect condition all and every part of the works and shall make good from time to time and at all times as often as the Engineer shall require, any damage or defect that may during the above period arise in or be discovered or be in any way connected with the works, provided that such damage or defect is not directly caused by errors in the contract documents, act of providence or insurrection or civil riot, and the Contractor shall be liable for and shall pay and make good to the Railway or other persons legally entitled thereto whenever required by the Engineer so to do, all losses, damages, costs and expenses they or any of them may incur or be put or be liable to, by reasons or in consequence of the operations of the Contractor or of his failure in any respect.

48. (1). **Certificate of completion of works.** — As soon as in the opinion of the Engineer the works shall have been substantially completed and shall have satisfactorily passed any final test or tests that may be prescribed, the Engineer shall issue a Certificate of Completion in respect of the works and the period of maintenance of the works shall commence from the date of such certificate provided that the Engineer may issue such a certificate with rspect to any part of the works before the completion of the whole of the works or with respect to any substantial part of the works which has been both completed to the satisfaction of the Engineer and occupied or used by the Railway and when any such certificate is given in respect of part of the works such part shall be considered as completed and the period of maintenance of such part shall commence from the date of such certificate.

(2) **Contractor not absolved by completion Certificate.** — The Certificate of completion in respect of the works referred to in sub-clause (1) of this clause shall not absolve the Contractor from his liability to make good any defects, imperfections, shrinkages or faults which may appear during the period of maintenance specified in the tender arising in the opinion of the Engineer from materials or workmanship not in accordance with the drawings or specifications or instructions of the Engineer, which defects, imperfections, shrinkages or faults shall upon the direction in writing of the Engineer be amended and made good by the Contractor at his own cost; and in case of default on the part of Contractor the Engineer may employ labour and materials or appoint another Contractor to amend and make good such defects, imperfections, shrinkages and faults and all expenses consequent thereon and incidental thereto shall be borne by the Contractor and shall be recoverable from any moneys due to him under the contract.

49. **Approval only by Maintenance Certificate.** — No certificate other than maintenance certificate referred to in Clause 50 of the conditions shall be deemed to constitute approval of any work or other matter in respect of which it is issued or shall be taken as an admission of the due performance of the contract or any part thereof or of the accuracy of any claim or demand made by the Contractor or of additional varied work having been ordered by the Engineer nor shall any other certificate conclude or prejudice any of the powers of the Engineer.

50. (1) **Maintenance Certificate.** — The Contract shall not be considered as completed until a Maintenance Certificate shall have been signed by the Engineer stating that the works have been completed and maintained to his satisfaction. The maintenance Certificate shall be given by the Engineer upon the expiration of the period of maintenance or as soon thereafter as any works ordered during such period pursuant to sub clause (2) of Clause 48 of these conditions shall have been completed to the satisfaction of the Engineer and full effect shall be given to this Clause notwithstanding the taking possession of or using the works or any part thereof by the Railway.

(2) **Cessation of Railway's Liability.** — The Railway shall not be liable to the Contractor for any matter arising out of or in connection with the contract of the execution of the works unless the Contractor shall have made a claim in writing in respect thereof before the issue of the Maintenance Certificate under this clause.

(3) **Unfulfilled obligations.** — Notwithstanding the issue of the Maintenance Certificate the Contractor and (subject to sub-clause (2) of this clause) the Railway shall remain liable for the fulfilment of any obligation incurred under the provision of the contract prior to the issue of the Maintenance Certificate which remains unperformed at the time such certificate is issued and for the purposes of determining the nature and extent of any such obligations the contract shall be deemed to remain in force between the parties thereto.

51. (1) **Final Payment.** — On the Engineer's certificate of completion in respect of the works, an adjustment shall be made and the balance of account based on the Engineer or the Engineer's representative's certified measuremets of the total quatity of work executed by the Contractor upto the date of completion and on the accepted schedule of rates and for extra works on rates determined under Clause 39 of these conditions shall be paid to the Contractor subject always to any deduction which may be made under these presents and futher subject to the Contractor having delivered to the Engineer either a full account in detail of all claims he may have on the Railway in respect of the works or having delivered "No Claim" Certificate and the Engineer having after the receipt of such account given a certificate in writing that such claims are correct, that the whole of the works to be done under the provisions of the Contracts have been completed, that they have

been inspected by him since their completion and found to be in good and s..... ir, that all properties, works and things removed, disturbed or injured in consequence of the works have been properly replaced and made good and all expenses and demands incurred by or made upon the Railway for or in the respect of damage or loss by from or in consequence of the works, have been satisfied agreeably and in conformity with the contract.

(2) **Post payment Audit .** — It is an agreed term of contract that the Railway reserves to itself the right to carry out a post-payment audit and or technial examination of the works and the final bill, including all supporting vouchers, abstracts, etc., and to make a claim on the contractor for the refund of any excess amount paid to him if as a result of such examination any over-payment to him is discovered to have been made in respect of any works done or alleged to have been done by him under the contract.

(3) **Repayment of security deposit.** — The total security deposit shall become due and shall be paid to the Contractor after the expiration of the period of maintenance, specified in the Tender reckoned from the date on which the Engineer shall have passed the certificate of completion comprising the whole of the works to be done under the provisions of the contract or, any other earlier date subsequent to the completion of the whole of such works that may be fixed by the Railway in this behalf, provided that all the stipulations of the clause have been fulfilled by the Contractor and all claims and demands made against the Railway for and in respect of damage or loss by, from or in consequence of the works have been finally satisfied, provided further that in the event of different maintenance periods having become applicable to different parts of the works pursuant to sub-clause (i) of clause 48 of these conditions, the expression expiration of the period of maintenance shall for the purpose of this clause, be deemed to mean the expiry of the latest of such periods.

51-A. **Production of vouchers etc. by the Contractor.** — (i) For a contract of more than one crore of rupees, the contractor shall, whenever required, produce or cause to be produced for examination by the Engineer any quotation, invoice, cost or other account, book of accounts, voucher, receipt, letter, memorandum, paper of writing or any copy of or extract from any such document and also furnish information and returns verified in such manner as may be required in any way relating to the execution of this contract or relevant for verifying or ascertaining cost of execution of this contract (the decision of the Engineer on the question of relevancy of any documents, information or return being final and binding on the parties). The contractor shall similarly produce vouchers, etc., if required to prove to the Engineer, that materials supplied by him, are in accordance with the specifications laid down in the contract.

(ii) If any portion of the work in a contract of value more than one crore of rupees be carried out by a sub-contractor or any subsidiary or allied firm or company (as per Clause 7 of the General Conditions of Contract), the Engineer shall have power to secure the books of such sub-contractor or any subsidiary or allied firm or company, through the contractor, and such books shall be open to his inspection.

(iii) The obligations imposed by sub-clause (i) and (ii) above is without prejudice to the obligations of the contractor under any statute rules or orders binding on the contractor.

52. **Withholding and lien in respect of sums claimed.** — Whenever any claim or claims for payment of a sum of money arises out of or under the contract against the contractor, the Railway shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from

the security, if any, deposited by the contractor and for the purpose aforesaid, the Railway shall be entitled to withhold the said cash security deposit or the security if any, furnished as the case may be and also have a lien over the same pending finalisation or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Railway shall be entitled to withhold and have a lien to the extent of the such claimed amount or amounts referred to supra, from any sum or sums found payable or which at any time thereafter may become payable to the contractor under the same contract or any other contract with this or any other Railway or any Department of the Central Government pending finalisation or adjudication of any such claim.

It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above, by the Railway will be kept withheld or retained as such by the Railway till the claim arising out of or under the contract is determined by the arbitrator (if the contract is governed by the arbitration clause) or by the competent court as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to supra and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Railway shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company, as the case may be whether in his individual capacity or otherwise.

52-A. **Lien in respect of claims in Other Contracts.** — Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Railway, against any claim of this or any other Railway or any other Department of the Central Government in respect of payment of a sum of money arising out of or under any other contract made by the contractor with this or any other Department of the Central Government.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Railway will be kept withheld or retained as such by the Railway till the claim arising out of or under any other contract is either mutually settled or determined by arbitration, if the other contract is governed by arbitration clause or by the competent court as the case may be and contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

53. **Signature on Receipts for Amounts.** — Every receipt for money which may become payable or for any security which may become transferable to the Contractors under these presents, shall, if signed in the partnership name by any one of the partners of a Contractor's firm be a good and sufficient discharge to the Railway in respect of the moneys or security purported to be acknowledged thereby and in the event of death of any of the Contractor partners during the pendency of the contract it is hereby expressly agreed that every receipt by any one of the surviving Contractor partners shall if so signed as aforesaid be good and sufficient discharge as aforesaid provided that nothing in this clause contained shall be deemed to prejudice or effect any claim which the Railway may hereafter have against the legal representative of any contractor partner so dying, for or in respect of any breach of any of the conditions of the contract, provided also that nothing in this clause contained shall be deemed to prejudice or effect the respective rights or obligations of the Contractor partners and of the legal representatives of any deceased Contractor partners interse.

LABOUR

54. **Wages to Labour.** — The Contractor shall be responsible to ensure compliance with the provision of the Minimum Wages Act, 1948 (hereinafter referred to as the "said Act") and the Rules made there under in respect of any employees directly or through petty contractors or sub-contractors or sub-contractors employed by him on road construction or in building operations or in stone breaking or stone crushing for the purpose of carrying out this contract.

If, in compliance with the terms of the contract, the Contractor supplied any labour to be used wholly or partly under the direct orders and control of the Railways whether in connection with any work being executed by the Contractor or otherwise for the purpose of the Railway such labour shall, for the purpose of this clause, still be deemed to be persons employed by the Contractor.

If any moneys shall, as a result of any claim or application made under the said Act be directed to be paid by the Railway, such money shall be deemed to be moneys payable to the Railway by the Contractor and on failure by the Contractor to repay the Railway any moneys paid by it as aforesaid within seven days after the same shall have been demanded, the Railways shall be entitled to recover the same from any moneys due or accruing to the contractor under this or any other Contract with the Railways.

54-A. **Apprentices Act.** — The Contractor shall be responsible to ensure compliance with the provisions of the Apprentices Act, 1961 and the Rules and Orders issued there-under from time to time in respect of apprentices directly or through petty contractors or sub-contractors employed by him for the purpose of carrying out the contract.

If the contractor directly or through petty contractors or sub-contractors fails to do so, his failure will be a breach of the contract and the Railway may, in its discretion, rescind the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation of the povisions of the Act.

Note.—The contractors are required to engage apprentices when the works undertaken by them last for a period of one year or more and/or the cost of works is rupees one lakh or more.

55. **Provisions of payments of Wages Act.** — The Contractor shall comply with the provisions of the Payment of Wages Act, 1936 and the rules made thereunder in respect of all employees directly or through the petty contractors or sub-contractors employed by him in the works. If in compliance with the terms of the contract, the Contractor directly or through petty contractors or sub-contractors shall supply any labour to be used wholly or partly under the direct orders and control of the Engineer whether in connection with the works to be executed hereunder or otherwise for the purpose of the Engineer such labour shall nevertheless be deemed to comprise persons employed by the contractor and any moneys which may be ordered to be paid by the Engineer shall be deemed to be moneys payable by the Engineer on behalf of the Contractor and the Engineer may on failure of the Contractor to repay such money to the Railways deduct the same from any moneys due to the Contractor in terms of the contract. The Railway shall be entitled to deduct from any moneys due to the contractor (whether under this contract or any other contract) all moneys paid or payable by the Railway by way of compensation of aforesaid or for costs of expenses in connection with any claim thereto and the decision of the Engineer upon any question arising out of the effect or force of this clause shall be final and binding upon the Contractor.

55-A. (i) **Provisions of Contract labour (Regulation and Abolition) Act, 1970.** — (1). The Contractor shall comply with the provision of the contract labour (Regulation and Abolition) Act, 1970 and the Contract labcur (Regulatlcn and Abolition) Central Rules 1971 as modifled from time to time, wherever applicable and shall also lndemnify the Railway from and against any olaims under the afcresaid Act and the Rules.

(2) The Contractor shall obtain a valid licence under the aforesaid Act as modified from time to time before the commencement of the work and continue to have a valid licence until the completion of the work. Any failure to fulfil the requirement shall attract the penal provision of the Contract arising out of the resultant non-execution of the work.

(3) The Contractor shall pay to the labour employed by him directly or through sub-contractors the wages as per provision of the aforesaid Act and the Rules wherever applicable. The Contractor shall, notwithstanding the provisions of the contract to the contrary, cause to be paid the wages to labour indirectly engaged on the works including any engaged by sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

(4) In respect of all labcur directly or indirectly employed in the work for performance of the contractor's part of the contract, the Contractor shall comply with or cause to be complied with the provisions of the aforesaid Act and Rules wherever applicable.

(5) In every case in which, by virtue of the provisions of the aforesaid Act or the Rules, the Railway is obliged to pay any amount of wages to a workman employed by the Contractor or his sub-contractor inexecution of the work or to incur any expenditure in providing welfare and health amenities required to be provided under the aforesaid Act and the Rules or to incur any expenditure on account of the Contingent liability of the Railway due to the contractor's failure to fulfil his statutory obligations under the aforesaid Act or the Rules the Railway will recover from the Contractor, the amount of wages so paid or the amount of expenditure so incurred, and without prejudice to the rights of the Railway under the section 20, sub-section(2) and section 2, sub-section (4) of the aforesaid Act, the Railway shall be at liberty to recover such amount or part thereof by deducting it from the security deposit and/or from any sum due by the Railway to the contractor whether under the contract or otherwise. The Railway shall not be bound to contest any claim made against it under sub-section (1) of section 20 and sub-section (4) of section 21 of the aforesaid Act except on the written request of the Contractor and upon his giving to the Railway full security for all costs for which the Railway might become liable in contesting such claim. The decision of the Railway regarding the amount actually recoverable from the contractor as stated above, shall be final and binding on the Contractor.

56. **Reporting of Accidents to Labour.** — The Contractor shall be responsible for the safety of all employees directly or through petty contractors or sub-contractor employed by him on the works and shall report serious accidents to any of them however and wherever occuring on the works to the Engineer or the Engineer's Representative and shall make every arrangements to render all possible assistance.

57. **Provision of Workmen's Compensation Act.** — In every case in which by virtue of the provisions of Section 12 Sub-section (1) of the Workmen's Compensation Act 1923, Railway is obliged to pay compensation to a workman directly or through petty contractor or sub-contractor employed by the Contractor in executing the work, Railway will recover from the Contractor the amount of the compensation so paid, and, without prejudice to the rights of Railway under Section

12 Sub-section (2) of the said Act, Railway shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by Railway to the Contractor whether under these conditions or otherwise. Railway shall not be bound to contest any claim made against it under Section 12 Sub-section (1) of the said Act except on the written request of the Contractor and upon his giving to Railway full security for all costs for which Railway might become liable in consequence of contesting such claim.

57-A. **Provision of Mines Act.** — The Contractor shall observe and perform all the provisions of the Mines Act, 1952 or any statutory modifications or re-enactment thereof for the time being in force and any rules and regulations made thereunder in respect of all the persons directly or through the petty contractors or sub- contractors employed by him under this contract and shall indemnify the Railway from and against any claims under the Mines Act, or the rules and regulations framed thereunder, by or on behalf of any persons employed by him or otherwise.

58. **Railway not to provide quarters for Contractors.** — No quarters shall normally be provided by the Railway for the accomodation of the Contractor or any of his staff employed on the work. In exceptional cases where accomodation is provided to the Contractor at the Railway's discretion, recoveries shall be made at such rates as may be fixed by the Railway for the full rent of the buildings and equipments therein as well as charges for electric current, water supply and conservancy.

59. (1) **Labour Camps.** — The Contractor shall at his own expense make adequate arrangements for the housing, supply of drinking water and provision of latrines, and urinals for his staff and workmen, directly or through the petty contractors or sub-contractors and for temporary creche (Balmandir) where 50 or more women are employed at a time. Suitable sites on Railway land, if available, may be allotted to the Contractor for the erection of labour camps, either free of charge or on such terms and conditions that may be prescribed by the Railway. All camp sites shall be maintained in clean and sanitary conditions by the Contractor at his own cost.

(2) **Compliance to rules for employment of labour.** — The Contractor(s) shall conform to all laws, bye-laws rules and regulations for the time being in force pertaining to the employment of local or imported labour and shall take all necessary precautions to ensure and preserve the health and safety of all staff employed directly or through petty contractors or sub-contractors on the works.

(3) **Preservation of peace.** — The Contractor shall take requisite precautions and use his best endeavours to prevent any riotous or unlawful behaviour by or amongst his workmen and other employed directly or through the petty contractors or sub-contractors on the works and for the preservation of peace and protection of the inhabitants and security of property in the neighbourhood of the works. In the event of the Railway requiring the maintenance of a special Police Force at or in the vicinity of the site during the tenure of works, the expenses thereof shall be borne by the Contractor and if paid by the Railway shall be recoverable from the Contractor.

(4) **Sanitary arrangements.** — The Contractor shall obey all sanitary rules and carry out all sanitary measures that may from time to time be prescribed by the Railway Medical Authority and permit inspection of all sanitary arrangements at all times by the Engineer, the Engineer's Representative or the Medical Staff of the Railway. Should the Contractor fail to make the adequate sanitary arrangements, these will be provided by the Railway and the cost therefor recovered from the Contractor.

(5) **Outbreak of infectious disease.** — The Contractor shall remove from his camp such labour and their families as refuse protective inoculation and vaccination when called upon to do so by the Engineer or the Engineer's Representative on the advice of the Railway Medical Authority. Should Cholera, Plague, or other infectious disease break out, the Contractor shall burn the huts, beddings, clothes and other belongings of or used by the infected parties and promptly erect new huts on healthy sites as required by the Engineer, failing which within the time specified in the Engineer's requisition, the work may be done by the Railway and the cost therefor recovered from the Contractor.

(6) **Treatment of Contractor's staff in Railway Hospitals.** — The Contractor and his staff, other than labourers and their families requiring medical aid from the Railway Hospitals and dispensaries will be treated as private patients and charged accordingly. The Contractor's labourers and their Families will be granted free treatment in Railway Hospitals and dispensaries where no other Hospitals or dispensaries are available provided the Contractor pays the cost of medicines, dressing and diet money according to the normal scale and additional charges for special examinations such as pathological and bacteriological examination, X-Ray, etc., and for surgical operations.

(7) **Medical facilities at site.** — The Contractor shall provide medical facilities at the site as may be prescribed by the Engineer on the advice of the Railway Medical Authority in relation to the strength of the Contractor's resident staff and workmen.

(8) **Use of intoxicants.** — The sale of ardent spirits or other intoxicating beverages upon the work or in any of the buildings, encampments or tenements owned, occupied by or within the control of the Contractor or any of his employees shall be forbidden and the Contractor shall exercise his influence and authority to the utmost extent to secure strict compliance with this condition.

(9) **Non-employment of female labour.** — The Contractor shall see that the employment of female labour in Cantonment areas, particularly in the neighbourhood of soldiers barracks, should be avoided as far as possible.

(10) **Restrictions on the employment of retired Engineers of Railway services within two years of their retirement.** — The contractor shall not, if he is a retired Government Engineer of Gazetted rank, himself engage in or employ or associate a retired Government Engineer of Gazetted rank, who has not completed two years from the date of retirement, in connection with this contract in any manner whatsoever without obtaining prior permission of the President and if the contractor is found to have contravened this provision it will constitute a breach of contract and administration will be entitled to terminate the contract at the risk and cost of the contractor and forfeit his security deposit.

60. (1) **Non-employment of labourers below the age of 15.** — The Contractor shall not employ children below the age of 15 as labourers directly or through petty contractors or sub-contractors for the execution of work.

(2) **Medical Certificate of fitness for labour.** — It is agreed that the contractor shall not employ a person above 15 and below 19 years of age for the purpose of execution of work under the contract unless a medical certificate of fitness in the prescribed form (Proforma at Annexure II) granted to him by a certifying surgeon certifying that he is fit to work as an adult is obtained and kept in the custody of the contractor or a person nominated by him in this behalf and the person

carries with him, while at work, a token giving a reference to such certificate. It is further agreed that the responsibility for having the adolescent examined medically at the time of appointment or periodically till he attains the age of 19 years shall devolve entirely on the contractor and all the expenses to be incurred on this account shall be borne by him and no fee shall be charged from the adolescent or his parent for such medical examination.

(3) **Period of validity of medical fitness certificate.** — A certificate of fitness granted or renewed for the above said purposes shall be valid only for a period of one year at a time. The certifying surgeon shall revoke a certificate granted or renewed if in his opinion the holder of it is, no longer fit for work in the capacity stated therein. Where a certifying surgeon refuses to grant or renew a certificate or revoke a certificate, he shall, if so required by the person concerned, state his reasons in writing for doing so.

(4) **Medical re-examination of labourer.** — Where any official appointed in this behalf by the Ministry of Labour is of the opinion that any person employed in connection with the execution of any work under this contract in the age group 15 to 19 years is without a certificate of fitness or is having a certificate of fitness but no longer fit to work in the capacity stated in the certificate, he may serve on the Contractor, or on the person nominated by him in this regard, a notice requiring that such persons shall be examined by a certifying surgeon and such person shall not if the concerned official so directs be employed or permitted to do any work under this contract unless he has been medically examined and certified that he has been granted a certificate of fitness or a fresh certificate of fitness, as the case may be.

EXPLANATIONS :

(1) Only qualified medical practitioners can be appointed as "Certifying Surgeons" and the term "Qualified Medical Practitioners" means a person holding a qualification granted by an authority specified in the Schedule to the Indian Medical Degrees Act, 1916 (VII to 1916) or in the Schedule to the Indian Medical Council Act, 1933 (XXVII) of 1933.

(2) The Certifying surgeon may be a medical officer in the service of State or Municipal Corporation.

DETERMINATION OF CONTRACT

61. (1) **Right of Railway to determine the contract.** — The Railway shall be entitled to determine and terminate the contract at any time should, in the Railway's opinion, the cessation of work becomes necessary owing to paucity of funds or from any other cause whatever, in which case the value of approved materials at site and of work done to date by the Contractor will be paid for in full at the rate specified in the contract. Notice in writing from the Railway of such determination and the reasons therefor shall be conclusive evidence thereof.

(2) **Payment on determination of contract.** — Should the contract be determined under sub-clause(1) of this clause and the Contractor claims payment for expenditure incurred by him in the expectation of completing the whole of the work, the Railways shall admit and consider such claims as are deemed reasonable and are supported by vouchers to the satisfaction of the Engineer. The Railway's decision on the necessity and propriety of such expenditure shall be final and conclusive.

(3) The Contractor shall have no claim to any payment of compensation or otherwise, howsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of determination of contract.

62. **Determination of contract owing to default of contractor.** — (1) If the Contractor should.....

(i) Becomes bankrupt or insolvent, or

(ii) make an arrangement with of assignment in favour of his creditors, or agree to carry out the contract under a Committee of inspection of his creditors, or

(iii) being a Company or Corporation, go into liquidation (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or

(iv) have an execution levied on his goods or property on the works, or

(v) assign the contract or any part there-of otherwise than as provided in Clause 7 of these conditions or

(vi) abandon the contract, or

(vii) persistently disregard the instructions of the Engineer, or contravene any provision of the contract, or

(viii) fail to adhere to the agreed programme of work by a margin of 10% of the stipulated period, or

(ix) fail to remove materials from the site or to pull down and replace work after receiving from the Engineer notice to the effect that the said materials or works have been condemned or rejected under Clause 25 and 27 of these conditions, or

(x) fail to take steps to employ competent or additional staff and labour as required under Clause 26 of the conditions, or

(xi) fail to afford the Engineer or Engineer's representative proper facilities for inspecting the works or any part thereof as required under clause (28) of the conditions, or

(xii) promise, offer or give any bribe, commission, gift or advantage either himself or through his partner, agent or servant to any officer or employee of the Railway or to any person on his or on their behalf in relation to the excution of this or any other contract with this Railway.

(xiii) (A) At any time after the tender relating to the contract has been signed and submitted by the contractor, being a partnership firm admit as one of its partners or employ under it or being an incorporated company elect or nominate or allow to act as one of its directors or employ under it in any capacity whatsoever any retired engineer of the gazetted rank or any other retired gazetted officer working before his retirement, whether in the executive or administrative capacity, or whether holding any pensionable post or not, in the Engineering Department of the Railways for the time being owned and administered by the President of India before the expiry of

two years from the date of retirement from the said service of such Engineer or Officer unless such Engineer or Officer has obtained permission from the President of India or any officer duly authorised by him in this behalf to become a partner or a director or to take employment under the contractor, as the case may be, or

(B) Fail to give at the time of submitting the said tender:-

(a) The correct information as to the date of retirement of such retired engineer or retired officer from the said service, or as to whether any such retired engineer or retired officer was under the employment of the contractor at the time of submitting the said tender, or

(b) the correct information as to such engineers or officers obtaining permission to take employment under the contractor, or

(c) being a partnership firm, the correct information as to, whether any of its partners was such a retired engineer or a retired officer, or

(d) being an incorporated company, correct information as to whether any of its directors was such a retired engineer or a retired officer, or

(e) being such a retired engineer or retired officer suppress and not disclose at the time of submitting the said tender the fact of his being such a retired engineer or a retired officer or make at the time of submitting the said tender a wrong statement in relation to his obtaining permission to take the contract or if the contractor be a partnership firm or an incorporated company to be a partner or director of such firm or company as the case may be or to seek employment under the contractor.

CSMD: add also in clause 62 XIII

Then and in any of the said cases, the Engineer on behalf of the Railway may serve the Contractor with a notice (Proforma at Annexure III) in writing to that effect and if the Contractor does not within seven days after the delivery to him of such notice proceed to make good his default in so far as the same is capable of being made good and carry on the work or comply with such directions as aforesaid to the entire satisfaction of the Engineer, the Railway shall be entitled after giving 48 hours notice (Proforma at Annexure IV) in writing under the hand of the Engineer to rescind the contract as a whole or in part or parts (as may be specified in such notice) and adopt either or both of the following courses :-

(x) to carry out the whole of part of the work from which the contractor has been removed by the employment of the required labour and materials, the costs of which shall include lead, lift, freight, supervision and all incidental charges.

(y) to measure up the whole or part of the work from which the contractor has been removed and to get it completed by another contractor, the manner and method in which such work is completed shall be in the entire discretion of the Engineer whose decision shall be final :

and in both the cases (x) and (y) mentioned above, the Railway shall be entitled (i) to forfeit

the whole or such portion of the security deposit as it may consider fit, and (ii) to recover from the Contractor the cost of carrying out the work in excess of the sum which would have been payable according to the certificate of the Engineer to the Contractor if the works had been carried out by the Contractor under the terms of the contract, such certificate being final and binding upon the contractor, Provided, however, that such recovery shall be made only when the cost incurred in excess is more than the security deposit proposed to be forfeited and shall be limited to the amount by which the cost incurred in excess exceeeds the security deposit proposed to be forfeited. The amounts thus to be forfeited or recovered may be deducted from any moneys then due or which at any time thereafter may become due to the Contractor by the Railway under this or any other Contract or otherwise.

Provided always that in any case in which any of powers conferred upon the Railway by subclause (1) of Clause 62 hereof shall have become exercisable and the same shall not be exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions thereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor for which his liability for past and future shall remain unaffected.

(2) **Right of Railway after rescission of contract owing to default of Contractor.** — In the event of any or several of the courses, referred to in sub-clause (1) of this clause, being adopted :-

(a) the Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any commitments or made any advances on account of or with a view to the execution of the works or the performance of the contract and Contractor shall not be entitled to recover or be paid any sum for any work there to for actually performed under the contract unless and until the Engineer shall have certified the performance of such work and the value payable in respect thereof and the Contractor shall only be entitled to be paid the value so certified.

(b) the Engineer or the Engineer's Representative shall be entitled to take possession of any materials, tools, implements, machinery and buildings on the works or on the property on which these are being or ought to have been executed, and to retain and employ the same in the further execution of the works or any part thereof until the completion of the works without the Contractor being entitled to any compensation for the use and employment thereof or for wear and tear or destruction thereof.

(c) the Engineer shall as soon as may be practicable after removal of the Contractor fix and determined ex-parte or by or after reference to the parties or after such investigation or enquiries as he may consider fit to make or institute and shall certify what amount (if any) had at the time of rescission of the contract been reasonably earned by or would reasonably accrue to the contractor in respect of the work then actually done by him under the contract and what was the value of any unused, or partially used materials, any constructional plant and any temporary works upon the site.

(d) the Railway shall not be liable to pay to the Contractor any moneys on account of the contract until the expiration of the period of maintenance and thereafter until the costs of completion and maintenance, damages for delay in completion (if any) and all other expenses incurred by the railway have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum or sums

(if any) as the Engineer may certify would have been due to him upon due completion by him after deducting the said amount, but if such amount shall exceed the sum which would have been payable to the Contractor, then the Contractor shall upon demand pay to the Railway the amount of such excess and it shall be deemed a debt due by the Contractor to the Railway and shall be recoverable accordingly.

SETTLEMENT OF DISPUTES.

63. **Matters finally determined by the Railway.** — All disputes and differences of any kind whatsoever arising out of or in connection with the contract, whether during the progress of the work or after its completion and whether before or after the determination of the contract shall be referred by the contractor to the ~~Railway~~ GM and the ~~Railway~~ GM shall within 120 days after receipt of the Contractor's representation make and notify decisions on all matters referred to by the contractor in writing provided that matters for which provision has been made in clauses 8, 18, 22(5), 39, 43(2), 45(a), 55, 55-A(5), 57, 57A, 61(1), 61(2) and 62(1) to (xii) (B) of General Conditions of Contract or in any clause of the special conditions of the contract shall be deemed as 'excepted matters' and decisions of the Railway authority, thereon shall be final and binding on the contractor provided further that 'excepted matters' shall stand specifically excluded from the purview of the arbitration clause and not be referred to arbitration.

64(1) (i) **Demand for Arbitration.** —

In the event of any dispute or difference between the parties hereto as to the construction or operation of this contract, or the respective rights and liabilities of the parties on any matter in question, dispute or difference on any account or as to the withholding by the Railway of any certificate to which the contractor may claim to be entitled to, or if the Railway fails to make a decision within 120 days, then and in any such case, but except in any of the 'excepted matters' referred to in clause 63 of these conditions, the contractor, after 120 days but within 180 days of his presenting his final claim on disputed matters, shall demand in writing that the dispute or difference be referred to arbitration.

(ii) The demand for arbitration shall specify the matters which are in question or subject of the dispute or difference as also the amount of claim itemwise. Only such dispute(s) or difference (s) in respect of which the demand has been made, together with counter claims or set off shall be referred to arbitration and other matters shall not be included in the reference.

(a) The Arbitration proceedings shall be assumed to have commenced from the day, a written and valid demand for arbitration is received by the Railway.

(b) The claimant shall submit his claim stating the facts supporting the claims alongwith all relevant documents and the relief or remedy sought against each claim within a period of 30 days from the date of appointment of the Arbitral Tribunal.

(c) The Railway shall submit its defence statement and counter claim(s), if any, within a period of 60 days of receipt of copy of claims from Tribunal thereafter, unless otherwise extension has been granted by Tribunal.

(iii) No new claim shall be added during proceedings by either party. However, a party may amend or supplement the original claim or defence thereof during the course of arbitration proceedings subject to acceptance by Tribunal having due regard to the delay in making it.

(iv) If the contractor(s) does/do not prefer his/their specific and final claims in writing, within a period of 90 days of receiving the intimation from the Railways that the final bill is ready for payment, he/they will be deemed to have waived his/their claim(s) and the Railway shall be discharged and released of all liabilities under the contract in respect of these claims.

64. (2) **Obligation during pendency of arbitration.** — Work under the contract shall, unless otherwise directed by the Engineer, continue during the arbitration proceedings, and no payment due or payable by the Railway shall be withheld on account of such proceedings, provided, however, it shall be open for Arbitral Tribunal to consider and decide whether or not such work should continue during arbitration proceedings.

64. (3) (a) (i) In cases where the total value of all claims in question added together does not exceed Rs. 10,00,000/- (Rupees ten lakhs only), the Arbitral Tribunal shall consist of a sole arbitrator who shall be either the General Manager or a gazetted officer of Railway not below the grade of JA grade nominated by the General Manager in that behalf. The sole arbitrator shall be appointed within 60 days from the day when a written and valid demand for arbitration is received by Railway.

(ii) In cases not covered by clause 64(3)(a)(i), the Arbitral Tribunal shall consist of a pannel of three Gazetted Rly. officers not below JA grade, as the arbitrators. For this purpose, the Railway will send a panel of more than 3 names of Gazetted Rly. Officers of one or more departments, of the Rly. to the contractor who will be asked to suggest to General Manager upto 2 names out of the panel for appointment as contractor's nominee. The General Manager shall appoint at least one out of them as the contractor's nominee and will, also simultaneously appoint the balance number of arbitrators either from the panel or from outside the panel, duly indicating the 'presiding arbitrator' from amongst the 3 arbitrators so appointed. While nominating the arbitrators it will be necessary to ensure that one of them is from the Accounts department. An officer of Selection Grade of the Accounts department shall be considered of equal status to the officers in SA grade of other departments of the Railways for the purpose of appointment of arbitrators.

(iii) If one or more of the arbitrators appointed as above refuses to act as arbitrator, withdraws from his office as arbitrator, or vacates his/their office/offices or is/are unable or unwilling to perform his functions as arbitrator for any reason whatsoever or dies or in the opinion of the General Manager fails to act without undue delay, the General Manager shall appoint new arbitrator/ arbitrators to act in his/ their place in the same manner in which the earlier arbitrator/arbitrators had been appointed. Such re-constituted Tribunal may, at its discretion, proceed with the reference from the stage at which it was left by the previous arbitrator(s).

(iv) The arbitral Tribunal shall have power to call for such evidence by way of affidavits or otherwise as the Arbitral Tribunal shall think proper, and it shall be the duty of the parties hereto to do or cause to be done all such things as may be necessary to enable the Arbitral Tribunal to make the award without any delay.

(v) While appointing arbitrator(s) under sub-clause(i), (ii) and (iii) above, due care shall be taken that he/they is/are not the one/those who had an opportunity to deal with the matters to which the contract relates or who in the course of his/their duties as Railway servant(s) expressed views on all or any of the matters under dispute or differences. The proceedings of the Arbitral Tribunal or the award made by such Tribunal will, however, not be invalid merely for the reason that one or more arbitrator had, in the course of his service, opportunity to deal with the matters to which the contract

relates or who in the course of his/their duties expressed views on all or any of the matters under dispute.

64. (3) (b) (i) The arbitral award shall state intemwise, the sum and reasons upon which it is based. c/f - - - - -

(ii) A party may apply for corrections of any computational errors, any typographical or clerical errors or any other error of similar nature occuring in the award and interpretation of a specific point of award to tribunal within 30 days of receipt of the award.

(iii) A party may apply to tribunal within ~~30~~ 60 days of receipt of award to make an additional award as to claims presented in the arbitral proceedings but omitted from the arbitral award.

64.4 In case of the Tribunal, comprising of three Members, any ruling or award shall be made by a majority of Members of Tribunal. In the absence of such a majority, the views of the Presiding Arbitrator shall prevail.

64.5 Where the arbitral award is for the payment of money, no interest shall be payable on whole or any part of the money for any period till the date on which the award is made.

64.6 The cost of arbitration shall be borne by the respective parties. The cost shall inter-alia include fee of the arbitrator(s) as per the rates fixed by the Rly. Administration from time to time.

Act

See a s/a

64.7 Subject to the provisions of the aforesaid Arbitration and Conciliation Act 1996 and the rules there under and any statutory modification thereof shall apply to the arbitration proceedings under this clause.

Annexure I

REGISTERED ACKNOWLEDGEMENT DUE

Dated.....

.....

.....

.....

Sub. (i) ..... (name of work)

(ii) Acceptance letter No. .....

(iii) Understanding/Agreement No. .....

.....

Ref.- ..... (Quote specific application of Contractor for extension to the date if received) .....

Dear Sir,

The stipulated date for completion of the work mentioned above is ..... From the progress made so far and the present rate of progress, it is unlikely that the work will be completed by the above date (or However, the work was not completed on this date).

2. Expecting that you may be able to complete the work, if some more time is given, the competent authority, although not bound to do so, hereby extends the time for completion from ..... to .....

3. Please note that an amount equal to the liquidated damages for delay in the completion of the work after the expiry of ..... (give here the stipulated date for completion with/without any penalty fixed earlier) will be recovered from you as mentioned in clause 17-B of the General Conditions of Contract for the extended period, notwith-standing the grant of this extension. You may proceed with the work accordingly.

4. The above extension of the completion date will also be subject to the further condition that no increase in rates on any account will be payable to you.

5. Please intimate within a week of the receipt of this letter your acceptance of the extension of the conditions stated above.

6. Please note that in the event of your declining to accept the extension on the above said conditions or in the event of your failure after accepting or acting upto this extension to complete the work by ..... (here mention the extended date) further action will be taken in term of clause 62 of the General Conditions of Contract.

Yours faithfully,

For and on behalf of the
President of India

Annexure II

CERTIFICATE OF FITNESS

1. (a) Serial Number .....

   (b) Date .....

2. Name of person examined .....
   .....

3. Father's name .....

4. Sex .....

5. Residence .....

6. Date of birth if, available, and/or certified age .....

7. Physical fitness .....

8. Identification mark .....
   .....

9. Reasons for :—

   (a) refusal to grant certificate, or (b) revoking the certificate .....

.....
Signature or left hand thumb impression of the person examined

.....
Initials of Certifying Surgeon

Serial Number .....

Date .....

I certify that I have personally examined (name) .....

son/daughter of .....
residing at .....

Who is desirous of being employed in a factory or on a work requiring manual labour and that his/her age as nearly as can be ascertained from my examination, is ..... years and that he/she is fit for employment in a factory or on a work requiring manual labour as an adult/child.

His/her identification marks are .....
.....

.....
Signature or left hand thumb impression of the person examined

.....
Signature of Certifying Surgeon

Note. — In case of physical disability, the exact details of the cause of the physical disability should be clearly stated.

Annexure III

REGISTERED POST A.D.

South Eastern Railway

To

M/s .....

.....

.....

Dear Sir,

Contract Agreement No. .....
In connection with .....

Inspite of repeated instructions to you by the subordinate offices as well as by this office in various letters of even No..... dated ..... you have failed to start work/show adequate progress and/or submit detailed programme for completing the work.

2. Your attention is invited to this office/Chief Engineer's office letter No..... dated ..... in reference to your representation dated.....

3. As you have failed to abide by the instructions issued to commence the work/to show adequate progress of work, you are hereby given 7 days notice in accordance with clause 62/ General Conditions of Contract to commence works/to make good the progress, failing which further action as provided in clause 62 of the General Conditions of Contract viz. to terminate your Contract and complete the work at your risk and cost will be taken.

Kindly acknowledge receipt.

Yours faithfully,

for and on behalf of President of India.

Annexure IV

REGISTERED POST A.D.

South Eastern Railway
(Without Prejudice)

To

M/s .....

.....

.....

Contract Agreement No. .....
In connection with .....

Dear Sir,

Seven days notice under clause 62 of General Conditions of Contract was given to you under this office letter of even Number dated ..... but you have taken no action to commence the work/show adequate progress of the work.

(2) You are hereby given 48 hours notice in terms of clause 62 of General Conditions of Contract and on expiry of this period your above contract will stand rescinded and the work under this contract will be carried out at your risk and cost and consequences which may please be noted.

Kindly acknowledge receipt

Yours faithfully,

for and on behalf of President of India.

भाग – IV
PART – IV

मानक विनिर्देश
Standard Specifications

PART — IV

CHAPTER I

SPECIFICATION FOR MATERIALS

SPECIFICATION NO. 1

BROKEN BRICK AGGREGATE

101. Brick aggregate shall be used for mass concreting, roof terracing, and also for filtration or any other purpose as directed. This must not be used as track ballast, aggregate for permanent road surfacing or reinforced concrete. The sizes for the different kinds of work shall conform to the Specification No. 6

102. The broken brick aggregate shall be free from dust, clay, loam or organic matter, and shall if so directed by the Engineer, be washed and screened at contractor's cost.

103. The aggregate shall be broken only from 1st class or selected 2nd class brick bats or good quality jhama bats.

SPECIFICATION NO. 2

SURKHI

104. The Surkhi shall be made from properly burnt or slightly burnt (but never from jhama) brick bats, prepared from clay of approved quality.

105. The material shall be ground to dust and should not give a residue exceeding 10% by weight when sieved through I.S. Sieve Designation, 200mm.-IS : 460-1985. Care shall be taken to see that surkhi is kept dry after manufacture.

SPECIFICATION NO. 3

BROKEN STONE OR MANUFACTURED AGGREGATE

106. Broken stone or manufactured aggregate shall consist of uncoated, hard, strong, dense and durable pieces and shall be free from injurious amounts of soft flaky particles, salt, alkali and vegetable matter and other deleterious substances. Clinkers, ashes, slag and aggregate of porous nature should not be used.

107. Deleterious substances in broken stone or manufactured aggregate should not exceed the following limits:

(a)	Very fine particles.	2%
(b)	Total of soft, friable, thin, elongated or laminated pieces	3%
(c)	Sum of the percentage of all other deleterious substances	5%

108. The sizes shall conform to the Specification No. 6 for respective works.

109. The aggregate shall, if so directed by the Engineer, be screened and/or washed. The cost of screening and /or washing will be borne by the Contractor.

SPECIFICATION NO. 4

GRAVEL

110. This shall consist of uncoated, hard, strong, dense and durable pieces and shall be free from injurious amounts of disintegrated stones, soft, flaky or elongated particles, salt, alkali, vegetable matter and other deleterious substances.

111. Deleterious substances should not exceed the following limits :—

(a)	Very fine particles	3%
(b)	Soft fragments	3%
(c)	Sum of the percentage of all other deleterious substances	5%

112. The sizes shall conform to the Specification No. 6 for respective works.

113. Gravel must be washed before use in any work. The cost of washing is included in the item.

SPECIFICATION NO. 5

NATURAL OR MANUFACTURED AGGREGATE FOR REINFORCED CONCRETE WORK

114. This should conform to Specification No. 3 & 4 in all respects except that there must not be any deleterious substances present in the aggregate.

115. Before use in the Reinforced concrete work, the aggregate must be thoroughly washed to free it from all deleterious substances. The cost of washing is included in the rate for reinforced concrete works.

SPECIFICATION NO. 6

SIZES OR GAUGE OF NATURAL OR MANUFACTURED AGGREGATE FOR DIFFERENT WORKS

116. **For track ballast.** — See Chapter XIII for this.

117. **Aggregate For mass concreting :—** All to pass through a squaremesh having openings of 40 mm. side in both directions and should be well graded in addition.

118. AGGREGATE FOR ROAD WORKS :— For water bound maccadam the aggregate should be hard stone ballast of 50mm. Alternatively gravel 50mm. size as well as 60mm. size jhama ballast could also be used for light traffic roads.

The hard stone ballast or gravel of 50mm. should pass 100% if sieved through a screen of square holes with 60mm. size and not more than 10% should pass through 20mm. square sieve. For Jhama ballast not more than 10% would get retained on 60mm. square sieve and more than 10% would pass through a 40mm. square sieve.

The following size of coarse aggregate (hard stone chips) should be used for the Road work specified :-

(i) Surface dressing 1st coat : ... ... 12mm.
90% to 100% Stone chips should pass through 12 mm. Sq. mesh and 100% shall pass through 20mm. Sq. mesh and not more than 10% should pass through 6 mm. mesh.

(ii) Surface dressing, 2nd coat : for Renewal coat, Seal coat, light chipping carpet. ... ... 10mm.
90% tc 100% Stone Chips should pass through 10mm. Sq. mesh and 100% should pass through 12mm. Sq. mesh and not more than 10% should pass through 6mm. mesh.

(iii) Pot hole repairs : ... ... 10 mm.
Specification as given for track ballast is applicable.

119. **Aggregate for Reinforced concrete works.**— This should be well graded and limited between the following sizes :-

(a) Stone aggregate shall pass through 90% to 100% on 20mm. square mesh and all stones must pass through a square mesh of 25 mm. size.

(b) Not more than 10% to pass through a square mesh of 6mm. size.

120. **Aggregate for plain Cement Concrete flooring works :—** This should be limited between the following sizes.

(i) All chips must pass through 90% to 100% on 20mm. sqare mesh and 100% should pass through a square mesh of 25mm. size.

(ii) Not more than 10% to pass through a square mesh of 6mm. size.

121. Deleted.

SPECIFICATION NO. 7

SAND

122. If sand brought to site is dirty, it must be washed clean in water. Sea Sand or sand containing saline impurities shall on no account be used.

123. For Concrete Works coarse grained sand should be used.

124. For mortar in plastering, Brick work and stone masonry, finer grained sand of approved quality should be used.

125. For Second coat of plastering or Neeru finish, sand used should be very fine.

SPECIFICATION NO. 8

(a) LIME

126. The two general classes of lime are— (a) Fat Lime and (b) Hydraulic Lime.

(a) *Fat Lime*— The lime which has high calcium oxide content and is dependent for setting and hardening solely on the absorption of carbon dioxide from the atmosphere.

(b) *Hydraulic Lime*— Lime containing small quantities of silica and alumina and/or Iron oxide which are in chemical combination with some of the calcium oxide content, giving a putty or mortar which has the property of setting and hardening under water.

127. Shell lime comes under class (a) and is generally used for plaster and whitewash. Lime from Kanker and Lime-stone come under Class (b) and are generally used for masonry work.

128. Works which are likely to be exposed to the action of water within a month from the date of completion should be constructed with cement mortar or surkhi mortar if the lime is sufficiently hydraulic.

129. **Visual observation.**— Fat lime can be distinguished by its pure white colour. Lumpy form may indicate quicklime or unburnt limestone, but the former may be differentiated by its porous structure. To be more sure the following simple test may be carried out to determine the quality of the lime.

130. **Hydrochloric acid test.**—This test should be used to determine whether the carbonate content in the lime is excessive and to roughly determine the class of lime. The necessity for the test should not occur if the lime has been tested for quality by standard laboratory tests before acceptance of the supply.

131. **Procedure.**— Place a teaspoonful of powdered lime (levelled flat to the rim of the spoon) in a test tube and gently tap for a period of about two minutes, so that the sample presents a neat surface on the top. With a glass marking pencil, make a mark on the test tube to indicate the volume of the sample. Into this test tube, add about of 50 percent hydrochloric acid by volume, preferably along a glass rod placed in the test tube so that the acid does not get smeared all over the side of the tube. The contents, after stirring with a glass rod, should not leave much inert material at the bottom of the test tube. The quantity of acid may be increased, if necessary, to ensure that none of the inert material is in the form of calcium carbonate; and the contents shall be well shaken to ensure that all effervescence ceases. The test tube with its contents shall then be kept standing in a test tube stand for about 24 hours.

132. **Observation.**— If the effervescence indicating the liberation of carbon dioxide is abundant, it may be inferred that the lime has not been burnt adequately and/or stored proper.

133. The volume of insoluble residue at the bottom of the test tube compared with the original volume of lime will indicate the proportion of inert material and give an idea if it is excessive or not.

134. In the case of hydraulic lime, a good thick gel will be formed, and below it inert material will be deposited. If, the gel is so thick that it will not flow even when the test tube is turned upside down, the inference may be that the lime is eminently hydraulic. If the gel formed is not quite thick and tends to flow on being tilted, the lime is feebly hydraulic. If there is no gel formation, the lime is non-hydraulic or fat.

135. (a) **Slaking of lime.**—Lime shall be slaked with great attention to ensure soundness. Improperly slaked or unsound particles of lime will continue to hydrate after the lime is used in construction, and by their expansion causing a subsequent failure of mortar, plaster or white-washing.

(b) In the case of stone lime it should be thoroughly slaked by spreading it on a dry brick platform to a depth of not more than 15 cm. and watering it through rose nozzle. If the lime is stacked deeper than 15 cm. it may not be thoroughly slaked and may cause the masonry to bulge or crack by slaking in the work. It should be allowed to slake for at least 12 hours before use. Lime is thoroughly slaked when any further addition of water to a representative sample produces no further chemical action or heat. After slaking, the lime should be screened through a screen of 5 meshes per lenlar c.m.

(c) Stone lime that is more than 10 days old after slaking should not be used for works and should be rejected.

(d) If kankar lime is used in any place, it should first be ground dry in an ordinary chakki and then screened through 16 B W G wire mesh containing 22 meshes per square cm, as in case of stone lime. It should not be ground in a steam mill as the stone being easily crushed, under-burnt lime might find its way into the work.

136. The slaking nature of lime may be found as follows.— (a) In a bucket, put two or three lumps of lime about the size of man's fist, or an equivalent amount in the case of granular lime. Add sufficient water to barely cover the lime, and note how long it takes for slaking to begin. Slaking has begun when pieces split off from the lumps or when the lumps crumble. Water used for test should be at the same temperature as the water used in field practice.

(b) If slaking begins in less than 5 min. the lime is quick-slaking it from 5 to 30 minutes it is medium slaking if over 30 minutes it is slow slaking.

137. STORAGE OF LIME :

(a) **Quicklime.**— Quicklime deteriorates rapidly on exposure by taking up moisture and carbon dioxide from atmosphere. It shall be slaked as soon as possible before deterioration sets in. If unavoidable it may be stored in compact heaps having only the minimum of exposed area. They shall be covered to avoid direct contact with rain or being blown away by wind.

Quicklime reacts violently with water liberating an enormous amount of heat. Hence suitable precautions agaist fire hazard shall be taken when storing quicklime. Quicklime shall not be allowed to come in contact with water during storage, handling or transit.

(b) **Hydrated Lime.**— Hydrated lime obtained in air-tight moisture-proof packages may be stored for a long period, not exceeding a year however, without appreciable deterioration of quality. Hydrated lime received in bulk or in packages that are not air-tight or moisture-proof shall be stored in a dry shed away from air draughts and out of contaot with damp surface.

(b) COAL ASH

138. The coal ash shall be hard, coarse cinder ground into powder in Ghani or Chakki so as to pass through IS Sieve No. Designation 2.36 mm. — IS 460-1985. It shall be free from mud, dirt or other foreign matter.

139. The sulphur content of the coal ash should not exceed 1% and the loss on ignition should not be more than 25%. Normally, ashes from Bengal—Bihar coal which have been washed by the rains of at least one monsoon season, satisfy the above conditions.

SPECIFICATION NO. 9

BRICKS

140. Bricks will be classified as follows:-

(a) **First Class.**— To be made of properly tempered clay, free from salt, vegetable matter, gravel and kankar admixtures; to be hard, sound thoroughly burnt, but not overburnt, even and uniform in shape and colour, free from cracks, flaws and other defects; to be of the correct sizes and shape specified, with well defined clear cut edges and with arises square and out of winding. They shall have a fine compact and uniform texture. They should emit a clear ring when struck and be equal in quality to the samples approved by the Engineer concerned. Water-absorption shall not be more than 20% of its dry weight in 24hours vide IS 1077-1985.

(b) **Second Class.**— These will be similar to first class bricks as regards their size and soundness, but their colour need not be uniform throughout nor their shapes so true and well defined as for first class. They should not however show any signs of being under burnt or liable to be should be free from cracks and disfigurements which would preclude their use in face work of subsidiary buildings. Water absorption should not be more than 22% of its dry weight in 24hours vide IS. 1077-1985.

(c) **Locally available Bricks.**— In the areas where the 1st or 2nd class bricks can not be manufactured to conform to the requisite specification, the best quality of the locally available bricks may be accepted as per samples that should be approved at the time of acceptance of tenders. The

brick is to be well shaped but may be slightly under-burnt or over burnt. Water absorption in 24 hours should not be more than 25% of its dry weight vide IS. 1077-1985 the defects in uniformity or shape shall not be such as to become difficult to obtain uniform courses.

i) Bats :— Shall be only from first and second class bricks.

ii) 1 Cu.m. of bats will be considered equal to 383 bricks for 24.6 cm. x 12.1 cm. x 7.0 cm. bricks; 529 for 19 cm. x 9 cm. x 9cm. bricks; 325 for 25.4 cm. x 12.7 cm. x 7.6 cm. bricks, 325 for 25.4 cm. x 12.4 cm. x 7.3 cm. bricks and 402 for 22.9 cm. x 11.4 cm. x 7.6 cm. bricks.

iii) Jhama :— A Jhama brick is a brick so over-burnt as to be useless for exact work.

141. All bricks taken out of the kiln shall be systematically stored according to class, in stacks of two bricks thick containing two thousand bricks each. No stack to contain more than 3% of the lower class and no stack to contain more than 2 classes of bricks. Contractor has to restack at his own expense if a stack contains more than 3% of the lower class bricks. Sufficient space (not less than 1 metre in width) must be left all round each stack to enable all bricks to be easily seen and examined.

142. For dimensions of bricks testing may be conducted as follows :—

(a) Twenty whole bricks shall be selected at random from stacks. All efflorescence, loose particles of clay and small projections shall be removed. They shall then be arranged upon a level surface successively in contact with each other and in a straight line. The overall length of the assembled bricks shall be measured with a steel tape or other suitable inextensible measure sufficiently long to measure the whole row at one stretch. Measurement by repeated application of a short rule or measure shall not be permitted. If for any reason it is found impracticable to measure 20 bricks in one row the sample may be divided into two rows of 10 bricks which shall be measured separately to the nearest millimetre. All these dimensions shall be added together.

(b) Bricks required for carrying out the tests :- A sample of 50 bricks shall be taken from every consignment of 50,000 bricks or part thereof. (IS.1077-1985 Paras 4.2.1.& 6.1).

143. Brick-bats shall be stacked in rectangular heaps accordingly as they are well burnt or under-burnt. The stacks should not be less than one metre in height.

144. No bricks shall be removed from the brickfield without the previous permission of the Engineer, if bricks are made in the Railway land.

145. (a) If bricks are made in Railway land with Railway's soil "royalty" has to be paid by the Contractor to the Railway at the rate of Rs. 5/- per 1000 Nos. of bricks or the amount arrived based on the quantity of earth required for manufacture of 1000 Nos. of bricks multiplied at the rate of Royalty fixed by the concerned State Government for 28.316 cu.m. of earth, whichever is higher. Moreover, subject to variation from time to time, the land rent for manufacturing bricks on Railway land at the rate of Rs. 0.50 per 1000 Nos. will be charged.

(b) Subject to revision, the sale of the bricks of any kind as well as bats may be allowed only under the written permission of the Engineer specifying the quantities to be sold.

(c) Rain spotted bricks, if they are otherwise good as 1st. Class bricks, may be accepted as 2nd Class.

146. The following general guide-lines are indicated in respect of use of first and second class bricks :-

i) Bricks, if found necessary to be used in the construction of bridges, shall be invariably first class.

ii) For all other works, only second class bricks shall be used. Where second class bricks conforming to Railway's specifications are not available, the best quality of locally available bricks may be accepted as per samples that are specifically approved at the time of acceptance of tender.

147. (a) The number of bricks allowed for walls greater than one full brick thickness (more than 25 cm thick) and as well as for walls upto one full brick thickness (upto 25 cm) for 1 Cu.m. of masonry are given as under :—

Size of bricks	No. of bricks for 1 Cu.m. of masonry	
	Walls greater 25 cm.	Walls upto 25 cm.
25.4 cm. x 12.7 cm. x 7.6 cm.	322	335
25.4 cm. x 12.4 cm. x 7.3 cm.	345	360
24.8 cm. x 12.1 cm. x 7.0 cm.	380	388
22.9 cm. x 11.4 cm. x 7.6 cm.	398	415
19 cm. x 9 cm. x 9 cm.	512	530

147. (b) For each 2.83 Cu.m. of finished brick work, the cost of 0.1416 Cu.m. of brick bats at the rate provided in section 'U' vide item No. 6 of the Schedule of Labour and Material Rates plus the percentage, if any, allowed to the Contractor over or below the Schedule, is to be recovered from the Contractor and the brick bats so obtained from the work are Contractor's bats and should be cleared from the site immediately on completion of work by the Contractor without any extra cost, irrespective whether the bricks are supplied by the Railway or by the Contractor.

SPECIFICATION NO. 10

CEMENT MORTAR

148. The mortal shall consist of cement of approved manufacture and sand of respective standard specification mixed in the proportion as may be defined in the relevant schedule items of work.

149. The cement and sand shall first be mixed dry by spreading on a suitable platform in alternate layers in their correct proportions where hand mixing is adopted. In mechanical mixing, the dry mix in correct proportion should be done inside the batch mixer.

150. Water is to be added to the mixture, only when the mortar is required for use, and then only in quantity essential to make the mortar easily workable with a trowel. The water used must be clean and free from vegetable matter. For use with Cement, if not clean to the eye, must be clarified preferably through rough sand filters. Vegetable matter in water kills cement.

151. All cement mortar must be used up within half an hour from the time of mixing with water.

SEPFIFICATION NO. 11

LIME MORTAR

152. The mortar shall consist of slaked lime and sand or surkhi, each complying with its respective standard specification & mixed in the proportion noted below for the concrete work.

Items of work	Lime	Sand or Surkhi
Mortar for concrete	1	3

153. Mortar of lime, sand and surkhi (Sand and Surkhi being in equal proportion) may also be used at the discretion of the Engineer.

154. Lime and sand are to be thoroughly mixed dry, on an approved platform of masonry, or stone, then sprinkled with the necessary quantity of water and ground in a mortar mill of approved design. The sand and lime are to be mixed only in sufficient quantities for a day's requirements. The mortar is to be ground for not less than 30 revolutions of the mill for concrete work. The mortar must be raked up continuously during the process particularly in the angles of the mill. Water may be added, as required during grinding, care being taken not to add more water than what will bring the mixed materials to the consistency of a stiff paste. The sides of the mill must be maintained in good order.

SPECIFICATION NO. 12

LIME CONCRETE

155. Aggregate for concrete shall be of good hard stone broken for mass concrete conforming to size 40 mm. as specified in Chapter XIII.

156. Clean gravel aggregate evenly graded for these size can also be used. Where good stone or gravel is not available 1st class jhama broken to the above size may be used.

157. For mass work the aggregate presoaked in water will be spread out on a prepared floor to an even depth of 15 Cm. and covered with an even layer of dry mixed lime mortar to a depth of 7.5 cm. making 22.5 Cm. in all. This then must be twice dry mixed till the dry mortar adheres to any wet stone then wet mixed by a suitable addition of water through a rose watering can into a stiff slurry.

158. The concrete so made shall be deposited in situ (and not thrown) in 15 Cm. layer and rammed with one rammer to every three carries. Each layer so laid shall be lightly picked over with a steel pick before adding the next layer.

159. Excess water will be judged if the concrete becomes jelly like under the rammer. Insufficient water or ramming may be judged if a hole 2/3 the depth laid excavated in the concrete and filled with water fail to retain the water overnight or for three hours under a strong sun.

160. No concrete shall be deposited in a work till an Engineer has passed the work as ready for the concrete and passed the order in the field book. No second or subsequent layer shall be deposited till the Subordinate-In-Charge has passed the previous layer in the field book. No masonry shall be built on concrete till an Engineer has passed the order, after testing the concrete, in the field book.

161. All concrete shall be kept continuously wet for 7 days and watered for another 7 days, after laying.

SPECIFICATION NO. 13

TURFING

162. (a) The sods used will be cut in rectangular shape not less than 10 cm. thick and 25 cm. square and laid so that their edges are in close contact and then joined by being gently rammed till they form a level and compact mat. The contractor will be responsible for watering where necessary to ensure that the turf grows properly. In the event of unsatisfactory growth of the turf at any place the contractor will be liable to returf the same at his own expense.

(b) Before turfing is commenced side slopes are to be dressed to the specified section..

163. Turfing or planting shall be finished by the beginning of rainy season but should not be taken over from the contractor unless it has formed a complete close grassy growth over the earth. No area which does not show a good healthy growth shall be paid for.

SPECIFICATION NO. 14

EXCAVATING FOUNDATIONS

164. The contractor should at his own expense demarcate the layout of the foundation expeditiously and in a workman-like manner, the layout will be given by the Engineer or his representative. All reference pillars and pegs shall be maintained by the Contractor. In case of any damage the contractor should immediately replace the same. The contractor should supply the necessary quantity of pegs, bamboos, strings, nails and labour the cost of which is included in the rates.

165. No excavated material shall be kept within a distance equal to the depth of the foundation from the outer edges of the excavation. The distance is to be increased according to soil conditions as directed by the Engineer and as shown in sketch No. 1 of Annexure 1.

166. The bottom of the foundation pits shall be dressed level in all directions and before any concrete is put in, the same shall be well watered and thoroughly rammed. The foundation trenches shall be dug out to the exact width of the lowest step of the footings and the depth shall be in accordance with the plans, or as may be otherwise ordered by the Engineer. The sides shall be left plumb and payment shall be made on the quantity as derived from the plan area of foundation and the depth. If the nature of the soil does not permit vertical side, with the express permission of the Engineer in writing, shoring may be used (either open or closed) as shown in sketch No. 2 of Annexure 1.

The respective rates are provided in the schedule. Where different foundation levels are necessary, the trenches shall be taken in horizontal terraces, dug out square. If, by the contractor's mistake the excavation is made deeper or wider than shown on the plans, the extra width or depth shall be made up with lean concrete 1:5:10 and not with earth or other materials, at the cost of the Contractor including cost of cement issued by the Railway.

167. Should rocks, or remains of old buildings, be met with, the material shall be removed with wedges and levers. Blasting will not be allowed without the permission of the Engineer in writing. Where the Engineer considers Blasting as essential the respective rates as admissible in the schedule will apply.

168. Before concrete is laid in the trenches, the foundation i.e. the excavated trenches shall be passed by the Engineer or his authorised representative.

169. The contract rate for excavation of foundations include all incidental charges such as levelling and dressing, filling the side trenches, ramming and watering complete as specified in the schedule of rates. Where there are any departures from this inclusive method of payment, the conditions will be defined in the tender notice and proposals sanctioned by the competent authority before any charges apart from the unit rate for excavation are incurred.

SHORING FOR FOUNDATION

170. (a) The shoring shall consist of struts made into vertical frames and walling pieces, which vary in dimensions according to the size of the foundation. These shall hold the laggings in position against the sides of the excavation and be further secured by wedges driven firmly down between the frame and the laggings. The frames must be secured together with wrought iron dogs, and in the case of deep foundations be supported by verticals uprights dogged to the frame; long trenches must be cross strutted at close intervals.

(b) The excavation should proceed as follows:-

(i) When the sides of the excavation show signs of caving in, the first frame must be put in and the first short laggings, which must be long enough to stand about 1.2m. out of the ground. The wedges must then be driven in and the excavation proceeded with. As the excavation proceeds, two men on the top and two men below shall drive down each lagging separately after drawing the wedge. When each lagging has been driven down as far as it will go, the wedge must be replaced and the next lagging driven down in the same way, and so on.

(ii) If the soil is dug away from under each lagging, the latter will drop down in most cases without the aid of a mallet.

(iii) The lagging must be kept plumb, otherwise there will be difficulty in getting the next frame in. It will be found simplest to put the lower frames in pieces, and simply secure them in position with double timber dogs.

(iv) When the excavation has reached the full length of the laggings, they should be drawn out cautiously one by one, and longer ones put in or a fresh row driven inside the others.

(v) The excavation may then go down to the depth required, the frames being put in at least every 1.5m. vertically. When the concrete for masonry work is in progress, the operation should be reversed, the laggings being prized up one by one and the frames withdrawn as the masonry is raised up.

(vi) Any cheap wood may be used for lagging, cut in 15 cm. or 17.5 cm. planks, 38 mm. to 50 mm. thick. The frames should be of sound wood that will not warp.

(vii) Easy working depends entirely upon the care that is taken in getting the laggings truly plumb and touching each other.

SPECIFICATION NO. 15

FILLING IN FOUNDATION

171. All foundations shall be refilled (in approved layers) to the original surface of the ground with approved materials, well watered and rammed.

172. The contractor shall not refill in and around any work, until it has been approved by the Engineer or his authorised representative. In case where the excavated foundation soil is to be used for refilling, it shall be brought back from the place, where it was temporarily deposited, and the trenches or other excavations shall be filled up to the height of the original surface of the earth, carefully rammed in regular layers of not more than 15 cm. in thickness, and consolidated by the addition of water to each layer, according to the directions of the authorised representative of the Engineer.

173. (a) The cost of refilling in foundation of bridges, buildings & other structures with ramming, watering, etc. is included in the rate of Excavating Foundations upto ground level as shown in sketch No. 3 of Annexure II and vide item Nos. 5 & 6 of Section 'A' of Schedule of Labour and Material Rates 1992. The disposal of the surplus earth if any, will be at the discretion of the Engineer, unless otherwise Specified.

(b) Extra is to be paid, if watering & ramming of Earthwork filled in foundation of banks is done vide item No. 8 of Section 'A' of Schedule of Labour and Material Rates 1992.

SPECIFICATION NO. 16

DRAINAGE

174. Open drains are to be provided for surface drainage.

175. (a) **Drainage in residential areas.** — The anticipated discharge is to be assessed by the Engineer and appropriate size is to be chosen from the type drawings, as shown in the sketches No. 4 to 17 of Annexure II to VII and the chart at annexure VIII.

(b) The chart indicates the volume of discharge for various sizes of drains. Accordingly any size of drains may be chosen from the accompanying drawings. The slope of the brick-walls as well as the longitudinal slope may be altered to suit the requirements at site. The rates provided in the schedule are for finished drains per metre length inclusive of all such alterations.

CHAPTER- II

EARTH WORK

GENERAL

INITIAL CROSS SECTIONS ALONG THE ALIGNMENT

201. Before commencement of the earthwork initial cross-sections should be taken along the proposed alignment and the same should be signed by the Engineer as well as the Contractor. During the course of work if any changes are required to be made in these cross- sections due to change of gradient, bridge openings etc. the same should be shown alongside the original cross-section and also signed by the Engineer as well as the Contractor.

202(a) *Site Clearance* :— Before work is started the whole area between the toes of banks or tops of cuttings shall be properly and effectively cleared by the Contractor of all small tress, roots, heavy grass and all obstructions, and work of this nature is covered by the initial rate for earthwork, unless stated to the contrary in the agreement. The initial rate included clearance of all type of jungle except tress having a girth above 30 cm. measured at 1 meter above ground level.

(b) The cutting down, uprooting and removal of large trees above 30 cm. in girth at 1 metre above ground level will be paid for separately. The Contractor will have no right to the trees or other materials which he will stack on one side as instructed by the Engineer and the Railway will dispose of the timber or other materials at their discretion. Stacking of the felled timber is included in the rate.

203(a) *Demarcation and profiles* :—The Contractor, before starting work, shall demarcate with a good deep furrow, at least 15 centimetres deep the toes of slopes of bank, and the outside limits of cuttings on both sides of the centre line, the boundaries of the bottom and the top of the slopes of the borrow-pits, and also lines parallel to and outside the toes of slopes of banks 60 cm. away. This is to be considered as part of the setting out of his work, and preliminary to his being allowed to break ground it is to be maintained and renewed by him when necessary, and when ordered by the Engineer or his representative. The cost of this demarcation work is included in the initial rate for earth work.

(b) The Contractor shall provide all stakes, bamboos, string and pegs for profiles (profiles to include allowance for shrinkage) requisite for the correct execution of the work and for making out borrowpits and slopes, and shall be responsible to see that they are maintained in proper order. The contractor shall provide labour for the setting out of the same when called upon to do so. This is included in the initial rate for earthwork.

(c) The contractor shall be responsible to see that the work is executed strictly in accordance with the orders issued by the Engineer or his representative and shall supply his own tools, and plants of all descriptions necessary and keep them in working order. The rates are inclusive of cost of all appliances and labour for drawing, bailing or pumping water from borrowpits in wet lands or after rains and as such no payments will be made for wet excavation separately from such borrow-pits.

204(a) *Borrowpits* — No excavation for the borrowpits shall be made within 1 metre of the limits of the acquired land. Borrowpits should not be dug close to level crossings, bridges, telegraph poles, electric poles, station yard limit, culverts etc. The distance will be fixed by the Engineer or his representative according to the conditions at site. The borrowpits shall be carefully and regularly

set out parallel to the railway line. The sides are to be sloped down all-round to a slope of 2 to 1 unless otherwise directed by the Engineer. Borrowpits are not to be made of uneven depth but the whole area of each pit is to be neatly excavated to the same level as shown in sketch No. 18 of Annexure IX. where the ground is low and swampy the outer or the most distant halves of the borrowpits will be excavated first so that in case of the pits being flooded by rain there will still be ground available for work.

(b) Borrowpits should normally be made 1.5 metres deep. Borrowpits deeper than 1.5 metres should only be made with special permission of the Engineer.

(c) A berm 10 metres wide is to be left untouched at every 100 metres between edges of borrowpits and not to be encroached upon for any excavation except under the instructions of the Engineer or his representative.

(d) The drainage of the borrowpits will be arranged by a cut on the remote side from the Railway embankment. The earth is to be excavated and thrown to such width, depth and height and in such places as may, from time to time, be directed.

(e) In no case borrow-pits should be dug within station yard limits without prior approval of the Chief Engineer.

(f) When executing repairs to banks, the borrow-pits shall be made with diagonal bunds which shall be removed completely by the Contractor after measurement and certificate to this effect given in the measurement book. The bill shall not be prepared until this certificate is given. Such borrowpits can be about 600 cm. X 600 cm. or of such smaller size as will give a depth of about 60 cm.

205. *Rates.* — It must be clearly understood that the contract rates are intended to cover the full cost of the finished work. Banks and cuttings are to be correctly dressed and finished in profile with such slopes as specified in each case. Work before being finally paid for is to be checked by the Assistant Engineer as having been correctly brought up or carried down to proper level, and to have been otherwise completed in accordance with the specification, and with the proper allowance for settlement as specified in para 218. No work will be considered as complete for payment till the Contractor has received a Certificate in writing that the banks have been bunded for impounding rain water to promote settlement.

206(a) *Payment* — The quantity of earth-work in cuttings and banks shall normally be worked out in the basis of cross-section measurements. Deduction shall be made in full for all bridge structures, openings and other gaps as existing at the time of final measurements. The gross volume of earth work will be worked out from the original and finished profile of the bank/cutting. For payment, the gross quantity thus calculated shall be reduced 10% towards shrinkage allowance for earth work in embankments, but no such deduction shall be made for earth work in cutting. Where the embankment has been compacted by heavy mechanical machinery, the deduction for shrinkage allowance shall be at the rate of 5% of the gross quantity of earth-work. This deduction towards shrinkage allowance for the purpose of payment is irrespective of the actual shrinkage allowance provided in setting out the profiles in different types of soils and the actual shrinkage that might have taken place in the interim period.

206(b) At the end of the final measurements, the following certificate shall be recorded in the Measurement Book by the Assistant Engineer :—

> "Certified that necessary allowance for shrinkage as prescribed was made while giving profiles to the contractor for doing earth-work and the same has been provided by the contractor".

(Final measurements for earth-work should be taken as indicated earlier before turfing is commenced).

207. Lead for purposes of payment will be measured from centre of gravity of excavation to centre of gravity of bank minus the free lead of 30 mtrs. No extra lead is to be paid for disposal of cutting spoil unless so specified in the contract Agreement.

When outer borrow pits are shallow and irregular, the Divisional/District Engineer may at his discretion measure the quantity in such irregular borrow pits and pay separate lead on them after ascertaining mean lead as above, excluding the irregular borrow pit from the main body of the work.

208(a) *Measurement for extra lead & lift* — Rate as provided in the Schedule of Labour and Material Rates 1992 is applicable only to the banks made entirely from the adjacent borrowpit the depth of which is not less than 1.5m. Where the entire quantity is not available in the adjacent borrowpit and earth has to be carted from outside Railway Land, the respective quantities of earth from local borrowpit and that led from outside Railway Land will be determined in the following manner.

(b) Borrowed earth from Railway Land will be thrown first on the embankment and then fresh cross-sections should be taken to determine the balance earth work which is to be done by quantities brought from outside Railway Land. Separate payment can then be made for the quantity of earth brought from outside Railway Land.

(c) With regard to such quantity of earth brought from outside Railway Land the contractor will completely indemnify the Railway Administration regarding procurement of land and other connected facilities for borrowing earth. The Railway Administration will only be responsible to pay for the quantities of earth brought & used at the site of work by the contractor from outside sources at the accepted tender rates.

209 (a) *Sectioning of banks for through rates* :— The Engineer shall at his discretion divide each bank into suitable sections to include as far as practicable uniform classification and height in the same section.

(b) Sectional length should not be more than 300 metres and through rate should be arrived at for each section.

210(a) The quantity contained within a distance of 50 metres at either end of the cutting must be led forward to the adjoining banks. When making final payment for the Bank the Sectional quantities of the last 50 metres of cutting will be deducted from the Sectional measurement of the bank irrespective of actual work done.

The deduction will however be subject to the following limitation :

When the quantity of the excavation in the 1st. 50 metres of the cutting exceeds that of the 1st. 50 metres of the Bank concerned, the total deduction will be limited to the volume in the 1st. 50 metres of the bank.

When the bank is very short and the volume contained in it is less than the quantity of earth in 1st . 50 metres of the cutting, it is obvious that the deduction must be limited to the entire capacity of the bank.

(b) if any cutting spoil is carried to bank from a distance more than 50 metres under the written orders of Engineer, the extra lead will be paid for this quantity only. Such written permission,

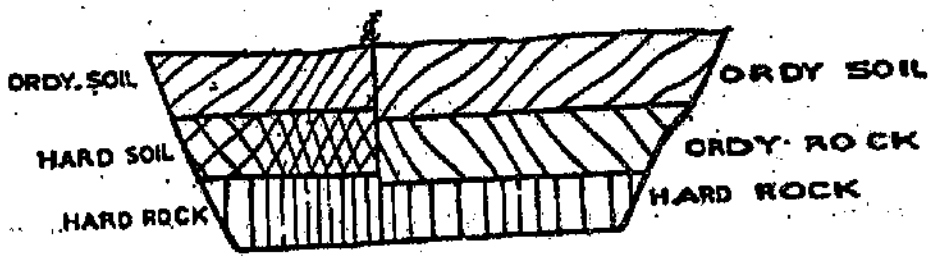
however, will be given by the Engineer only when he is satisfied that leading this quantity of cutting spoil from such a distance and payments made therefor will be more economical than borrowing the same quantity of earth from outside borrow pits. No payment will be made for spreading. The rates provided in the schedule are all inclusive.

(c) Where cutting spoils are used for making Banks, stones over 15 cm. size which are normally not to be used in the banks shall be stacked separately at a site to be indicated by the Engineer. To determine the quantity of cutting spoil led out for making the bank, the sectional quantity of the cutting shall be reduced by the volume of stones and boulders stacked outside, which will be arrived at by deducting 25% for voids from the stack measurements of these stones and boulders. The stacking of these stones and boulders including lead upto 50 metres and lift upto 1.5 metres is covered by the initial rate for earth work.

211. The lift for a cross section will be given by the difference of levels between the average ground level and the formation. In case of level ground centre line height of the cross section may be taken as lift as shown in sketch No. 19 of Annexure IX.

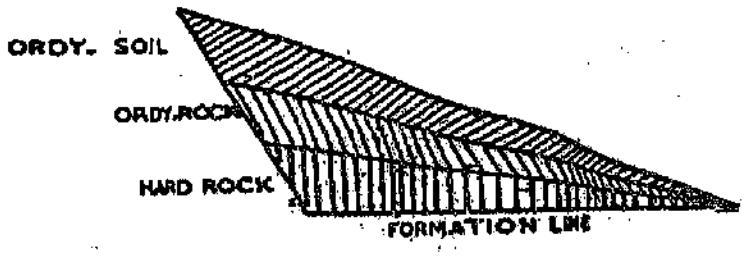
212(a) For purpose of payment, cutting shall be assumed to be composed of such soil / soils only, as stand exposed on both or one side of the finished cuttings, depending upon whether the cutting is box type or one sided on a transversely sloping ground. The content of each type of soil thus assigned to any cross section shall be determined as indicated below. It is to be noted that no portion of cutting will be payable for any such type of soil as is not exhibited on the finished side slope.

(i) *For box type culverts* :— The centre line of the alignment will be marked vertically on the cross section and the content of each type of soil will be determined by computing the area of the strip, formed by joining the points, which form the extremity of occurrence of the particular soil on the finished side slope of cutting, by straight horizontal lines terminating on the centre line. The sketch below is illustrative of the manner in a which payment is to be made.

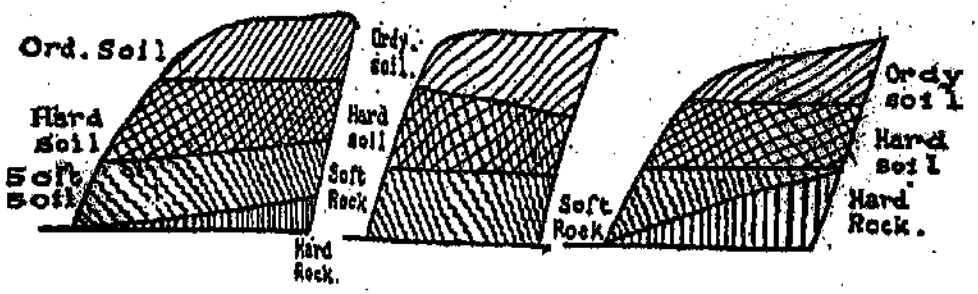


(ii) *For one sided cutting on transversely sloping ground* :— Content of each type of soil will be determined by computing the area of the strip, formed by joining the points, which form the extremity of occurrence of the particular soil on the finished side slope of the cutting, by straight lines to the zero point.

The following sketch is illustrative of the manner in which the payment of the cutting will be made.



(iii) *For widening of existing cuttings for one or more lines where the existing cutting slope disappears and a fresh slops stands* :— Before undertaking widening of the cutting, pre-classification of the existing cutting slope (which will disappear) should be done after clearing and cleaning the surface and the strata met marked on the cross-section sheets which should be signed by the Engineer as well as by the Contractor in token of acceptance of classification. After completion of the work various strata as stand exposed on the new finished slope of the cutting shall again be marked on the cross-sections and signed again by both parties. Then the demarcation points of adjacent strata as determined by classification of the existing slope and the final slope should be joined assuming variation as shown in the sketches below :

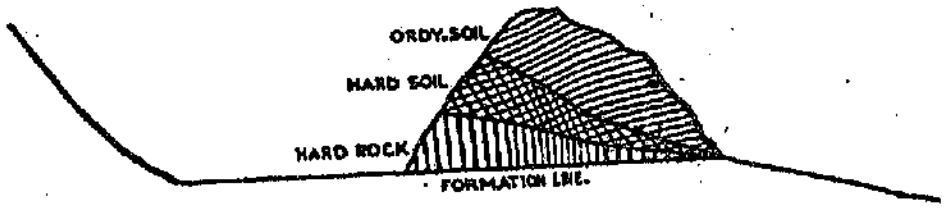


The cross-sectional areas for different strata may be worked out and quantities payable classification-wise made accordingly.

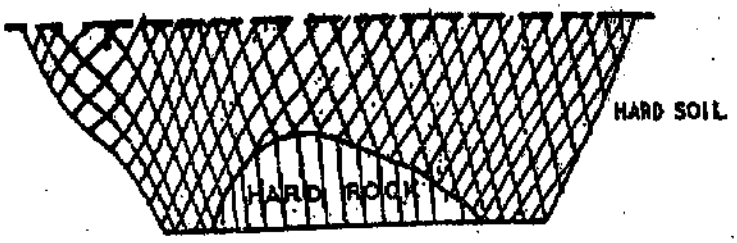
(iv) *For extension to the existing cutting where no fresh cutting slope is available after work* :— Before execution of the work pre-classification of the existing cutting slope which will not be finally available, should be done first and recorded in the initial cross-sections on the same process as indicated in para 212(a) (iii) above.

Quantity of each type of soil shall be determined as per the method indicated in Para 212(a) (ii) of the standard specifications of the Schedule of Rates vol. 2.

The sketch below is illustrative of the manner in which the payment of the cutting is to be made.



(v) *For cases where soil characteristics within the gullet of the cutting portion are not exposed on both or one edge of the finished cutting slopes* :— As cases like the sketch given below are few and far between, no cognizance should be given separately for the soil characteristics except hard rock appearing only within the gullet. For the purpose of payment of the hard rock met within the gullet, the basis of stack measurements as indicated in the para 210(c) of the standard specifications of the Schedule of Rates, Vol. 2 should be followed.



212.(b) Classification in the above manner shall be made only at such points where the cross sections giving the ground profile have been initially recorded. The classification as recorded in the above manner in case of cutting shall be signed by the Contractor in token of his acceptance. The classification as recorded by the Assistant Engineer in the above cases for cutting is subject to approval by the Divisional Engineer, whose decision shall be final and binding on the contractor. In the case of banks also the classification of soils met with in executing the work shall be made by the Assistant Engineer, subject to approval and decision of the Division Engineer, if not made by the former and on these classifications shall be based the rates to be paid to the contractor in his bills. The Divisional Engineer shall normally be the sole judge of the nature and proportions of soils excavated and his decision shall be accepted as binding.

However, if the Chief Engineer decides that the said classification of both banks and cuttings shall be reviewed by the Divisional Railway Manager/Senior Divisional/Territorial/Deputy Chief Engineer, then the assessment as made by the Reviewing Officer shall supersede that made by the Divisional Engineer and shall be accepted as final and binding on the contractor.

212.(c) Cross-sections are normally to be taken in cutting at intervals of 20m. and in banks at intervals of 50m. This may have to be taken at more frequent intervals in cases, where there are heavy undulations. Additional cross sections may be taken, if requested by the contractor, and a certificate obtained from him to the effect that no additional cross-sections are required to be taken and he is satisfied with the cross sections already taken, before allowing him to commence the earth-work in cutting. Once the excavation in cutting is commenced, no additional cross-section will be allowed to be taken.

212.(d) In case the contractor does not agree with the classification made by the Divisional Engineer, he must inform the latter in writing within 7 days after the classifications are made. If he fails to do so, no such claim will be entertained from the contractor at a later date and the classifications made by the Divisional Engineer will be binding on him.

213. *Water logged or swampy ground.* — When embankments are to be carried across water logged or swampy ground, or to be made in soil which requires special protective measures it rests with the contractor in all such cases to bring these facts to the notice of the Division Engineer who will get the orders of the Senior Divisional/Deputy/Territorial Chief Engineer, as to the methods to be adopted and the rates to be paid, and will arrange for a special agreement for the same if necessary.

EMBANKMENT

214(a) *Repair work : (Old bank)* — when doing repair work to banks it is absolutely essential that borrowpits are of a uniform size with diagonal bunds. Borrowpits should be measured for payment in this case.

(b) The diagonal bunds should be removed only at the middle as shown in the figure, leaving two portions at the end. This will afford subsequent check if found necessary. The Assistant

Engineer after taking measurement should endorse a certificate in measurement book that diagonal bunds have been removed at the middle. The diagonal bund is to be removed completely as soon as the borrowpits are measured as shown in Sketch No. 20 of Annexure IX. This must be done before no claim certificate is given by the Assistant Engineer.

(c) Renewals of bank called for by exceptional floods shall be paid for at the same rates as original work but the quantities must first be measured and be accepted by the Engineer, in writing . In the absence of such accepted measurements before the renewal commences no claim can be entertained.

215(a) All large clods are to be broken by labour specially detailed for this work. This must be strictly attended to and enforced by the Engineer, even if it becomes necessary to stop the contractor's work till this order is carried out, or to put on departmental labour at contractor's expense with due intimation.

(b) The Engineer may object to the use of any soil which he considers unfit for embankment. If moorum and other hard soil occur in a borrowpit, the contractor should use such without extra payment moorum or hard soil as a topping to the bank, wherever it is considered possible by the Engineer.

216. All banks are to be made in successive layers of not more than one third metre in depth over the whole width between the side slopes unless watering and ramming is required to be done and slightly concave in section so as to retain the water for subsidence as shown in Sketch No. 21 of Annexure X.

217. Side slopes are to be carried up simultaneously with the rest of the work and are not to be filled in afterwards. This should be ensured by insisting on the earth being spread on the whole width from the toe of slope to toe of slope simultaneously.

218. *Allowance of settlement*:—The normal allowance for subsidence or settlement of earth in a bank is to be not less than 17 centimetres per metre subject to a maximum of one metre but this may be varied by the authority entering into the contract, if found necessary. Profiles are to be put up by giving the full allowance for settlement and these are to be checked from time to time by the supervisory staff and worked to by the contractor. This figure for subsidence will be applicable for earthwork by head load only. When the earth work is done by earth moving machinery or by trucks the shrinkage allowance may be reduced to half of the above figure.

219(a) In side long ground the borrowpits are to be dug on the upper side of the bank, and are to be continuous, so as to serve as catch-water drains and if so ordered, the contractor must get the earth for the bank exclusively from such pits till the catch-water drain is complete to the required length, section and level as shall be prescribed by the Engineer.

(b) In doubling, benching should be done on the side slope of existing bank for proper keying. In steep side long ground the ground is to be benched if ordered by the Engineer.

220. In widening an existing bank,benching 20 cm. deep shall be cut in the existing bank before any new earth is placed, to form a bond between the new and old earth work.

221. When it has been decided to divert a stream adjoining a bank, the excavation for this work is to be undertaken and completed before any borrowpit work is done at site and all earth out of such diversion is to be put into the main bank if so ordered. Such excavation will be considered as normal borrowpit excavation for bank and paid accordingly.

222. Consolidation :—

(a) Continucus longitudinal earth bunds 20 cm. high and 30 cm. wide are to be made on the outer edges of the top of embankments, also cross bunds of the same dimensions at every 15 metres are to be made so as to impound rain water to expedite consolidation. This is included in the earth work rate.

(b) Where possible, the formation should ordinarily be allowed to settle for at least one year.

(c) Where, it is not possible to allow for natural consolidation by leaving the formation to stand at least one complete monsoon where urgency of opening to traffic so warrants, thorough compaction should be effected by sheep-foot roller.

223. *Turfing* : The turfing of banks will not be commenced without the written permission of the Engineer. As stated in Specification No. 13 the side slopes are to be dressed to the specified section before turfing is commenced. This dressing is included in the initial rates for earth work and should a contractor stop work before dressing the bank, his account shall be debited with estimated cost of the dressing based on the rate for item No. 22 of section 'Y' of Schedule of Labour and Material Rates 1992 decreased/increased over the accepted tender percentage for misc. works and the dressing work completed by another contractor or departmental labour as decided by the Engineer.

224. Before water commence to flow through gullies on the slopes of embankments or cuttings, the location is to be strengthened for erosion as early as practicable and made good with suitable material well rammed into the place. It is advisable to protect the place by turfing, pitching or other means as may be ordered by the Engineer.

CUTTING

225.(a) Side slopes will be provided as ordered by the Engineer, whose decision will be final and binding on the contractor.

(b) Catch water drains of suitable dimensions will be constructed outside the top of each slope, where ordered by the Engineer.

(c) The inner edge of the spoil heap shall be set back so as to leave a berm of at least 3 metre clear upto a slope of 45° from the outside edge of formation level including 1.2 metre drains and may be set as much further back as the Engineer shall direct, shown in sketch No. 22 of Annexure X.

(d) Side drains of suitable dimension will have to be provided on either side of the cutting formation as ordered by the Engineer.

226(a) *Precautions* :— In excavating cutting special precautions are to be taken to ensure that the excavations may drain themselves through gravity only. To ensure this the central block of earth of gullet is to be excavated first. This will be done in such a manner that the bottom of the excavation shall, where possible, slope downwards from the centre of the cutting towards the ends. It will be made in such cuts or steps as may from time to time be directed. Generally in deep cuttings the first cut or step will approximately follow the surface of the ground, where this will secure the necessary slope for drainage, and will be excavated to such depth not exceeding 3 metres as may be ordered with perpendicular sides, leaving pathways for the workmen along the sides of the cut, parallel to the centre line. In shallow cuttings, not exceeding 1.5 metre in depth in the deepest part, the gullet may be cut out at once to formation level.

(b) When the gullet is cut to its full depth in shallow cuttings, or to the depth of the first cut in deep cuttings the side portions of triangular section uptc the slopes may be excavated. In deep cuttings the second cut will not be started until the top portion is thus completed as shown in sketch No. 23 of Annexure X.

(c) The necessity of excavating cuttings in this manner is evident as, in the event of heavy rain occuring with work but partly completed, and the bottom of the excavation uneven and incapable of drainage, excavation delay might occur or expensive pumping might become necessary. The Contractor is solely responsible for any such contingency and the railway will not be liable for any compensation.

227. In computing the quantity of earth-work in cuttings and side drains, no congizence will be taken of the additional excavation, which may be necessiated during progress of these work due to the presence of boulders or other material, and payment will only be made for the quantity as per cross sections required to be provided.

228. Care must be taken that the cess at the top of slopes is not encroached on by the spoil, which should be roughly but neatly dressed off. In country where there is any cross fall, sufficient spoil should be thrown on the uphill side of the cutting to supplement the catch water drains and assist in keeping surface water out. Ordinarily this work must be done first as shown in sketch No. 24 of Annexure X.

229. All materials got out of cutting suitable for pitching, ballast or any other purpose whatsoever will be property to the Railway, and are to be stacked where directed by the Engineer within the limits laid down for the stacking of spoil. This is included in the rate for the cutting.

230. *Blasting* :— (a) If any blasting operations are necessary, they are to be carried out in accordance with the rules laid down in appendix 'A'.

(b) Whenever explosives are supplied by the railway, the cost will be debited to the Contractor who will be responsible for the safe custody and use on work, after being so suppiled.

CLASSIFICATION OF SOIL

231. Earthwcrk shall be classified in the following manner :-

(a) *Soft Soil* — Comprising of any of the following -

Vegetable or organic soil, turf, sand, cinder, gravel, loam, clay, mud, peat, black cotton soil or loose moorum etc. or previously dug earth or a mix true of these, as can be excavated by spade or shovel.

(b) Soil Medium Hard is as in (c) but softer, requiring close application of picks only.

(c) *Hard soil or Soft rock* :— Comprising of any of the following -

(i) Stiff heavy clay, hard shale, or compact moorum etc., requiring crowbar and/or pick and shovel closely applied.

(ii) Generally any material which requires close application of picks and crow bars or soariffers to loosen and not affording resistance to digging greater than any of the hard soil mentioned above.

(d) *Rock* —Comprising of any of the following -

(i) Lime stone, sandstone, laterite, hard conglomerate cr other soft or disintegrated rock etc. which can be quarried or split with crow bars or wedges; but nct requiring blasting (Item 3 (a) of the schedule).

(ii) Rocks of above variety, but hard , requiring light blasting (Item 3(b) of the schedule).

(iii) Any rock for the excavation of which the use of mechanical plant for boring holes & blasting is required on an extensive scale (Item 3(c) of the schedule).

Note:— For small quantity of hard rock required to be removed by blasting, use of mechanical plants may not be justified. Hand drilling will be resorted to and the payment for the same should be made under item 3(b) of the schedule.

CHAPTER-III

BRICK WORK

GENERAL

301. Bricks used in a particular work shall be all of the same size. No bricks used in a work shall vary by plus minus 6mm. in length, & 3mm. in width and height from the size permitted in the work by the Engineer.

302. All the best shaped bricks, and those most uniform in colour shall be reserved for the face work, all bricks otherwise passed as of the same class but showing slight defects shall be used for interior work.

303. Mortar :— For brick work, the schedule allows 25% of wet mortar for walls upto (25cm) one full brick thick and 28% of wet mortar for walls greater than (25cm) one full brick thick.

304. The thickness of mortar joint in brick work should not exceed 10mm.

305. In case of thick walls (two-brick thick and over), the joints shall be grouted at every course over and above bedding and flushing with mortar effected while laying the bricks in position. Grouting must not however take place while initially setting the bricks in position.

306. Before being used in the work, all bricks must be thoroughly soaked in water for about one hour. They shall be laid in the water by hand and not thrown in, from the head as brought from the stacks. The bricks should be just skin-dry at the time of laying.

307. The work is to be kept well watered on faces, tops and ends. When work is stopped, covers (wet gunny bags etc) are to be provided in sections for covering the top of the wall and to be left on until commencing the work again. Watering of new work is to be done by a syringe so as not to wash away the mortar; completed work is to be kept wet for at least seven days. The cost of gunny bags, watering etc. will be borne by the contractor.

308. If incomplete work is not taken up for any length of time, a "bund" is to be laid temporarily in weak mortar, round the top of the work and the trough thus formed is to be kept filled with water till the work is restarted so that the mortar gains strength.

309. No "Bats" are to be used in the work, except where necessary to make the "bond", in which case they are to be cut and dressed to requisite dimensions.

BOND

310(a) The "Bond" used will be that known as "English" bond (unless otherwise specified) as shown in sketch No. 25 of Annexure XI.

(b) In piers and abutments, if so ordered, Brick work may be done in "Herring Bone" bond with the transverse joints 45° alternately left and right to the face of the wall to ensure thorough breaking of joint as shown in the sketch No. 26 of Annexure XII.

(c) Columns shall be done as shown in the sketch No. 27 of Annexure XII.

Square pillars in 2 half bricks and 3 half bricks shall be done as per sketch No. 28 of Annexure XII.

311(a) The mortar used for the face work shall be stiff, the bricks being malletted down to correct line and level and the vertical joints being worked full with trowel edge. The mortar used for the hearting may have a slightly higher slump than that used for the face and should be of such consistency that the mortar will rise up and fill up the joint when a brick, bedded on mortar, is pressed against another brick already laid.

(b) Each course is to be perfectly straight & level, both in the longitudinal as well as transverse directions and to the dimensions as shown on the plan of the work. The face of the work of a vertical wall, is to be truly plumbed and free from waves and irregularities. If battered, the batter is to be truly maintained. All bed joints are to be normal to line of pressure acting on them i.e. horizontal in vertical walls, radial in arches, and at right angles to the face in battered retaining walls. The vertical joints are to be directly over one another in alternate courses and be staggered by half the width of a brick over the joints in the course next below.

312. Care is to be taken so that all joints are full of mortar, well flushed up, and in cases where no pointing is to be done, neatly struck as the work proceeds. The bricks are to be set solid with the handle of the trowel or with a wooden mallet.

313. Where brick work is to be pointed or plastered the joints shall be raked clear of mortar to a depth of 12mm. while the mortar is still soft. On no account should mortar be allowed to set and so require removal by digging out to enable the pointing to be done, as this spoils the bricks.

314. Walls of all structures shall be built up regularly in all cases where the nature of the work so permits leaving, no part one metre lower than another as shown in Sketch No. 29 of Annexure XIII. When this cannot be worked to, the brick work shall be stepped so as to maintain a uniform and effective bond, but stepping back should not be started within 1/2 metre of a corner and should not be done for more than one metre in height as shown.

HONEY-COMB BRICK WORK

315. Honey comb brick work, where required shall be of the thickness specified and shall be constructed with selected bricks. All bricks shall have a bearing of not less than 3.8 cm. in the case of half brick thick work and 1.9 cm. in the case of one brick thick work. The mortar in cross joints shall be struck flush as the work proceeds. One brick thick work shall be of whole bricks throughout laid as headers.

SCAFFOLDING

316. In all work the scaffolding must be strong and durable. Contractor shall be held responsible for any accident that occur due to any deficiency in this respect. The inner end of the scaffolding pole where necessry shall rest in a hole provided in a header course only, and only one "header" for each pole shall be left out as shown in Sketch No. 30 of Annexure XIII. Such holes are not to be allowed in pillars and thin partition walls which are to be constructed with double scaffolding, with no part of the scaffolding tunneling the wall under constructions.

MISCELLANEOUS

317(a) All building materials brought to site are to be properly stacked at once, so as to admit proper inspection and classification. This is included in the masonry rate. The building materials should be approved by the Engineer before they are utilised in the work.

(b) Mortar sheds, mortar vats, concrete mixing floors, soaking pits etc. will not be paid for separately, but are included in the rate for masonry.

(c) For proper watering syringes must be used for masonry and concrete works by the Contractor at his own expense.

BRICK WORK IN ARCHES

318. The Schedule of Rate includes the cost of centering in all cases upto 3.5m. span. In larger arches, the centering will be paid for by the Railway.

319. All arches are to be formed on properly framed centres.

320. Arches will be laid in cement mortar as specified and according to the specified drawing for the work. In bridge work, arch masonry shall invariably be in cement mortar, not weaker than 1:4.

321(a) All arches shall be provided with one Key at the crown.

(b) Keys shall extend over the full thickness of the arch. The sides of the keys shall be truly radial. The bricks on the extrados are not to be cut; those on the intrados, shall be cut as necessary.

(c) Headers and stretchers in keys shall be so arranged as to break effectively the bond in the adjacent arch rings.

322. The joints in archwork are not to exceed 6mm. in thickness and the bricks are to be set with a wooden mallet.

323. Arches in bridges are not to be commenced until the abutments have been built up level for a distance of 1.8 metres from the face of the arch where practicable. In any case the abutments must be strong enough to take the thrust without failure.

324. Arches are to be built in 9 cm. (for metric bricks) or (12.5 cm.) one brick width concentric rings, and each ring is to be fully completed before the one above it is commenced. In all cases, whether specially moulded radial bricks or ordinary bricks are used, care must be taken that the centre line of the brick face is radially, placed. The arch rings will in all cases be bonded together by special keys which may be of stone, concrete or brickwork in cement. In important bridge arches, special drawings and instructions will be issued to show these keys in all details.

325. Archwork is to be carried out evenly from either abutment and as soon as the arch is complete, the masonry is to be built up to the height of the crown so as to load the haunches. Care is to be taken that the masonry is carried up evenly on either side.

326. Flat arches should have a camber given tc their bottom surface of 1 in 120.

327(a) For spans larger than 2 metres, timber centering is to be used and are to be provided with hardwood wedges for slackening the centering-sand boxes shall be used for slackening, for spans over 6 metres. In all centerings, the arrangement shall be such that the slackening can be effected without any vibration being transmitted to the arch. If the centerings are not extending to the entire clear span, but rest on intermediate brick pillars, the brick pillars shall be well and strongly built, the top of each pillar being capped with wood and connected up with other pillars by a continuous piece of timber from abutment to abutment.

(b) In all centerings, the upper bearing surface shall be very correctly formed to the curve of the intrados of the arch.

(c) Centering should not be struck, till the adjacent arches (if any) are complete with keys and the Cement mortar fully set.

CHAPTER IV

STONE MASONRY

401. Stone masonry provided in the schedule of rates is of four classes as described here in below.

A. ASHLAR WORK

402. In Ashlar work every stone shall be fine tooled on all beds and joints, to be true and square, giving perfectly vertical and horizontal joints with the adjoining stone or brick work. The fine tooled dressing is meant as finest surface which can be given to a stone with a chisel and without rubbing.

403. All stones will be laid in courses of not less than 25 cm. in height and no stone should be of less volume than 0.035 cu. m. Stones should not be less in breadth than the height or less in length than twice its height.

404. No joint shall be thicker than 10 mm. The face stone shall be laid with alternate headers and stretchers; the headers shall be arranged to be as nearly as possible in the middle of the stretchers above and below, so that the stones break joint on the face for atleast a length equal to half the height of the course. A maximum of 20% of wet mortar is allowed.

405. All stones are to be thoroughly cleaned and washed before being set. The stones are to be hard, sound and free from cracks, flaws and defects.

406. The masonry shall be kept thoroughly wet for at least 14 days after building.

407. All stones are to be thoroughly wetted before being put into the work.

B. COURSED RUBBLE MASONRY

408. The stones shall be laid in horizontal courses not less than 15 cm. in height for buildings and 20 cm. for bridges. The general arrangement of the courses is shown in sketch No. 31 of Annexure XIV.

409. All Stones in one course shall be of the same height both in the face and in the heart work and all courses shall be of the same height unless permitted to the contrary by the Engineer, in which case no course shall be of greater height than the one below it. All stones are to be set full in mortar.

410. Face stones shall be squared on all joints and beds. The beds shall be truely horizontal for the full depth of the stone, the vertical joints shall be dressed true and sqare for not less than 4 Cm. back from the face, the bush projecting not more than 4 cm. Quoins shall be laid alternately header and stretcher.

411. No stone shall be less in width & breadth than $1^1/_2$ times its height.

412. All beds shall be horizontal and all side joints vertical. No visible joint shall be more than 1 cm. thick.

413. In each course at every 1.5m. in horizontal measurement, headers shall be used. If the wall is too thick (over 75 cm.) to permit of one header stretching from front to back, 2 or more headers shall be used overlapping by not less than 15 cm. The headers in one course shall be approximately at mid distance of those in the courses immediately above and below.

414. Stones shall be laid to break joint at least half the height of the course. 30% of wet mortar is allowed.

415(a) The hearting shall consist of large stones of the full depth of the course, the vertical joints being in any direction but dressed with the hammer approximately square with the beds. The stones shall be fitted together to have the vertical joints as small as possible. These vertical joints may be filled with spalls set vertically to avoid thick joints of mortar. No spalls shall be used on the beds.

(b) No under pinnings shall be allowed in faces or hearting.

416(a) The upper surface of the work shall be brought to uniform level at every course.

(b) The masonry shall be kept thoroughly wet for at least 14 days after building.

417. All stones are to be thoroughly cleaned with water & wetted before being put into the work.

C. UNCOURSED RUBBLE MASONRY

418. In each course at every 1.5m. in horizontal measurement, headers of the height of the courses shall be placed. They shall be of dimensions and dressed according to the specification for headers and shall tail into the work for not less than 3 times their height. If the wall is too thick (over 75 cm) to permit of one header stretching from front to back, 2 or more headers shall be used over lapping by not less than 15 cm. The headers in one course shall be approximately at mid distance of those in the courses immediately above and below. The general arrangement of the same is shown in the Sketch No. 32 of Annexure XIV.

419. Between the headers, each course shall be built up of small stones well bedded in mortar and breaking joint. These stones shall be the most flat bedded obtainable, undressed, of height not less than 10 cm. and not more than 3 stones shall be placed one above the other to make up the height of one course as fixed by the headers. The use of small stones should be avoided as far as reasonably possible. No stone should be less in breadth or length than its height. Their side joints shall not make an angle with planes or courses sharper than 60°. Spalls shall be used freely in order to avoid thick masses of mortar. The thickness of joints may be 1.75 cm. 35% of wet mortar is allowed.

420. At corners the quoins shall be of the same height as the course and laid alternately header and stretcher along the two faces and otherwise the same as other face stones.

421. The masonry shall be kept thoroughly wet for at least 14 days after building.

422. All stones are to be thoroughly cleaned with water & wetted before being put into the work.

D. RANDOM RUBBLE MASONRY

423. Stone shall be set in the work as received from the quarry without any dressing beyond removing weak edges and corners with the mason's hammer.

424. Stones shall be laid to break joint as much as possible and solidly bedded in mortar. No face joint shall exceed 1.5 cm. in thickness, spalls shall be used freely to avoid thick masses of mortar. Hearting bed joints must not exceed 2.5 cm. or vertical joints 3 cm. in thickness. 35% of wet

mortar is allowed. The general arrangement of masonry is shown in the Sketch No. 33 of Annexure XV.

425. No dry work or hollow spaces shall be left. Every stone, large or small , shall be set flush in mortar, smaller stones shall be used to fill in the interstices between larger ones.

426. At every 1.5m. in horizontal and every 60 cm. in vertical measurement, headers shall be used. If the wall is too thick (over 75 cm.) to permit of one header stretching from front to back, 2 or more headers shall be used overlapping by not less than 15 cm. The headers should be staggered in consecutive courses.

427. A fair proportion of stone shall be of large size, that is at least 30 per cent shall exceed 0.014 cu.m. in volume.

428. Work shall be brought to a horizontal surface at intervals of not more than one metre.

429. Face stones shall be laid without visible spalls and shall be of stone selected for size, evenness of bed and of uniform colour.

430. Face stones shall be laid so that they tail back and bond well into the work and shall be of a height not greater than the breadth on face or length in the work.

431. Face stones shall be such that about 50 percent, shall be of 0.03 Cu.m. in volume.

432. At corners the quoins shall be headers laid alternatively header or stretcher along the two faces. Each header shall be at least 45 Cm. long and shall be rough dressed for at least 10 Cm. back from each of the two faces. The quoins shall be of selected stone and shall not be less than 0.03 Cubic metres in volume.

433. The masonry shall be kept thorcughly wet for at least 14 days after building.

434. All stones are to be thoroughly cleaned with water & wetted before being put into the work.

435. No stone with any "Skin" on any of its surfaces is to be put into the work.

436. Random rubble masonry shall not be used in the construction of culverts or bridges under or over the Railway Lines.

MISCELLANEOUS

437(a) The scaffolding must be strong and durable; for any accident occuring due to defect or neglect in this respect, the contractor will be responsible.

(b) All masonry shall be broomed down on completion and stains (of cement mortar patches) have to be removed from the face.

(c)(i) Coursed rubble masonry. The class of masonry adopted for Bridge-work shall consist of a series of horizontal course uniform in depth throughout any one course. No course shall be less in depth than any course above it but varying as may suit the natural beds or cleavage lines of the stone quarried from a minimum depth of 22.5 cm. to a maximum of 45 cm. in large bridges, 22.5 cm. to 35 cm. in less important bridges and 10 cm. to 22.5 cm. in flat tops and rail opening, parapet walls, ballast walls and buildings.

(ii) In minor bridges the stones between the bond stones in each course may be made up of two courses where these stones are more economical than stones uniform in depth with the header or bond stones.

(d) Random Rubble masonry may be used for platform walls and buildings . For Bridge work the mortar should be of cement.

(e) The Voussoirs to be dressed clean, sharp true and free of all winding and summered to the correct radius of the arch and to the soffit and crown lines respectively and to be of the full depth of the Arch Ring. Every 5th stone in length of barrel of arch to be a through stone and the joints of the rings in between to break joint or overlap each other by half the width of the Voussoirs. All joints are to be 1 cm. thick.

(f) Coping may be ashlar or chisel rock faced. All stones to be dressed to full dimensions throughout with 1.5 cm. chisel draft round all the edges of the face stone forming sharp and straight edges with the drafts of the bed and joints. All joints are to be uniformly 1 cm. thick.

CHAPTER V

CEMENT CONCRETE

GENERAL

501. This specification deals with the general structural use of plain and reinforced concrete.

502. Test of materials and construction shall be carried out as laid down in the further clauses of this specification and as directed by the Engineer. If these tests show that any of the materials or construction do not comply with the requirements of this specification the contractor will be responsible for the costs, including the replacement of the defective materials and or construction.

503(a) The Aggregate shall consist of good hard stone of approved quality well graded, clean and free from all impurities unless otherwise specified the size of the aggregate for mass Cement concrete work in foundation etc. shall be 40 mm. and for reinforced concrete 20 mm. good hard quality, well graded gravel to the specified size may also be accepted for cement concrete work. Clinker, ashes, slack and aggregate of porous nature should not be used for concrete work.

(b) Aggregates for Reinforced concrete work must be thoroughly screened and/or washed, if necessary, to free it from any deleterious substances.

(c) Cement & reinforcement will be supplied by the Railway unless otherwise stated in the contract in which case these are to comply to the relevant I.S. Specification No. 269-1976 and 226-1975.

504(a) For proportions of different mixes Appendix 'B' may be referred to. The size of measuring boxes to be used for measuring the ingredients will be 40Cm. x 25 Cm. x 17.4 Cm. for cement and 40 Cm. x 25 Cm. x 34.8 Cm. for other aggregates.

(b) The following proportions for Cement concrete work shall be adopted.—

(i)	For foundations of single storey Bldgs. and drains ..	1:4:8
(ii)	For mass constructions and large footings and foundations	1:3:6
(iii)	Cement concrete reinforced	1:2:4 or 1:1½:3 as may be specified.
(iv)	For concrete Roadways, Tanks and Swimming pools, etc.	1:1½:3 or 1:2:4 as may be specified.

505. Water shall be clean and free from harmful matter i.e. oil, acid, alkali, earth or organic matter and other deleterious substances, and generally be of a quality fit for drinking;sea water shall not be used.

506. The cement on the site shall be stored in water-proof shed of adequate dimensions with a raised floor. Reinforcement shall be stored in properly constructed racks/blocks above ground level.

507. The Engineer may, as and when he considers necessary, order for 15 Cm. test cubes to be cast by the contractor at the site of work and tested for crushing strength. The charges for such tests will be borne by the Contractor.

508. The water/cement ratio specified in the designed mix shall be strictly maintained. The quantity of water to be mixed with concrete of different nominal mixes should be as per I.S. 456-1978 (Third revision). As a rough guide 30 litres of water to be added for each bag of 50 Kg. cement. It should be increased or decreased depending on the type of Concrete and size of aggregate. Item 12 of Appendix 'B' may be referred to.

509. In addition to the accurate control of the water/cement ratic slump tests shall be used as a guide to the workability of the mixed concrete. The slump must show no significant variation, from the slump established by the designed mix. The test is to be carried out as per Appendix:-E.

510. All tests shall be carried out at regular intervals and a record of the results kept at site.

MECHANICAL MIXING

511. The cement concrete shall be mixed in an approved mechanical batch mixer. The mixer shall be completely discharged of each batch before recharging. The volume of mixed materials shall not exceed the stated capacity of the mixer and the mixer drum shall be thoroughly washed out whenever work ceases, including meal breaks. Mixing shall continue for not less than two minutes for each batch. For all major and important work, concrete mixer & vibrator must be used by the contractor. If Railway supplies the machines, deductions will be made for hire charges as per current standing orders.

HAND MIXED CONCRETE

512. For unimportant structures, Engineer may allow at his discretion hand mixing of concrete.

513. *Hand mixing of Mass Cement Concrete* :— A cemented platform of adequate size is to be prepared first on which previously washed clean stone chips or gravel has to be stacked. These stacks should have uniform thickness not exceeding 40 cm. in height. Clean and dry sand and cement; measured in measuring boxes as per specified proportion is mixed up dry thoroughly till a uniform colour is found. Dry mix of cement and sand previously prepared is to be laid evenly on the top of these stacks as per proportion of the concrete. Care should be taken while preparing the dry mix of cement and sand that not more than 5 bags of cement are opened at a time. This should be reduced if the sand is wet. The portion over which the dry mortar is spread, is to be turned continuously with a shovel from end to end, clean water being added through the rose nozzle of a watering can, so as to bring the concrete to a slightly wet uniform consistency.

514. Cement concrete when first deposited should be shaken by working vertical rammers, made out of 60 mm. to 20 mm. dia. bars, so as to expel imprisoned air bubbles. It may also be rammed with iron rammers of not less than 5 kg. in weight but in no case the concrete is to be rammed after initial setting has started, which is 30 minutes after normal setting cement (from fresh stock) has first been watered and 5 minutes after quick setting cement has first been watered. In reinforced work, special "spuds" shall be substituted for rammers.

515. Hand mixing for re-inforced cement concrete: Normally hand mixing should not be allowed for re-inforced concrete structures unless the Engineer is satisfied that the importance and volume of concrete justifies it. It is of paramount importance to have rigid control over the process

of mixing, proportion of water and the extent of vibration in order to achieve stipulated strength of the concrete so made. Following procedure should generally be adhered :—

516. A platform of adequate dimensions should be made as in the case of mass concrete on which previously washed stone chips measured in boxes of appropriate size are to be dumped. Required amount of dry mix of cement and sand is to be added and mixed thoroughly with addition of minimum amount of water to give the workability.

TRANSPORTING

517. The contractor shall obtain the sanction of the Engineer in writing for the methods he proposes to use for transporting the concrete.

PLACING

518. During concreting a competent man should be in continuous attendance on the job to adjust and correct the positions of any reinforcement which may get displaced.

519. *Construction joints* :— The positions of all construction joints should be ascertained from the Engineer before the work commences and where directed the joints shall be provided. Any special requirements will be indicated on the Engineer's drawings. No construction joint shall be formed without a proper stopboard at the joints unless so permitted by the Engineer. Concrete in walls shall be placed in layers 30 cm. high over the full length of the wall. Each layer must be compacted before placing the next layer.

520. Construction joints between concrete made from mixes of different strengths or mixes using different cement shall be made and positioned as the Engineer shall direct.

521. *Vibration* :— The contractor shall intimate the Engineer the type of vibrator to be used, concreting procedure, pitch of vibration points and maximum and minimum vibrating times for all typical concrete members to be vibrated.

SPECIFICATION FOR VIBRATING CONCRETE

522. *Water Cement Ratio* :— The water cement ratio (by weight) for all vibrated concrete shall be 0.45 and it shall not be varied unless otherwise directed by the Engineer.

523. Placing :—Concrete shall be placed in layers not over 45 to 60 Cm. deep and each layer shall be vibrated in place by methods which will not permit the ingredients to separate. In no case the cement concrete be thrown. Surfaces shall be smooth and free from voids caused by stone pockets. Where necessary, vibration shall be supplemented by manual operation to secure the desired results.

524. *Number and size of Vibrators* :— Vibrators shall be of sturdy construction, adequately powered and capable of transmitting to the concrete not less than 3600 impulses per minute when operating under load. The vibrations, shall be of sufficient tense to cause the concrete to flow or settle readily into place and visibly affect the concrete over a radius of at least 45 cm. when used in concrete having a slump of 2.5 cm. A sufficient number of vibrators (at least one vibrator for the rate of concreting of 1.5 Cu.m. per hour) shall be employed so that at the required rate of placement' vibration throughout the entire volume of each layer of concrete and complete compaction are secured.

525. *Manipulation of Vibrators* :— (a) Internal vibrators shall be kept consistently moving in the concrete and shall be applied at points uniformly spaced not farther apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw a pool of grout from surrounding concrete.

(b) The vibration shall be such that the concrete becomes uniformly plastic and there shall be at least 20 seconds of vibration per 0.1 Sq. m. of surface of each layer of concrete computed on the basis of visibly affected radius and taking overlap into consideration.

526. *Curing* :— The concrete shall be covered with a layer of sacking canvas, hessian or similar absorbent materials and kept constantly wet for a minimum period of 21 days. This period may be reduced to three days for rapid hardening cement concrete and twenty four hours for aluminia cement concrete. For slabs water shall be impounded on them by making clay "Bunds".

527. *Bending* :— Reinforcement shall be accurately shaped as required by the detailed drawings and bending schedules. Hot bending will not be allowed. The contractor will be provided with bending schedules giving the cut lengths diameter, bending dimensions, and location of each bar in the work. The lengths and dimensions, will be deducted as accurately as possible; but the contractor must check them before cutting the bars or placing them in position in the work, as no responsibility can be accepted for any inaccuracies or the consequences thereof. The actual weight of steel reinforcement used in the works shall be taken as the weight of steel calculated from the final bending schedules and payments will be based on the total thus obtained.

528. *Placing* :— All intersections of reinforcement shall be securely tied with malleable iron wire of suitable size approved by the Engineer at the Contractor's cost. The layout of all reinforcement shall be approved before concreting commences.

529. The Contractor shall employ effective and suitable methods to maintain the concrete cover to the steel reinforcement as specified on the detailed drawings. These measures shall include the provision of all necessary chairs, etc. not shown in the drawing and in order to avoid displacement of bars, chairs should preferably be embedded pieces of M.S. bars of requisite diameter or of briquettes made out of cement mortar 1:2 to the required size and well cured.

530. *Welding* :— Site welding shall not be used unless specified. Cold worked bars shall in no case be welded.

531. Before construction commences the contractor shall notify the Divl. Engineer for approval of the method and system of form work he proposes to use.

532. The vertical strutting shall be carried down to such construction as is sufficiently strong to afford the required support without injury and shall remain in position until the newly constructed work is able to support itself. Soffit shuttering shall be constructed in such a manner that it can be struck without disturbing the struts. A small opening about 15cm. x 10cm. shall be kept at the base of column shuttering. From this opening all pieces of wood, nails, chips etc. shall be removed. Until the Inspector of Works has certified that there is no dropped material on the base, shall, the opening be closed and concreting the column commenced.

STRIKING OF CENTERING

533.A. *The striking periods* :— In normal circumstances that is at temperatures about 21°C (or 70°F) forms may be struck after expiry of the following periods.

	Location	Striking time in days for Ordinary Portland Cement
(a)	Vertical sides of slabs & beams & columns	48 hours
(b)	Bottoms of slabs upto Spans of 4m.	7 days
(c)	Bottoms of slabs of Spans above 4m.	14 days
(d)	Bottoms of beams upto 6m. span & arch rib bottoms upto 6m. span.	21 days
(e)	Bottoms of beams over 6m. span & arch rib bottoms above 6m. span	21 days
(f)	For Bridge slabs irrespective of span.	21 days

B. For rapid hardening cement, 3/7th. of the above periods will be sufficient in all cases except vertical sides of slabs, beams and columns, which should be retained at least for 24 hours.

534. It is the contractor's responsibility to ensure that in striking the shuttering the structure is not distorted, damaged or over loaded in any way.

535. *Camber*:— Unless otherwise specified the form work for underside of beams and slabs shall be given an upwards camber so as to approximately eliminate the anticipated deflection as directed by the Engineer.

536. *Tolerance* :— On all setting out dimensions 3 metres and over, a tolerance of plus or minus 6 mm. will be allowed. On all setting out dimensions under 3 metres a tolerance of plus or minus 3 mm. will be permitted on the cross section dimensions of structural members. The top surface of concrete floor slabs and beams shall be within 6 mm. of the nominal level and line shown on the drawings. Column and wall shall not be more than 6 mm. out of plumb in each storey height and not more than 20 mm. out of plumb in their full height unless otherwise specified. The contractor will be responsible for the cost of all corrective measures required by the Engineer to rectify work which is not constructed within the tolerance set out above.

MISCELLANEOUS

537. All concrete surfaces to be exposed in the finished building shall be finished smooth. No form or rendering shall be applied to obtain smooth surface. Any voids or honey-combing to any surface when the form work is removed shall be made good to the requirements of the Engineer. All undesired fins and other projections shall be carefully removed.

538. All exposed surfaces shall be treated as ordered by Engineer where concrete surfaces are to be plastered, rendered or screeded; the surface of the concrete is to be prepared as required by the plastering specification, otherwise the contractor is bound to produce an even and smooth finish under his own arrangements.

539. The contractor shall co-ordinate with sub-contractors for incorporating any electrical conduit pipes, fixing blocks, chases, holes, etc. in concrete members as required. The contractor shall ensure that these requirements have been approved by the Engineer, before the work is put in hand. All fixing blocks, chases, holes etc. to be left in the concrete shall be of the sizes required and shall be accurately set out and cast with the concrete. No holes or chases shall be cut in the concrete without the prior approval of the Engineer.

540. Before construction commences the Contractor shall supply to the Engineer for approval of the drawings showing the general detailed arrangement for the concreting plant, and all other devices which he is proposed to use for the construction of the structural frame work.

541. If the contractor desires to have permanently embedded in the concrete any temporary supports for the shuttering, he must furnish in writing exact details of such proposals and such supports must comply in design and quality and position with the requirements of the Engineer. All the tie wires shall be cut back from the face of the concrete and rendered over to ensure that rust marks do not appear on the surface of the concrete.

542. If in the opinion of the Engineer, there is a doubt as to the strength of a structure, due to the site-made concrete strength cubes failing to attain the specified strength, or to poor workmanship, misplacing of concrete, and similar circumstances or attributable to alleged negligence on the part of the contractor, then the Engineer shall instruct the contractor to make a loading test on the works or any part thereof. The nature of the test and the loading shall be left to the discretion of the Engineer. The Contractor shall bear the cost of the test and the cost of correcting any defects, in accordance with instructions of the Engineer.

543(a) The measurement of concrete will be as per detailed drawings, shapes and sizes based on net structural sizes as per drawings (i.e exclusive of plaster). The contractor should study the various shapes and sizes and the typical type of form work that will have to be provided for, to give the finished shape.

(b) He should also note that he has to provide necessary wooden plugs, sleeves for his own items of work and for which no special payment will be made. He will have to provide, if asked for, wooden plugs, special sleeves, etc. for other nominated Sub-contractor such as Electrical, Sanitary & plumbing, Air-conditioning Contractors and for which he will be paid for separately. But in case the other contractors provide the same, then, he will have to take proper care, not to disturb their work while laying concrete.

544. The top of all R.C.C. slabs, or concrete base to take tiled flooring should be finished to proper levels so that tiles like Indian marble tiles, precast marble mosaic tiles etc. can be set on a bed of cement mortar or as specified.

545. No disturbance or vibration (such as caused by work or traffic over it) of cement concrete shall be permitted after 30 minutes from the time of wetting the mixture for 48 hours or in reinforced work for 7 days.

CHAPTER VI

FLOORING

A. BRICK ON EDGE OR FLAT

601. *Base* :— The foundation shall consist of cement or lime concrete laid as per respective specification to the required thickness , or if approved by the Engineer, dry brick soling filled with sand.

602. *Laying* :— Over the concrete or soling, a layer of brick-on-edge or flat shall be laid in mortar. The bricks shall be 2nd class as specified in the work order. They shall be thoroughly soaked before laying. The bricks shall be laid on edge or flat as ordered. The bricks shall conform to specification as laid down for bricks (Chapter I-Specification No. 9)

603. *Joints* :— The joints are not to exceed 6mm. in thickness. Courses are to break joint.

604. *Curing* :— The floor shall be kept well watered for 10 days after laying. If much traffic is to pass over it before it is thoroughly cured, the surface should be protected with a layer of damp sand.

605. *Dry Brick Flooring* :— When a dry brick floor is being laid, as is suitable in some goods sheds, coal stacking grounds, etc. the bricks are to be well burnt jhama bricks, or 2nd class bricks as specified in the work order. Over a solid foundation, a thin layer of sand is to be spread and the dry bricks are to be evenly embedded on this as close together as possible, All joints are to be filled with sand.

B. LIME CONCRETE FLOOR

606. *Dressing of Fill* :— The earth filling after being thoroughly watered and rammed shall be dressed down to correct levels, as shown on the drawings or as ordered by the Engineer.

607. *Base* :— If ordered before laying the lime concrete, a specified thickness of dry brick soling laid flat on earth or on dry stone ballast well rammed may be provided.

608. *Concrete* :— The concrete shall be composed of 0.5 cu.m of wet mortar mixed with 1 cu.m. of broken stone aggregate or brick-bat aggregate of 40 mm. gauge.

609. *Laying* :— The lime concrete shall then be laid and thoroughly rammed to thicknesses as shown on the drawings (or as ordered by the Engineer). To ensure the finished surface of the concrete being at the correct height, the surface level before ramming should be higher than the finished surface by about 1/3rd the thickness of the finished layer.

610. *Ramming* :— The ramming shall be done with iron rammers, weighing not less than 4.5 kg. each, and finished with wooden "thapis" till no impression can be made on the concrete surface. While ramming lime water should be sprinkled on the surface of the concrete to keep it moist. When this surface is finished, it should be kept damp for 7 days.

611. *Cement plaster* :— (a) If cement plaster is to be used on a lime concrete floor, it is to consist of 1 part of cement to 3 parts of sand prepared in accordance with the specification for cement mortar.

(b) The lime concrete surface being thoroughly damp, the cement mortar shall be laid as stiff plaster not less than 15 mm. thick, and beaten down into place with very light "thapis" till it creams. The surface shall then be trowelled smooth and finished as ordered. The whole area of the room is to be done at one time to avoid joints.

(c) Lime concrete 1:3:6 laid in base course of floors will be paid as per item No. 1 of section 'B'. The priming coat of plaster in cement mortar 13, 15 mm. thick over the base course will be paid as per item No. 1(b) of section H.

612. *Curing* :— All openings out of the room shall then be closed with earth bunds, and the floor flooded with water. The floor should then be left, to set for atleast a fortnight under water, more water being added to keep up the level from time to time. If possible, the floor should remain drowned for a month, and if not, should be washed down two or three times daily for a month after the floor is brought into use.

C. CEMENT CONCRETE FLOORS

613. *Sub-grade* :— In case the concrete floors are to be laid directly on rammed earth, moorum or coal ashes, sand should be sprinkled & rammed on the (rammed) sub-grade before laying the concrete. The sub-grade in all cases shall be formed to proper levels, watered and well rammed or otherwise consolidated before laying the concrete. It shall be noted that any slope required to be provided in the floor is to be given to the sub-grade.

614. *Sub-floor or base concrete* :— As soon as the condition of the concrete base permits, and before it has fully hardened, all dirt, laitance and loose aggregate shall be removed from the surface by means of a wire broom, which shall leave the coarse aggregate slightly exposed and the surface should otherwise be roughened to improve bond with the topping. When it is not possible to remove laitance and roughen the slab by brooming, the surface shall be cleaned and prepared for bond by chipping after the base has hardened. Just prior to placing the finish, the base shall be thoroughly cleaned by scrubbing to the satisfaction of the Engineer. When the wearing course is laid over a base course of lime concrete or cement concrete of a weak mix, the top layer shall be placed in position before concrete in the base course has completely set, the surface being thoroughly cleaned and well moistened immediately before laying the top layer. It is of utmost importance in such a case, to see that the base course is laid with mix containing minimum amount of water that will give workability. When the wearing course is laid after the basecourse has set, the base course must be thoroughly cured for atleast 3 days before the wearing coat is laid. A thin coat of neat cement grout shall be broomed into the surface of the base slab for a short distance ahead of the topping which shall be applied before the grout gets hardened.

615. *Thickness* :— The thickness of the floor shall be as specified in the drawings or as ordered by the Engineer.

616 (a) *Mix* :— The coarse aggregate used for wearing coat should be carefully selected, sufficiently tough and hard stone (or pea gravel if so specified) broken in a manner that will provide particles of regular structure conducive to good anchorage. Elongated or thin plate like fragments should never be used.

(b) The sand should be coarse grained and clean.

(c) The least amount of mixing water that will produce a workable mix and will allow finishing without excessive trowelling must be used.

(d) For large works mechanical mixing and use of surface vibrator should be resorted to as directed by the Engineer. (Nothing extra shall be paid for the use of these mechanical appliances).

617. *Laying* :— (a) The concrete shall be laid in alternative bays not exceeding 6.0 sq. m. each, formed with strips of wood or flat iron on edge, oiled to prevent sticking. The odd numbers in the first, third, etc. rows and even numbers in the second, fourth, etc. rows shall be laid first. Atleast

48 hours (24 hours when rapid hardening cement is used) shall elapse before the concreting in the remaining intermediate bays is commenced. Before filling up the intermediate panels, the sides of the hardened flooring panels shall be painted with a bitumanastic paint to ensure neat, straight joints, free from serrations. After being placed, the concrete shall be spaded with suitable tools to prevent formation of voids or honeycomb pockets. The concrete shall be brought to the specified levels by means of a heavy straight edge resting on the side forms and drawn ahead with a sawing motion, in combination with a series of lifts and drops alternating with small lateral shifts. When concreting the remaining alternate bays care shall be taken to ensure that the edges of previously laid bays are not broken by careless or hard tamping.

(b) Immediately after laying the concrete the surface shall be inspected for high or low spots and any needed correction made up by adding or removing the concrete. After striking off the wearing course to the established grade it shall be compacted with a wooden float. The floating shall be followed by steel trowelling after the concrete has hardened sufficiently to prevent excess of fine material from working to the surface. The finish shall be brought to a smooth surface free from defects and blemishes. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface of the wearing coat to absorb moisture or to stiffen the mix. After the concrete has further hardened additional trowelling shall be done to the satisfaction of the Engineer. Where ordered, an approved non-slipping pattern shall be given to the surface before it sets hard.

618. The vertical edges of the bays shall be neatly marked on the surface of the concrete with a pointed trowel.

619. *Curing and Protection* :— All freshly placed concrete shall be protected from the elements and from all defacement due to building operations and traffic of men and animals. The contractor shall provide and use when necessary, at his own cost, tarpaulins to completely cover or enclose all freshly finished concrete. As soon as the concrete has hardened to prevent damage thereby it shall be covered with at least 25mm. of wet sand, or other covering considered satisfactory by the Engineer and shall be kept wet continuously by sprinkling with water for atleast fifteen days. After the curing is completed the surface shall be thoroughly cleaned and washed.

620. *Coloured Floors* :— When ordered, the floors shall be coloured by the addition of pigment.

621. *Polishing of floors* :— When, instead of smooth finishing, a polished surface is ordered the polishing shall be done in accordance with para 630 of the specification on "Terrazo flooring and dado".

D. TERRAZO FLOORING AND DADO (IN SITU)

622. *Under layer* :— The under layer shall be laid as in the case of ordinary cement concrete flooring in panels, laid to required levels. As soon as it is evenly spread it shall be quickly beaten with wooden "thapis" or masons trowel to an even but rough surface to form key for the top layer. Suitable alluminium dividing strips shall be placed in such a way so as to form bays of square patterns etc. as ordered by the Engineer. The top of the strips shall be atleast 1 mm. above the finished level of the floor.

623. *Marble Chips* :— The marble chips shall be of uiform approved size. They shall be machine crushed of approved quality and colour and shall be free from foreign matter, dust etc.

624. *Top layer* :— Cement and marble chips shall be mixed dry in the ratio of 1 cement : 2 marble chips. The mixture shall be well turned over, adding just enough water to obtain mix of driest consistency possible to work with a sawing motion of the strike-off board or straight edge.

625. *Coloured finish* :— (a) The accompanying table may be used as a guide to determine the approximate quantities of high-grade pigments required for the colours and shades.

Cciour desired.	Commercial names of colour for use with cement	Approximate quantities required Kg. per bag of cement	
		Light shade.	Medium shade.
Grey	German town lamp black	0.227	0.454
Blue-black and	or carbon black or	0.227	0.454
black.	black oxide of manganese	0.454	0.907
	or mineral black	0.454	0.907
Blue	Ultramarine blue	2.268	4.082
Brownish or dull brick red	Red Oxide of iron	2.268	4.082
Bright red to vermillion	Minerai turkey red	2.268	4.082
Red sand stone to purplish Red.	Indian red	2.268	4.082
Brown to reddish brown	Metallic brown (oxide)	2.268	4.082
Buff colonial tint and yellow.	Yellow ochre or yellow oxide	2.268	4.082
Green	Chromium oxide or greenish blue	2.268	4.082
	Ultra-marine	2.722	5.444

(b) When a coloured finish is ordered the pigment shall be non-organic, of approved manufacture and suitable for mixing with cement. When lighter shades are desired approved white portland cement shall be used instead of ordinary Portland cement. The quantity of pigment required to produce the desired shade shall be determined before hand by experiment. The pigment shall be thoroughly mixed dry with cement and sufficient quantity of the mixture kept apart for subsequent grouting of pin holes that appear as a result of cutting and polishing. Dry mixture for whole work should be prepared at one time, otherwise it may be difficult to obtain a uniform colour throughout.

626. *Placing top layer* :— The terrazo finish shall be laid in bays not exceeding 1.5 sq.m. or as directed. The terrazo shall be laid in position slightly off the finished surface so that after rubbing and polishing, the thickness of the finished surface is not less than the specified thickness.

627. The surface of the top layer shall be trowelled over and brought true to required levels by using a straight edge.

628. *Rolling* :— Just before the initial set takes place, the top surface shall be rolled lengthwise and cross-wise so as to secure thorough compaction of the marble chips and cement paste. Additional marble chips of the large size shall be inserted in the topping where required, and rolling continued until nearly 85 percent of the finished surface shall be composed of stone. Immediately after rolling the surface shall be floated and trowelled once. No attempt shall be made to remove trowel marks.

629. *Junction and Corners* :— The junction of floor and wall, dado or skirting shall be rounded off to a uniform radius as directed without any extra payment.

630. *Finishing* :— After an interval of 12 to 24 hours, when the terrazo concrete has hardened enough to prevent dislodgement of aggregate particles it shall be evenly and smoothly rubbed with carborandum stone (60 grade) or ground down with an approved type of grinding machine shod with free, rapid cutting carborandum stones, till marble chips are evently exposed and the surface is smooth and even. The floor shall be kept wet during the grinding process. All material ground off shall be removed by thoroughly washing with water. Air holes, pits and other blemishes shall then be filled with a thin grout of cement and colouring matter in the proportion used in the terrazo concrete. The grout shall be well pressed in the holes with a trowel. After an interval of 2 and 4 days the surface shall be again rubbed and polished with carborandum bricks of 80 and 100 grade respectively. Air holes and pits appearing after each rubbing and polishing shall be grouted as described for the first rubbing. The final polish shall be carried out after an interval of 15 days with polishing stones or carborandum bricks of FF (finest) grade. The surface shall be polished smooth to the satisfaction of the Engineer. Similar procedure shall be followed while polishing with machine.

631. After the final polish, oxalic acid shall be dusted over the surface at 0.03 kg. per sq. m. sprinkled with water and rubbed hard. The following day, the floor shall be wiped with a moist rag and dried with a soft cloth. After the floor is completely dry, a hot mixture of turpentine and bees-wax (4:1 by weight) shall be applied to the surface and rubbed with clean cotton waste. The rubbing must be continued until the floor ceases to be sticky. It would however be preferable to use an approved type of patented floor polish, particularly on a large work involving substantial quantities of terrazo work.

632. The floor shall be protected from traffic of all kinds and damage from other sources, by the contractor at his own cost and kept covered and damp till it is given the final finish.

E. CEMENT TILE (PLAIN AND TERRAZO) FLOORING

633. *Tiles* :—The tiles shall conform to Indian Standard Specifications for "Cement concrete flooring tiles". Unless otherwise ordered the wearing surface of the tiles shall be mechanically rubbed atleast once by the manufacturer and shall have uniform colour. The wearing face of the tiles shall be plain and free from projections and depressions without cracks and shall be parallel to the bottom surface of the tile. The tiles shall be uniform in size, true and square, with sharp edges and free from twist, cracks or other defects and shall be obtained from manufacturers approved by the Engineer. The minimum thickness of the wearing layer for "General purpose tiles" shall be 6.0 mm. The wearing layer for coloured terrazo tiles shall consist of coloured terrazo finish using marble chips of best available variety and should be got approved by the Engineer before use. The contractor must produce a certificate from the manufacturer of the tiles stating that the tiles conform to I.S. Specifications No. IS 1443-1972.

634. *Floor Base* :— The floor base to which the tiles are to be fixed shall be roughened and well watered before hand. Some times, on old uneven floors a levelling Course of concrete is necessary to ensure satisfactory results.

635. *Laying* :— The tiles shall be laid in a mortar bed composed of one part portland cement to 5 parts of the clean washed sand, as ordered, with neat cement slurry mixed with pigment to match the shade of tiles between joints. Before laying, the tiles shall be soaked in water for atleast 30 minutes and then allowed to dry for about 10 minutes. It is advantageous to have the tiles damp but not wet when they are laid. Only a small amount of mortar enough for 3 or 4 tiles shall be spread at a time. As the tiles are placed in the mortar wet cement slurry, they shall be tamped down with the handle of a hammer or a trowel until their elevation is exactly in line with that of other tiles. A

square and a level shall be used on every course to be sure that the tiles are placed evenly and that the points are uniform. The top surface of the tiles shall be laid to a true plane, as directed.

636. In case the dimensions of the room do not fit a multiple of the tile dimensions, after the border is allowed for, a fractional tile can be used to fill the space. Alternatively, the border can be laid in situ to suitable dimension.

637. *Joints*: The joints shall be uniform and straight. Six or seven hours after the tiles have been laid the floor should be washed with plain water. The joints shall be then filled with neat cement slurry mixed with a pigment to match the tiles. The surplus grouting materials shall then be removed with saw dust or old gunny bags. No one shall be allowed to walk on the floor during the first 24 hours after it is finished.

638 *Curing* :— The work shall be kept wet and protected for fifteen days before starting the polishing.

639. *Polishing*:— The floor shall be finally polished in an approved manner to the satisfaction of the Engineer, and washed clean. Wherever power supply is available the floor should be thrice machine polished except for small works where hand polishing may be permitted by the Engineer.

640. *Wax polishing* :— After the floor has properly cured and set, preferably after the floor has been used for about two months, a thin coated wax polishing of approved makes shall be applied, then rubbed with cotton waste till it ceases to be sticky.

F. WHITE GLAZED TILING IN FLOORING

641. *Tiles* :— The tiles shall be of approved manufacture and quality and shall be sound, hard, well and evenly glazed, free from twist and cracks, with true and sharp arises. The rear face shall be grooved or recessed in parts to provide key for mortar.

642. *Laying* :— The tiles shall be soaked by submerging in water for a minimum period of 30 min. before fixing. The floor base to which tiles are to be fixed shall be rough and well watered before hand. The tiles shall be bedded in cement mortar as specified. The mortar shall also be applied on the back of the tiles and also thinly to the edges after which the tiles shall be pressed and tapped home. Top surface of tiles shall be laid to true plane, level or to falls as directed.

643. *Joints*:— The joints shall be uniform straight and as thin as possible. The exposed joints shall be filled up flush, with white cement slurry.

644. *Curing* :— The work shall be kept wet and protected with saw dust for ten days and thoroughly cleaned and washed afterwards.

G. MOORUM FLOORING

645. The thickness of moorum flooring should be 10 cm. after compaction it shall be laid in 2 layers of 5 cm. each. Each layer should be watered well and compacted with 1 tonne hand roller or hand rammed with heavy wooden or steel rammers. The time interval between the two layers should be as minimum as possible and the top layer laid when the base layer is in green stage after rolling/ramming.

CHAPTER VII

PLASTERING AND POINTING

A :- *Programming of work in relation to Plastering.*

701. For plastering work, all building operations requiring use of water, such as construction of brick and other types of walls, the encasement of steel columns and beams with concrete, etc. shall be so programmed that they are sufficiently dry and matured to receive the plaster without subsequent damage to plaster.

702. All service pipes, wires etc. that are to be embedded in the plaster shall be completed and suitably protected against corrosion, where necessary, before plastering is begun and the time of plastering shall be scheduled accordingly.

703. Where other building operations are required to proceed simultaneously with plastering (for example fixing of services on large contract work) special care shall be taken to programme the work so as to cause the minimum amount of interference. Plastering operation shall be so scheduled as to allow sufficient interval between undercoats and finishing coats.

704. Plastering operations shall not be started until necessary fixing, such as doors, windows and mantelpieces, fittings for light and services, etc. are completed and all pipes and conduits to be embedded in the wall are installed.

705. A preliminary inspection shall be made to ensure that the surfaces are even and suitable dry for plastering.

706. Care shall be taken to ensure that subsequent building operations do not cause any appreciable damage to the plaster work. This may be achieved by careful programming and by the avoidance of last minute alterations in the design or in the sequence of work. Where such alterations are un-avoidable permanent decorative works shall be postponed.

B.:- PREPARATION OF SURFACE FOR APPLICATIONS OF PLASTER

707. Masonry walls on which plaster is to be applied directly shall be clean and dry with joints raked to a depth of at least 12 mm.

708. The loose layer of dust on masonry shall be brushed away before the plaster is applied. A bunch of coir rope or wire brush may be used to be more effective. A freshly cast concrete surface is often covered by laitance and this shall be removed. All smooth surface shall be suitably roughened to ensure adequate bond with the plaster.

709. Suction is the force by which the plaster is held on to the surface after it is laid and till it is hardened, and this is achieved by wetting the wall suitably if it is dry or by applying a coat of cement grout, as in the case of a concrete surface with low suction.

710. The wall shall not be soaked but only dampened evenly before applying the plaster. If the surface becomes dry in spot, such areas shall be moistened again to restore uniform suction.

711. Plaster work whenever possible, shall be done on the shady side of building as it is difficult to keep walls properly damp when exposed to sun. The plastering shall not be commenced unless the preparatory work is passed by the Engineer.

C :- PREPARATION OF MORTAR FOR PLASTER

712. Deleted.

713. *Cement plaster :* Cement and sand shall be mixed dry in the specified proportions to obtain a uniform colour. Water shall then be added to get the required consistency for the plaster.

714. Cement mortar shall be used within half an hour after the addition of water to cement provided it is kept agitated or turned over at intervals of at least 20 minutes. Any mortar for plaster which is partially set shall be rejected and removed forth-with from the site.

715. Mixing is to be done on a clean water tight platform. Correct proportion of sand is to be measured in boxes of appropriate size in relations to the standard cement bag and the assigned mix. During mixing the mortar shall be hoed back and forth with water and well turned to ensure uniform mix.

716. *Use of cinder :-* Where sand is not available the Engineer may permit the use of cinder in type I and II quarters or any similar light structures. Cinder should be hard and coarse collected from the bottom layers of old dumps, at least 1 metre below the surface. Cinder should be thoroughly washed for removing sulphur and foreign matters. This should be dried, crushed and selved through 3 mm square mesh to eliminate larger pieces. For plaster work cinder should be used with cement only. The cinder should conform to specification No. 8 (b)-for Coal Ash.

D :- APPLICATIONS OF PLASTER

717. In the case of cement plaster, the commencement of the set is accompanied by a noticeable stiffening of the mix. In the case of cement plaster heavily gauged with lime, however, it is not always obvious to the operator when the set has started and it is with this type of mix that the retention of the full measure of strength afforded by the cementitious material is particularly important. Such plaster may be overworked both before and after application with resultant impairment of the set of the gauging plaster. This not only reduces the strength of the material, but also gives it the shrinkage characteristics of a pure-lime plaster with its liable accompaniment of the surface cracking. It is essential, therefore, that mixes shall be used as soon as possible after water has been added.

718. For external plaster, the plastering operations may be started from the top and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame is ready and the temporary supports of the ceiling resting on the wall or the floor have been removed.

719. The first undercoat is then applied to ceilings and walls. It is an advantage to plaster the ceilings first to permit removal of scaffolding before plastering the walls. In the case of high roofs the same scaffolding may be needed for plastering the top portions of the walls.

720. The rendering coat (where necessary) shall be approximately 10 mm. thick and carried to the full length of the wall or to natural breaking points like doors and windows. Before the rendering coat hardens, it shall be deeply worked, and done to a rough surface to provide mechanical key for the second coat if any. In case of 12.7 mm. thick cement plastering, the floating coat of 3 mm. thickness shall be applied while the under coat is still to set and the surface rubbed smooth.

721. The Schedule provides rates for 10mm, 15mm, 20mm & 25mm. thick plastering. The thickness of plaster to be adopted will be decided by the Engineer in each case unless otherwise provided for expressly in the detailed working drawings.

722. After suitable time interval, the second coat may be applied. After a further suitable time interval, the finishing coat may be applied first to the ceilings and then to the walls. The hardened coat shall be dampened evenly before starting the application of the subsequent coat.

723. Sometime, ends of scaffolding battles have to be housed in the wall which is being treated with plaster. In such cases after the battles are taken out, the hole or holes left in the wall shall be filled up with brick and mortar, and the patch plastered up true, even and smooth in conformity with the rest of the wall, so that no sign of any patch work shows out.

724. Where corners and edges have to be rounded off, such rounding off shall be completed along with the finishing coat to prevent any joint marks showing out later.

E. NEERU FINISH. Para 725-728 Deleted.

F:- CURING

729. To develop maximum strength and density in the plaster, it is necessary to cure cement plasters properly. Each coat shall be kept damp continuously for at least two days. Moistening shall commence as soon as the plaster has hardened sufficiently and is not susceptible to damages. The water shall be applied by using a fine fog spray or common water spraying syringe. Socking of wall shall be avoided and only that much of water as can be readily absorbed shall be used. Excessive evaporation on the sunny or windward sides of buildings, in hot dry weather, may be prevented by hanging mattings or gunny bags on the outside of the plaster and keeping them wet.

The finished plaster shall be kept wet for atleast seven days.

G :- POINTING

730. In face work that is to be pointed, care must be taken that raking out of joints to a depth of atleast 12 mm. is carried out while the mortar is still soft and fresh.

731. The pointing will be done as the masonry progresses; if and when specially ordered otherwise the pointing will be done on completion of the whole work.

732. Before pointing is commenced the whole surface is to be properly cleaned with cocoanut husks wire brushes to produce a clean smooth surface. On no account any chipping of the bricks is to be permitted.

733. The mortar for pointing will generally consist of one part of cement to three of sand. Only that much of mortar must be prepared at a time as can be used up before initial setting takes place.

734. All pointing must be neatly and cleanly done, and no mortar should appear smeared over the face of the stone or bricks. Horizontal lines must be truly horizontal and vertical lines truly vertical except in case of Random Rubble masonry.

735. It is sometimes desirable to emphasize the pointing by making the joint lines of a darker colour, and this can be effected by an admixture of charcoal or ash in the mortar.

Curing is to be done similar to plastering.

736. *Cement Punning :* Cement punning at 13.5 Kgs per 10 sq.m. is generally done in dados, skirting and floor finishing.

CHAPTER VIII

ROOFING

801. Before putting on the sheets, it must be ensured that the roof trusses or rafters are properly set in position; purlins fixed at proper places in relation to the lengths of sheets to be used. Their level and alignment also must be checked by a string. Variations in level should be adjusted first by raising or lowering the purlins or rafters as necessary.

A :- CORRUGATED IRON SHEET ROOFING AND WALLING

802. The sheets shall be laid with laps of 15.0 cm. at the ends of one or two corrugations at the sides, starting the laying from the side opposite that of the prevalent winds in the monsoon.

803. For the galvanised iron Sheets, screw or bolt holes are to be drilled and not punched, from the inside towards the outside, about 23.0 cm. apart on the sides, and at every second corrugation on the ends, care being taken that all holes shall occur in the ridge of the sheet as laid, and never in the valley of the corrugations.

804. The sheets shall be carefully set on the purlins and fastened to them by best quality approved galvanised iron screws and washers or by bolts and washers as may be shown on the drawing or specified by the Engineer. The galvanised iron bolts shall be used with 'Limpet' washers.

805. The ridges and hips shall be of neat galvanised sheets of specified gauge with a 30.0 cm lap on each side, securedly fastened down so as to prevent the rain driving under it.

806. Wind ties should be provided on all roofs. Particularly for open sheds or varandahs where the wind can get under the roof, it is absolutely necessary to fasten down sheets by continuous length of flat iron 50 mm. x 6 mm. wind ties. At least one wind tie will normally be required for each row of sheets, on the slope of the roof.

B :- ASBESTOS CEMENT SHEET ROOFING

807. Cat ladders or roof boards must invariably be used by men working on the roofs. No unauthorised person shall be permitted access to any area over which the sheeting is being laid. Where it is not possible to keep this area clear, the contractor shall take necessary protective measures for the safety of the persons getting access to the area.

808. The asbestos cement sheets shall be handled and stored in the best possible manner so as not to damage the sheets in any way. All damages caused due to careless handling or storing shall be borne by the Contractor. The sheets shall be stacked on Firm and level ground laid on wooden battens according to the stacking methods specified by the manufacturers and protected from damage. When they are stacked for any length of time they shall be stored under cover.

809. Asbestos cement materials shall be cut with a saw and drilled with brace and twist drill. The hole shall on no account be punched. The hole shall be 1.5 mm. larger than the diameter of the fixing bolts and shall always be drilled through the crown of the corrugations and never on the flats or valleys. The holes for fixing the sheeting shall be drilled in the exact position to suit the purlins, i.e., on the centre line of the purlins, if these are of timber and square head coach screws are used, or as close as possible to the back of the purlin if steel angles are used. To achieve this object it is necessary to drill the holes on the sheets after these are put in the correct position.

810. All sheets and accessories found to be cracked after fixing shall be replaced by new ones. The cracked sheets so removed shall be salvaged by the contractor by cutting into smaller but sound lengths where ordered. Nothing extra shall be paid for such work.

811. The nuts of J bolts, crank bolts or heads of coach screws should bear on a galvanised iron washer which in turn shall be bedded on an approved type of bitumen washer. The screws or bolts shall be tightened sufficiently to seat the bitumen washers properly over the corrugations.

812. Unless otherwise specified in the manufacturer's instructions, where 4 corners of sheets overlap, two of them must be mitred (Cut off.).

813. Asbestos cement sheets and accessories shall be laid strictly in accordance with the manufacturers instructions which must be obtained before starting the work. Principal instructions for laying "BIG SIX" type corrugated sheets and "Trafford" type semi corrugated sheets are given below :-

(a) The purlin spacing shall not exceed 170 cm.

(b) The spacing of members for side walling shall not exceed 200 cm.

(c) Free overhang at eaves shall in no case be more than 38.0 cm.

(d) All sheets shall be laid with their smoother side towards the weather.

(e) The end laps (i.e. horizontal laps) shall not be less than 15.0 cm. for roof having pitches of $21\frac{1}{2}°$ or more. For flatter (less than $21\frac{1}{2}°$ pitch) roofs and normal pitch ($21\frac{1}{2}°$ and above pitch) roof in position of severe exposure, the end laps shall be increased to 20 to 30 cm. as directed by the Engineer.

(f) **Side laps :—**

(i) The sheets shall be laid with side lap of half the corrugation starting the laying from the side opposite that of prevalent winds in the monsoon (i.e. side laps shall be laid on the side facing away from the prevailing winds and rains.)

(ii) All Trafford sheets have one end marked "TOP" on the smooth side of the sheet. This end must always point towards the ridge. The sheets shall be laid with a side lap of one corrugation the left hand small corrugation of each sheet being covered by the right hand large corrugation of the next sheet.

(g) **Laying :—**

(I) The "BIG SIX" sheets when laid from left to right shall be laid as under :-

The sheets shall be laid from left to right starting at the eaves. The first sheet shall be laid uncut, but the remaining sheets in the bottom row will have the top left hand corners cut or "mitred". The sheets in the second and other intermediate rows will have the top lefthand corner and the bottom righthand corner cut with the exception of the first sheet in each row which will have only the bottom righthand corner cut and the last sheet in each row which will have only top lefthand corner cut. The last or top row sheet will have the bottom righthand corner cut with the exception of the last sheet which shall be laid uncut. If the sheets are laid from right to left, the whole procedure shall be reversed.

The "mitre" described above is necessary to provide a snug fit where 4 sheets meet at a lap. It is out from a point 15.0 cm. (or whatever the length of the end lap may be) upto to vertical side of the sheet to a point 5 cm. along the horizontal edge. This cutting may be done with an ordinary saw at site.

(ii) The "Trafford" sheets shall be laid from right to left starting at the eaves. The first sheet shall be laid uncut but the remaining sheets in the bottom row will have the top right-hand corner cut or mitred. The sheets in the second and other intermediate rows shall have both the top righthand corner and bottom lefthand corner cut with the exception of the first sheet in each row, which shall have only the bottom lefthand corner cut, and the last sheet in each row which shall have only the top righthand corner cut. The last or top row sheets shall have the bottom lefthand corner cut with the exception of the last sheet which shall be laid uncut.

The "Mitre" described above is necessary to provide a snug fit where four sheets meet at a lap. The length of the mitre is 15.0 cm. (or whatever the length of the end lap may be) and the width is equal to the width of corrugation.

(h) All fixing accessories shall be of galvanised iron and machine made. Hook bolts, and coach screws shall be 8 mm. dia and shall be inserted through 11 mm. holes drilled (not punched) in the crown of the corrugation. Each accessory shall be provided with one bitumen impregnated asbestos-felt underwasher and one G.I. washer. Coach screws for fixing sheets through wood work shall be normally 11 cm. to 13 cm. long, hook bolts shall normally be 8 cm. + depth of purlin for single sheet fixing and 9 cm. + depth of purlin where 2 sheets overlap or where ridges or other accessories are to be fixed with the sheet. G.I. seam bolts shall be used in stitching ridges, corner pieces, finals, etc.

C:- LIME TERRACING ON FLAT R.C. ROOF - Para 814 to 819 Deleted.

D :- TARFELT

820. Waterproofing roofs using bitumen impregnated felt or similar fabric over reinforced concrete slab or on old lime terracing.

When bitumen or tar are proposed to be used, the following specifications are to be followed :-

821. The work shall generally be done in dry weather as the tar or bitumen will not stick properly to damp surfaces.

822. Roofing Felt will fully conform to specification No. IS: 1322-1982 Type-3, Grade-I, for Bitumenous felts of Indian Standards Institution and each roll of Roofing Felt will bear the certification mark of the said Institution. In this connection the code of practice No. IS : 1346-1976 of the Indian Standards Institution may also be referred to for laying treatment which should be followed if directed without any extra cost.

823. The roof is to be thoroughly cleaned of all foreign matter. Any previous treatment is to be cleaned off completely. All cracks are to be cut open and filled with 1:3 cement mortar, depressions on the surface of the roof are to be filled up with cement mortar to allow a free flow of water towards the outlet drains. Where there are parapets, the roofing is to be turned up atleast 15 cm. from the surface and tucked into the parapet to a depth of atleast 5 cm. The roofing is to be similarly turned up against and tucked into chimney stacks, tank supports or similar

masonry structures on the roof. All junctions between the horizontal and the vertical are to be levelled off.

824. The roof shall then be treated with an approved tar or bitumen primer 1.464 Kg/Sq. m. at the correct application temperature over which the felt is to be laid, commencing at the lowest level and working towards the highest, thereby ensuring that the cover laps of the strips do not oppose the direction of flow of water, all over laps shall be at least 8 cm. Flashings to parapets and other vertical surface are to be made of independent pieces of felt with an overlap of at least 8 cm. on the previously laid surface and the treatment taken up at least 15 cm. from the roof surface and tucked in 5 cm. and pointed. At drain, outlets, the felt is to be taken down as far as possible, the lower and two outer sides being treated with separate pieces of felt. All junctions between the horizontal and vertical are to be properly treated to guard against any leakage through the same.

825. The surfaces of the felt shall then be thoroughly brushed clear off of all loose mica, dust and other impurities after which bitumen or tar of approved type shall be applied at the correct application temperature uniformly on the surface at a rate of not less than 0.7 Kg/Sq.m. The roof shall then be covered with gravel at the rate of 0.006 Cu.m/Sq.m. the vertical flushing being sealed only but not finished with gravel.

826. The pea gravel shall be of 6 mm. size.

827. The top layer is to break joints with the underlaid tar or bitumen at the appropriate temperature. The top layer of felt is to be screeded with an approved type of tar or bitumen laid at the correct temperature and finished with pea gravel. The whole treatment in general shall conform to the relevant sub-clauses of this specification.

828. In ordinary residential buildings, the roof shall also be treated with bitumen or tar of approved Quality at the rate of 1.464 Kg/Sq.m and then top impregnated with stone grit of 6mm size at 0.006 Cu.m.

E:- REPAIRS TO TERRACED ROOFS

829. If a special compound is being used, the maker's direction must be followed. Otherwise the following should be done.

830. If there are visible cracks in the concrete, holes should be made with a brace bit about 25 mm. deep at every 15 cm. A mixture of neat cement and water mixed to make a thick fluid should be pumped into each hole with a garden syringe till the crack overflows. It may be necessary to pump in some more of the cement cream if the edges of the cracks show as the water in the cream is drawn off. The excess cement can be scrapped off the roof in an hour or so after the work is completed.

831(a) If the roof is porous, it should be cleaned of all fungus and slime, and two washes should be made (1) a solution of 34 Kg. bar soap shredded and dissolved in 4.55 litre of boiling water and (2) a solution of 0.113 Kg. alum in 4.55 litre of boiling water.

(b) These solutions should then be laid on alternately with whitewash brushes till the roof has had three coats of each. At least twelve hours elapse between each coat, and care must be taken not to work the wash up into bubbles when laying.

(c) For the best results this work should be done when the roof is thoroughly dry, and if possible, in sunny weather.

F :- REPAIRING OF CRACKS WITH CEMENT OR TAR/BITUMEN

832. *Cleaning* :— The cracks shall be cleaned out and in case of large cracks, uneven and broken edges shall be cut to from V-shaped groove at least 6 mm. wide.

833. *Repairing with cement* :— When repairing of cracks is specified tc be done in cement, the cracks shall be thoroughly flooded with water and allowed to soak in before filling them with cement slurry which should preferably have some anti-shrinkage compound of approved quality. After completing the repairs the work shall be cured for at least seven days.

834. *Repairing with tar or bitumen* :— (a) When cracks are repaired with tar or bitumen mixture, they shall be absolutely dry and clean, unless special type bitumen emulsion like "colas" is used. When crack leaks the following additional treatment is desirable.

(b) Cut 15 cm. wide x 13 mm. deep chase over the crack and after filling the crack with Bitumen bound the surface with 6 mm. thick Bitumen and cover with strong heslan strip. Pour Bitumen over the heslan about 3 mm. higher than the surface of the roof to allow for shrinkage. Spread pea gravel over the Bitumen.

(c) The filler shall be well tamped into the cracks with the edge of a trowel and left flush with the Surface of roof.

(d) The repaired cracks must cause no ridge across the direction of the slope of roof.

CHAPTER IX

WOOD WORKS

901. *Doors and windows* :— Timber Doors and Windows are classified into the following categories :-

(a) Teak wood frame with Teak shutters.
(b) Bija sal frame with Teak shutters.
(c) Sal frame with Bija sal shutters.
(d) Timber/wood (other than teak, Bija & Sal wood) of approved species frame and shutters.

902. *Permissibie defects* :— Defective knots such as decayed knots, loose knots, knot holes etc. may be permitted only in the 3rd and 4th category of Doors and Windows provided that they shall not unduly weaken the member and further that they shall be plugged if they appear on the exposed edges.

903. *Defects Prohibited* :— Timber for doors, windows and ventilators shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, borer holes, splits and cracks.

904. Moisture content :— Frames or panels made out of timber with excess of moisture tend to warp subsequently at loss of surplus moisture. Depending on the kind of timber, moisture content is desirable to be within 16 to 20 percent for frames and 10 to 16 percent for shutter.

905. *Plywood* :— Ply wood should not be used for panels of exterior doors and windows. Wherever used the ply wood should conform to I.S. specification No. IS : 303-1975.

906. *Inspection and measurements* : All timber will be inspected by the Engineer or his representative before being used, and any rejected by him shall be removed from the work site forthwith. The Engineer or his representative shall at all times have access to the Cotractor's works and premises whether situated on Rly. land or elsewhere to inspect the material used and the quality of workmanship executed on any works in progress.

907. The Engineer or his representative shall not be barred from rejecting any wrought timber on account of defective quality by reason of his having previously passed the same timber before it has been worked upon.

908. All doors and windows must be inspected and passed by the Engineer before being put into the work and no painting is to be done until the wood work is passed.

909. *For doors and windows* :— The overall sizes as well as the details should strictly conform to the specified dimensions as approved by the Engineer.

910. Measurement of wood work will be taken in cubic measures for frames and square measures for shutters respectively.

CONSTRUCTION AND WORKMANSHIP

911. All assembly of shutters of doors, windows, ventilators and frames thereof shall be exactly at right angles. In the case of frames, the right angle shall be checked from the inside surface of the members.

912. All the members should be straight without any warp or bow and shall have smooth well planed faces at right angles to each other.

913. Horns if provided should not be less than 6.5 cm. in length.

914. Heads, posts, transomes and mullions of door and window frames shall be made out of single pieces of timber only. The heads and posts shall be throughout tenoned into the mortices of the jamb posts to the full width of the latter and the thickness of the tenon shall not be less than 1.25 cm. Transomes shall be throughout tenoned into the jamb post in the same manner. The tenons shall be close fittings into the mortices and pinned with corrosion resisting star shaped metal pins not less than 10 mm. diameter. The depth of rebate in frames for housing the shutters shall in all cases be 1.25 cm. and the rebate in shutters for closing in double shutter doors or windows shall not be less than 20 mm.

915. Styles, rails and solid panels in door and window shutters shall be of the same species of timber. So also shall be the members of the frame.

916. Styles and end rails of shutters shall be made out of one piece only. Lock and intermediate rails exceeding 20 cm. in width may be made, out of one or more piece of timber but the width of each piece shall not be less than 7.5 cm. where more than one piece of timber is used, they shall be jointed with a continuous tongued and grooved joint glued together and reinforced with metal dowels at regular intervals not exceeding 20 cm. Jointed pieces of timber shall belong to the same species.

917. *Panelling* :— Solid wood panels shall be made out of one or more pieces of timber of not less than 12.5 cm. in width. In order to avoid warping, splitting and cracking, normally pieces not exceeding 20 cm. in width, should be used. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved joint glued together and reiforced with metal dowels. The grains of the solid panel shall run along the longer dimension of the panel. Panels shall be framed into grooves to the full depth leaving an air space of 1.6 mm. and the faces shall be closely fitted to the sides of the grooves. Opening for glazing shall be rebated and moulded out of solid timber and shall be provided with mitred glazing beads closely fixed in position. The panels shall be designed such that no single timer of plywood panel exceeds 0.5 Sq. m. in area.

918. The contact surfaces of tenons and mortices shall be treated before putting together with a suitable adhesive like animal glue for wood work or synthetic resin adhesive. Tongued and grooved joints shall also be properly glued together.

919. *Tolerance* :— The tolerance on overall dimensions of doors and windows and size of shutters shall not exceed + 3 mm. and - 0.0 mm.

920. *Size of doors and windows* :— Appropriate size of the doors and windows to be chosen from the list of sizes given in the drawing.

921. *Fittings* :— Three holdfasts of approved size and design shall be fixed on each side of a door frame, one at the centre point and the other two at 30cm. from the top and the bottom of the door frames. In case of windows, a pair on each side shall be fixed at quarter points of the frames.

922. Each door shutter shall be fixed to the frame with three hinges of the type specified in the schedule one at the centre and the other two at 24cm. from top and the bottom of the shutter. Each window shutter shall be fixed to its frame with two hinges of suitable type at quarter points.

923. Each door and window shall have the minimum fittings of one tower bolt, one handle, two cleats on interior side of the doors and windows and one metal lock bar on the exterior side for the doors where necessary. These are the minimum fittings to be provided for ordinary doors and windows. For any bigger size doors and windows, extra fittings are to be provided as advised by the Engineer-in-charge. Payment will be made for all fittings as per schedule separately.

924. Sample for fittings should be submitted to the Engineer-in-Charge well in advance for his approval who shall retain this till the completion of the work. Rates in the schedule of rates are inclusive of labour and material for these fittings.

925. End of all timbers resting on masonry or frames and horns etc. that go and butt against the masonry shall be protected against moisture and decay with coating of coaltar or other suitable protective materials. The proportion being 0.90 kg. of lime with 4.5 litre of Tar. This is included in the rates.

926. GLAZING :—

(a) The glass used for panels shall be of good and durable quality to be supplied by the Contractor shall be of 5 mm./3 mm. in thickness. The particular type, quality and shade shall be as agreed to between the Engineer-in-Charge and the supplier.

(b) The glass shall be embedded in putty and secured to the rebate by wooden beads of suitable size and shape.

(c) For external glazed doors and windows, the beadings shall be fixed on the outside.

(d) Wash leather, ribbon velvet, rubber, flannel, felt asbestos or other similar materials may be used in place of putty for internal glazing. The materials shall be fitted either as a bedding on one side or in such a manner that it covers all parts of the glass which will be covered by the beads.

(e) No glazing is to be considered complete until all stains have been removed from the surface of the glass and wood work.

(f) No glass is to be inserted in frames until the frames have been primed and prepared for painting, so that the putty may adhere properly.

(g) The Contractor shall make good any glass broken by his workmen whilst cleaning.

(h) All the windows shall be cleaned, all damaged putty or glazing shall be repaired to the satisfaction of the Engineer.

(i) For steel frame doors and windows special metallic putty and clips as specified by the Makers are to be used.

927. WOOD WORKS OTHER THAN DOORS & WINDOWS :

All timber and wood works (other than doors and windows) in a building should, after it has been passed by the Engineer, have the priming coat of paint or oiling put on before being fitted in position particularly in case of roof work. All nail holes and cracks should then be made good with putty and all knots killed with quick lime and stopped with red lead and oils and the surface pumised or rubbed down with sand paper in readiness for the second coat of paint, which should be applied after the wood work has been fixed in position.

Note :— Priming alone does not provide full protection against weather and therefore all works should receive further coats, polish or varnish as the case may be within a reasonable period. Any cut surface, particularly that exposing the grain should be primed before the joinery is in position.

CHAPTER X

PAINTS, POLISHES, VARNISHES, WHITE & COLOUR WASHING

A. GENERAL

1001. New wood work is to be given two coats of paints; these coats are exclusive of the priming coat.

1002. The outside of the chowkats of doors and windows which are against the brick work, as also all other timber embedded in brick work, is to be given two coats of boiling coal tar before erection, the payment for which will be made as per item 18 of Section 'J' separately.

1003. Paint should not be applied to wood-work unless it is well seasoned. The surfaces to be painted must be thorcughly dry, clean and smooth.

1004. All wood work should be rubbed smooth with sand paper, first with a coarse grade about $2^1/_2$ and then finished with a medium grade of paper, say $1^1/_2$ when finished, no scratches from the coarse paper should show. Surface of wood work should be finished to the satisfaction of Engineer and got approved before painting, polishing or varnishing.

1005. Kill the knots with patent knotting or with knotting made as follows:-

To 142 gm. of shellac add 0.56 litre of methylated spirit, and when thoroughly dissolved, stir in 14 gm. of red lead.

1006. The paint is to be thoroughly ground up in pure linseed oil in the proper proportions in a paint mill of approved pattern. if the paint to be used is supplied ready mixed, it must be reground in a paint mill before use, so as to ensure thorough and uniform mix. The paint is to be used as soon after remixing as possible (Paints are to be thinned by adding pure boiled linseed oil only).

1007. In repainting old work, the procedure should be as follows :-

(a) Clean with lime wash or soapwash filling all holes with putty. If old paint is blistered, rub down and scrap and then bring forward with 3 or 4 touchings before the general surface is begun. If old paint is greasy with smoke, clean with spirit or turpentine before painting.

(b) Putty for stopping holes in wood work should consist of 85 gm. linseed oil, to 454 gm. of whiting i.e. absolutely dead lime.

1008. Samples of all paints are to be submitted to and got approved by the Engineer before ordering.

1009. The priming, undercoating and finishing coats shall be of distinctive tints.

1010. Finishing coats of paint shall be of such colours as directed by the Engineer.

1011. Preliminary trials of colour proportion shall be made and approved by the Engineer and when approved the whole batch to be used on any one surface shall be prepared at once in order to avoid colour variations.

1012. In no case shall any paint be applied to any concrete cement or plastered surfaces until at least 4 months have elapsed after the completion of the work, or when approved by the Engineer. If any fine crystalline salt deposits are then visible on the surface the whole of the arsas to be painted shall be cleaned down with muriatic acid solution.

1013. Sample boards showing tints of all paints to be used are to be prepared by the Contractor and submitted to the Engineer and no painting is to be done until such samples have been approved by the Engineer.

1014. All paint on wood work shall be rubbed down with fine glass paper between each coat. Each coat shall be hard dry and free from moisture or condensation before the next coat is applied. The finishing coat shall be of approved tint. The work shall not show any hair mark, ridges or drops of paint; and puddle in the corner of panels, angles, mouldings etc. shall not be left.

1015. All iron and steel work before painting is to be scraped and cleaned with wire brushes and finally with rag until all grease, scale, rust and loose substances are removed. Each coat is to be carefully and evenly applied. No coat is to be applied until the previous coat is hard, dry and free from moisture.

1016. Kerosine oil shall not be mixed with any paint under any circumstances.

B. CEMENT PAINT (Snowcem etc.)

1017. Cement paint shall be of approved manufacture and quality. It should be mixed and applied in accordance with the manufacturer's directions.

1018. Before painting is commenced on a surface, all dirt, oil, grease, efflorescence and paints of organic type shall be completely removed. Traces of oil from forms remaining on cast-in-situ concrete work shall be carefully removed by steel brushes or abrasive stone. If there is a general coating of oil on the surface, the entire area to be painted shall be lightly sand blasted.

Efflorescence on concrete surfaces shall be removed by wetting the surface and then scrubbing with a 20% solution of Muriatic Acid.

1019. When the surface to be painted is very smooth it shall be acid-washed or rubbed with abrasive stone to obtain a slightly roughened surface.

1020. Before the paint is applied, the surface to be painted shall be dampened uniformly. The surface shall be sprayed several times with a few minutes interval between each spraying to allow the moisture to soak into the surface.

1021. The cement paint shall be applied in the specified number of coats. After the first coat of paint has hardened sufficiently it shall be cured by keeping the surface damp for at least 24 hrs.

The surface shall be wetted again just before applying the second coat. At least 24 hours shall elapse between application of the two coats. The second coat shall be moistened with a fine spray as soon as the paint has hardened sufficiently to prevent marring the surface. It shall then be kept damp for not less than 2 days.

1022. To start mixing, only 1/2 the required amount of water shall be added to the powder and thoroughly mixed to a stiff paste. Water shall then be gradually added till the desired consistency is obtained. Paint should be stirred until all the particles are wet and is uniform. The paint shall be kept stirred during use and no paint which has been mixed for a longer period than one hour shall be used.

1023. In so far as is practicable, cement paint shall be applied in the shade. Open sunshine shall be avoided especially during warm windy weather.

1024. Brushes used for cement paint shall have short stiff fibre bristles. Spray gun application of paint may be employed if approved by the Engineer.

C. PAINTING IRON AND STEEL WORK

1025. The surface to be painted shall be thoroughly cleaned and shall be dry and free from dust, rust and scale. All steel work shall be thoroughly cleaned with wire brushes or steel scrapers and cotton waste or cloth, all rust and old paint being removed to the satisfaction of the Engineer before painting is commenced.

1026. The make, quality and shade of the paint used shall be duly approved by the Engineer and number of coats to be applied shall be as directed by the Engineer.

1027. The work shall be fully painted over in two or three coats as may be stipulated, of the special paint and when feasible, each coat shall be of a shade easily distinguishable, from the under coat on the same work, as a check on the number of coats applied. The said shades shall be approved and fixed upon by the Engineer, who shall also determine the particular shade to be used for each coat according to its sequence.

In the case of bridges in sections, where the sea atmosphere is likely to have a corrosive effect on the steel work, the steel work should be given a coat of raw linseed oil before the first coat. 3.37 litres should normally cover every 100 sq. m. of area.

1028. In no case shall one coat be applied over another until the previous coat had at least 3 clear days for drying and has been inspected and passed. The painting shall be done only in dry weather, and when the work is free from dust and moisture. Each coat shall be thoroughly worked in with the brush and the paint laid over evenly without brush marks. As soon as the surface has been covered as evenly as possible, the brush should be passed over it in a direction at right angles. Paint shall be applied by means of suitable brushes. Application by means of rags or inferior brushes will not be allowed.

1029. The following size of brushes are generally used :-

a) For dusting large flat surfaces-size 35.5 cm. to 30 cm.

b) For Girder work = Size 20 cm. to 10 cm.

c) For Wood work = Size 15 cm. to 5 cm.

d) For fine work = Size 10, 5, 2.5 & 1.3 cm.

D. PAINTING WOOD WORK

1030. Each coat of paint shall be allowed to dry thoroughly before the next is laid, and all except the last coat shall be slightly rubbed down with sand paper as ordered. About 0.45 kg. of pumice stone is required for 93 Sq. metre for rubbing down old surfaces. The work shall not show any hair marks, ridges or drops of paint and no puddles in the corners of panels, angles of mouldings, etc. shall be left. When the surface is dry priming coat shall be applied before the paint of the required colour or tint is applied on new woodwork.

1031. *Oiling* :— Wood work not exposed to weather may be oiled with pure double boiled linseed oil, instead of being painted, if so directed by the Engineer. One coat for old work and two coats for new work in dry weather are generally required. The wood work must be thoroughly cleaned, rubbed down dry and smooth before applying the coats of oil.

E. VARNISHING

1032. Wood work to be varnished shall be finished smooth with the plane and shall not show where shavings have broken off or the plane has jumped. It shall then be rubbed smooth with medium and fine sand-paper. In no case the sand paper shall be rubbed across the grains, as in this case even the finest marks will when the work is finished.

1033. The wood work shall then be sized with thin clear glue, which shall be applied hot. It shall then be rubbed down and sized with the same sizing nearly cold, if the wood work is to be stained, the staining colour shall be mixed with the second coat of size which must be applied regularly, evenly and quickly, keeping the colour on the flow. Joining up with work already dry will result into patchy and blotchy work.

1034. The surface shall then be rubbed down lightly with fine sand-paper, taking care to rub along the grain and to leave the colour even, and the first coat of good copal varnish applied. As far as possible, varnishing should be done in dry weather.

1035. If two or three coats of varnish are ordered the first coat of varnish shall be rubbed down with fine sand-paper and second and third coats applied according to orders.

F. POLISHING

1036. The wood to be polished, should first be painted with a filler composed of 2.27 Kg. of whiting mixed in1.5 litres of spirit left to dry and then sand-papered. A thin coat of polish should then be applied and sandpapered before applying second and third coats.

1037. A good French polish can be made by dissolving the following ingredients in 13.5 litres of methylated spirit :-

Shellack black	—	1.4 Kg.
Olibanum	—	0.23 Kg.
Gamboge	—	0.23 Kg.
Copal or sandarac	—	0.23 Kg.
Gum Benzoil.	—	0.23 Kg.

1038. The gums are crushed small and added to the spirit and the mixture is agitated until the gums are dissolved. A warm bath aids the operation. Alternatively, ready mixed french polish of approved make may be used if so directed by the Engineer.

G. WHITEWASHING

1039. The surface to be white washed shall be thoroughly cleaned of all blots, mortar drops or foreign matter by means of coir rope or coooanut husks or brooms before white wash is applied. The white wash shall be prepared from shell lime/fresh white stone lime of approved quality.

1040. Unslaked lime shall be placed in a large vessel full of water and shall be thoroughly mixed and stirred up until the mixture attains the consistency of thin cream. It should then be strained through a clean cloth and mixed with 1 kg. of boiled gum for every 240 Kg. of lime. The white wash shall then be applied with a brush vertically and horizontally alternately to a smooth, uniform and white finish, the finishing coat being applied vertically. Doors, windows and floors must be protected from being splashing with white wash, splashing and dropping if any, shall be removed completely and the surface cleaned without extra payment. Each coat of white wash should be allowed to dry and should be approved by the Engineer or his representative before applying the next coat. When dry, the coat of white wash should show no signs of cracking nor come off easily on the finger when rubbed.

1041. When lime wash is to be used for disinfecting purpose, it should be applied hot, the necessary heat being obtained by placing lime which is not fully slaked direct into the mixture and applying the mixture to the walls at once.

H. COLOUR WASHING

1042. The specification for white washing shall apply generally to this work also the only difference being that the necessary amount of colouring matter according to the tint required should be added to the white wash. No colour wash should be done unless the Engineer has approved and passed a sample of the required colour. The sample should not be obliterated and if the contractor should deviate from the selected sample, he shall, at his own expenditure, recolour-wash the whole building or buildings to the satisfaction of the Engineer.

1043. The colour wash, whether inside or outside, must be of uniform tint. Old blots or the colour of the old surface should not show up through the finished surfaces.

1044. For new work two coats of white wash must first be applied. For recolour washing, the old colour should be broomed/brushed and washed off and a coat of white wash applied to kill the old colour wash.

I. DISTEMPER

1045. The material used for distemper should be of genuine manufacture and approved by the Engineer. The surface should be cleaned before applying the distemper and the marker's instructions shall be carefully followed.

1046. The finished surface shall present a uniform colour and smooth texture before application of the distemper.

1047. Second or succeeding coats shall not be applied until the preceeding coat has been passed by the Engineer and permission given to proceed with the succeeding coat. Failure to abide by these instructions may result in the contractor having to do the coat over again or to have reduced payment for one coat only. All splashes of distemper on the floor, window sills, wall or elsewhere shall be cleaned up immediately on completion by the Contractor at his own expense. The finished surface of distemper should be such that the distemper does not come off by rubbing with fingers.

1048. The Indian Standard Specifications I.S. 427-1965 & I.S. 428-1969 respectively for dry and oil emulsion distemper shall apply.

1049. *Distempering New walls :* The plastered walls to be distempered should have a fine polished surface and shall be absolutely dry. If the work does not have a polished surface it should be sand papered thoroughly to produce an approved clean and smooth surface. Two coats of distemper over the priming coat should do. New plaster must be allowed to dry up sufficiently, before any treatment is attempted.

1050. *Distempering old walls :* If the old wall is covered with distemper, the same shall be removed by washing lightly with soft cloth with plenty of warm-water or by some other suitable method. In case the wall is coloured or white washed, the wash must be removed thoroughly first. All holes and depressions shall be filled with gypsum, which should be allowed to set and dry completely before distempering is done. The walls shall then be sand papered and in case the surface is still rough, a coat of white chalk mixed with glue should be applied, as base coat and distempering done over the same. Generally no coat of priming would be rubbed in this case and one coat of distemper should suffice.

1051. *Mixing :-* Distempers should not be mixed in quantities larger than that required for a day's work to have uniformity of shade.

1052. *Application :* Distempers should be applied in dry weather with a broad stiff brush, and after the first coat has thoroughly dried, another Coat should then be laid on. The first coat should always be of a lighter tint and should be applied with care. The brushes used should never be allowed to rest on the bristles and after use they should be carefully and thoroughly cleaned.

1053. *Maintenance :* Old distempered walls may be lightly washed in dry weather with a soft cloth and plenty of water. No attempt should be made to wash distempered walls during the monsoon.

CHAPTER XI

ROADS

A:- GENERAL

1101. *Classification :*

(a) Service or Temporary Roads.

(b) Roads for light traffic only e.g. Path ways to give access to bungalows and residences.

(c) Main Roads i.e. permanent colony roads, station approach road, circulating area in station premisses or metalled portion of level crossings.

1102. *Earth work for road :*

(a) For earth work, Chapter II may be referred to.

(b) Formation width should be 3.35 m. for a single lane traffic, and 6.70 m. for double lane or as directed.

(c) Wherever possible formation should be allowed to settle for a year before undertaking metalling work.

1103. *Drainage :*

(a) Adequate drainage should be provided, side drains and catchwater drains of sufficient size being provided to carry the rainfall at all times.

(b) For drainage over the surface of the road a camber of 1 in 60 to be used for bituminous tarred surface or 1 in 40 for other surfaces not finished with bitumen and tar.

B :- SERVICE OR TEMPORARY ROAD

1104. These roads being temporary, Engineers should ensure that minimum expenditure is incurred keeping in view the nature and extent of anticipated traffic.

1105. It should be located as far as possible on original hard moorum, rock or other hard foundation.

1106. Wherever the road crosses hard natural waste land, side drains should be omitted, since the road can be easily diverted whenever it is furrowed, under traffic.

1107. Culverts and bridges should be avoided as far as possible. Simple causeways may be provided by stone pitching or random rubble masonry base if unavoidable. Cast iron, pipes unsuitable for water supply or hume pipes may be used with advantage and salvaged afterwards for reuse.

1108. For making service roads the specifications and rates as laid down in Section - 'A' Earth work is applicable, unless otherwise stipulated.

1109. The service road shall be maintained by the contractor for the whole of the first season till the first monsoon in exchange for the free use of the road for contractor's vehicle.

1110. Any special repairs to service roads due to monsoon damage will be ordered by Work Order and paid for at the rates provided for in the section 'A' Earthwork on borrowpit measurements, unless otherwise stipulated.

1111. Any temporary bridges ordered will be maintained at the expenses of the Railway.

1112. Normally the service Road will be a dry weather unmetalled road but rates are provided for metalling or mooruming such places as may be expressly ordered by Work Order by the Sr. Divisional/Divisional/District Engineer.

1113. Wherever road metalling is unavoidable the Engineer shall order such metal having regard to availabiltty, price and the traffic expected.

1114. Maximum gradient should not be steeper than 1 in 10 and minimum radius of curve not less than 10 metres.

C :- ROADS FOR LIGHT TRAFFIC ONLY.

1115. The formation should be well consolidated by ramming and rolling. Formation should be covered then by scling of one layer of Jhama brick or fifteen centimetres of hand packed large stones. Then rammed and rolled with heavy hand roller or Mech. roller to the exact camber (from 1:40 to 1:60 as directed by the Engineer) required for the finished road surface. This soling must be covered by the top metalling of either good hard stone broken to a 50 mm. gauge or of Jhama ballast broken to 60 mm. gauge or gravel 50 mm. gauge and to a thickness ordered for the class of road.

1116. The Jhama ballast must be deep red in colour with a large proportion of deep blue or black. If any Jhama which is not thoroughly burnt is found in the stacks, the Engineer concerned may have the metal hand picked at the expense of the contractor, who shall be bound to remove the rejected portions.

1117. The metals to be screened without extra payment, as per provisions laid down in para 118 of Specification No. 6.

D. PERMANENT MAIN ROAD :- WATER BOUND MACADAM SURFACE

1118. Formation should be well consolidated by rolling with heavy hand roller or a mechanical roller of approved type & weight to the camber required for finished round surface.

1119. All vegetable growth, tree stumps and roots to be removed. The holes thus formed to be filled with good hard moorum or other selected material.

BOULDER SOLING

1120. The foundation of a road is of the greatest importance as upon this, its strength mainly depends to resist the blows of heavy traffic. Therefore, avoid perishable rubbish.

1121. Once put in, the foundation cannot be altered, therefore, prepare the subgrade carefully.

1122. After the formation is dressed to the proper camber and dry rolled, a rough boulder paving of specified depth of medium and large boulders is laid by hand, filled in with smaller boulders, and all projecting points broken off, so that when laid the surface may be fairly even. The broad end of boulders should be laid downwards. The voids of large boulder should be filled up with medium size boulder and hand packed carefully with suitable sizes longways of boulders should be

placed across the road. Chips and spalls should be wedged in very carefully, interstices filled in with small stones and dust and then rolled with rollers. Commence rolling the sides and finish off at the centre.

1123. The approved size of stone for soling shall be collected only from sources approved by the Engineer. It shall be sound, hard and durable. The average depth of individual stone must not be less than the ordered depth of soling. A sample of stone approved is to be deposited with the Engineer.

1124. The soling stones shall be laid by hand closely in position with voids as minimum as possible and firmly bedded, the length being made perpendicular to the face of the bank. The stones shall break joints as much as possible and firmy packed by filling all interstices which are left even after careful hand packing with stone chips driven tight with rammers or hammers.

1125. The stones shall be roughly hewn or squared with hammer to ensure their fitting fairly one into the other so as not to expose the earth work below. No pinning is to be allowed between the sides of the stones and the use of chips should be confined to hollows and inequalities in the bed and packing the surface after the stones are laid. No deduction should be made for such voids or filling with smaller size of stone as approved.

1126. Over the formation a soling of large stone, hand packed and at least 15 cm. thick must be laid and well consolidated to the same camber by rolling or ramming. Over this the metal (hard stone or jhama, as may be specified) is to be laid to a thickness not exceeding 10 cm. in depth and spread over ontop with $33^{1}/_{3}$% of the metal quantity as moorum blinder and added with a good amount of water and rolled with a 10 ton roller.

1127. While preparing the sub-grade if the earth excavated is suitable for blinding purpose, the same should be used and the quantity of blinder to be taken supply should correspondingly be reduced.

1128. The $33^{1}/_{3}$% quantity of the blinding material collected should be apportioned in such way so as to cover up the soling and as well as the wearing courses for giving a well compacted surface.

1129. If necessary sand blindage may be given after final rolling at the rate of 0.042 Cu.m. per 10 Sq.m. of road surface on water bound macadam roads and at the rate of 0.057 Cu.m. per 10 Sq. m. of road surface on bitumen/tar roads.

WEARING COURSE

1130. This wearing course may be any one of the following kinds :-

(a) Reinforced Concrete.

(b) Stone sett, or

(c) Black topped surface.

1131. *Reinforced Concrete* :- (a) In special cases a cement concrete road may be laid to specification supplied by the Concrete Asscciation of India a summary of which has been given in Appendix "D"..

(b) Payment for Reinforced concrete Road work will be made as per rates vide item No. 2/3, as the case may be combined with items 14 & 15 (i) of section 'B' concrete.

1132. *Stone sett* :- (a) A Stone sett road may be laid on a solid foundation as decided by the Engineer which may be upto 15 cm. concrete for very heavy traffic; this shall be to same camber

as is required in the finished road. The stone setts shall be 25 cm. x 12 cm. x 10 cm. of the hardest procurable stone. The stones must have a clear section; any piece discoloured or distorted with boulder skin or earthy and porous matter, cracked or showing symptoms of decay shall be rejected. All stones must be rectangular as possible, smooth on the top surface, and evenly hammer dressed on the other five sides, and shall be laid on edge with the continuous vertical joint not in the direct line of traffic.

(b) The stone setts are to be laid on a 2 cm. thick bed of sand. This will allow for adjustment of irregularities in the stones when the vertical joints are to be filled with an impervious jointing. The stones should be laid dry at first with joints 6 mm. to 10 mm. wide, which should later be filled in with cement grouting of 1 cement : 4 sand, unless otherwise ordered; an asphaltic grouting may be used in special cases.

(c) If the stone setts are to be laid dry without jointing as is sufficient in some goods shed roads, etc. they shall be laid as close to each other as possible with sand spread over the top to work into the crevices. Two strips, one foot on either side should be laid in mortar.

1133. *Black Topped Surface :-*

(a) General Description & Materials used -

(i) The water bound macadam road made as indicated in the previous paras is generally finished off by one or other of the specifications which follow to convert it into a black top road. The object of applying these bitumen coating is to prevent dust and also to prevent the surface of the water bound macadam road being destroyed by the traffic which passes over it.

(ii) The traffic which is expected upon the road will determine as to the process and thickness of black top finish.

(b) These finishes may be roughly divided into the following categories :-

(i) *Surface Dressing :-* Where the bitumen is applied to the surface of the prepared macadam road in either one or two coats depending upon the nature of the traffic.

(ii) *Premixed Carpet :-* The thickness of premixed carpet will also be designed in accordance with the traffic to be expected on the road.

(c) *The binding materials used for producing these various surfaces are :-*

(i) Bitumen or Asphalt or road tar :- applied hot.

(ii) Bitumen emulsion :- applied cold.

E. SURFACE DRESSING (HOT APPLICATION)

1134. For surface dressing only plant absolutely necessary is a mechanical roller and tar boiler.

Surface dressing with road tar is applied in two stages. The function of the first coat is to stabilise the base by adequate penetration and smoothen up the surface of the base with a layer of stone chippings, gravels or sand. The function of the second coat is to resist wear and abration by traffic. This coat should be renewed when there is evidence that it is wearing through and revelling the base. If this is done without delay, the base will remain intact for an indefinite period and water-bound macadam renewals will no longer be necessary.

1. FIRST COAT AND RENEWAL COATS

1135. *Construction* :- Preparation of Base :- (a) If the existing base is badly potholed, rutted or has a steeper camber than one in sixty, it must be reconditioned.

(b) If the surface is not so bad as to warrant reconditioning, a week or so before starting surfacing, it should be patch repaired and left open tc traffic. Small potholes should be repaired with precoated chippings and well rammed. Large potholes should be cut square or rectangutar, the sides dressed vertical, and all loose material cleaned out. The bottom and sides should be painted with road tar and precoated metal should be filled into the excavation suitably and consolidated with a roller or by hand rammers.

(c) Immediately before the road tar is applied, the surface should be cleaned by :-

(i) removing caked earth and other foreign matter with wire brushes or small picks.

(ii) Sweeping with brooms.

(iii) Finally dusting with old sacks.

HEATING THE ROAD TAR.

1136. (a) The tar should be heated in tar boilers, if available, (improvised boilers made from cut drums will do) to the following temperatures :-

Road Tar grade R.T. 2	.. ..	93°C to 104°C (200°F to 220°F)
Road Tar grade R.T. 3	.. ..	104°C to 115°C (220°F to 240°F)

(b) These temperature ranges should not be exceeded. Great care must be taken that no water from the tar drums or any other source enters the tar boiler, otherwise the tar will froth up and overflow. A full tar drum must always remain suspended over the tar boiler so that the contents will never be reduced to less than 1/4 of its volume otherwise, the heat stored up in the fire bricks will cause a rapid rise in temperature.

SPRAYING THE ROAD TAR :

1137. *Spraying* : (i) After the surface of the road has been well cleaned and dusted, the edges of the road must be defined by stretching 12 mm dia ropes each 15 to 30 metres long. In spraying tar with a sprayer, great care must be taken to spray uniformly along the length of the road and never across the road otherwise unsightly over-lapping will occur. Even when sprayed longitudinally, overlapping must be reduced to a minimum by brushing. The quantity of tar used over a marked area and adjusting the application accordingly. The height at which it is moved are the controlling factor.

(ii) If small sprayers are used, there must be replenishments from tar boilers progressing with the work (or from cut-drum heaters suitably spaced along the work) to reduce lead to a minimum.

POURING & BRUSHING :

1138. After cleaning and demarcating as above, the tar should be poured, from pouring cans or perforated tins, by one man with a pouring can, and two men equipped with long handled soft brushes or squeezes. The tar is brushed evenly over the surface immediately after pouring. Pouring and brushing should be done longitudinally and over lapping reduced to a minimum.

APPLYING THE BLINDAGE.

1139. Before spreading, the stone chippings or pea gravel, they must be properly screened. The stone chips, are spread on the tarred surface immediately after application of the tar at the specified rate (specified in the Schedule of Rates). Care must be taken that the blinding-material is spread evenly over the surface. When stone chips 20 mm. size are used, a better finish can be obtained by screening the material separately into the two sizes viz 20 mm. and 10 mm. specified, first spreading the larger size and then the finer.

ROLLING.

1140. Immediately after the chippings or gravel are spread and while the tar is still warm, the surface must be rolled with a 5 ton power-driven roller or a 3 or 4 ton hand roller till the chippings have stuck to the road surface. Rolling must not be overdone as this will crush the chips.

OPENING TO TRAFFIC

1141. Traffic is permissible 24 hours after work is completed but, if possible (not during the hottest part of the day) for 48 hours, otherwise the blindage is liable to be displaced.

2. SIMULTANEOUS TWO COURSE SURFACE DRESSING :-

1142. *Preparation of Base :* (a) If the existing base is badly pot holed, rutted or has a steeper camber than 1 in 60, it must be reconditioned.

(b) If the surface is not so bad as to warrant resectioning, a week or so before surfacing is to be started the surface should be patch repaired and left open to traffic. Small potholes should be repaired with precoated chippings and well rammed. Large potholes should be cut square or rectangular, the sides dressed vertical and all loose material cleaned out. The bottom and sides should be painted with Road Tar, precoated chips filled into the excavation suitably and then consolidated with a road roller or by hand rammers.

(c) Immediately before the Road Tar is applied the surface should be cleaned by :-

(i) Removing caked earth and other foreign matter with wire brushes or small picks.

(ii) Sweeping with brooms.

1143. *Heating the Road Tar* (a) The Tar should be heated on Tar boilers if available. If not, improvised boilers made from cut drums will do. The Tar shall be heated to the following temperature:-

Road Tar No. 3	.. ..	93°C to 104°C (200°F to 220°F)
Road Tar No. 3A	.. ..	104°C to 115°C (220°F to 240°F)

(b) These temperatures should not be exceeded. Great care must be taken that no water from any source enters the Tar boiler, otherwise the Tar will froth up and overflow. A full Tar drum must always remain suspended over the Tar boiler so that the contents of the boiler will never be reduced to less than 1/4 of its volume, otherwise the heat stored up in the fire bricks will cause a rapid rise in temperature.

1144. (a) *Applying the first Coat of Road Tar :* After the surface of the road has been well cleaned and thoroughly dusted, it is advisable to clearly define the road edges by stretching 12 mm. ropes each from 15 m to 30 m in length. The Road Tar should always be sprayed if at all possible, as pouring from cans and subsequent brushing tends to displace the blinding material of the first

course before this has had sufficient time to set. When spraying, great care must be taken to ensure that the Tar is sprayed uniformly along the length of the road and never across the road. If sprayed across the road, unsightly overlapping will occur. The quantity of Tar used during spraying can be checked by measuring the quantity used over a marked area and so allow an adjustment of the application. The height at which the spraying nozzle is held and the speed at which it is moved are the controlling factors.

(b) The labour employed on heating and applying Tar should be provided with goggles, boots and puttees for protection.

1145. *Applying the Bindage of the first course :* Immediately after the first coat of road Tar has been applied the larger size of binding material should be sprayed evenly over the surface and rolled with a light roller. One or two passes of the roller will suffice as it is not intended to close up the surface.

1146. *Applying the second Coat of Road Tar :* Immediately after the first course has been rolled, the second coat of Road Tar, heated to the correct temperature, should be sprayed over the surface at the correct rate of application.

1147. *Applying the Bindage of the second course :* The smaller size of binding material should now be spread evenly over the surface at the specified rate.

1148. *Rolling :* The surface should now be rolled to set with a light power driven roller. Six to eight passes of the roller will suffice.

OPENING TO TRAFFIC :

1149. Traffic can be permitted on the surface 24 hours after the work has been completed, but if possible, should not be allowed to use such a surface during the hottest part of the day within the first 24 hours after laying, otherwise the bindage is liable to become displaced.

LIGHT CHIPPING CARPET

1150. PREPARATION OF BASE.

(a) Before the Tar Carpet is applied to the existing Base the road must be absolutely free from dust or caked mud.

(b) Where the existing base is potholed or rutted, these irregularities must be filled in with premixed chippings and well rammed, about a week before the carpet is laid.

(c) The surface should be cleaned by :

(i) Removing caked earth and other foreign matter with wire brushes.

(ii) Sweeping with brooms.

(iii) Finally dusting with old sacks.

1151. TACK COAT :

(a) Road Tar No. 3A heated to a temperature of 104°C to 115°C (220°F to 240°F) should be applied to the base at a rate of 7.25 Kg.- 13.61 Kg. per 10 Sq.m. depending on the closeness of the surface texture.

(b) For application of the tack coat it is best to use a sprayer, but if this is not available the specified quantity should be applied with pouring cans and brushed out evenly.

(c) The tack coat should be applied just ahead of, and keep pace with spreading of the premix.

1152. PREPARATION OF PREMIX.

(a) Place 0.06 Cu.m. to 0.075 Cu.m. of stone chippings according to thickness of premix carpet into the mixer and thoroughly mix dry.

(b) Add 3.88 Kg- 4.54 Kg of Road Tar No. 3A heated to 104°C-115°C (220°F to 240°F) and mix until the chippings are thoroughly coated with Road Tar.

(c) Empty the premix on the stretchers or wheelbarrows and carry to site.

1153. SPREADING OF PREMIX.

Immediately after applying the tack coat, spread the premix with rakes to the desired thickness and to the correct camber, and check by template or distribute evenly by means of a Track Spreader.

1154. ROLLING :

(a) As soon as a sufficient length of about 15m. of Premix has been laid, commence rolling with a power roller of medium weight (8/10 tons). Rolling should commence at the edges and progress towards the centre.

(b) When the roller has passed once over the whole area any high spots or depressions which become apparent should be corrected by removing or adding premix. When this has been done, roll to compaction. Avoid excessive rolling as this serves no useful purpose but may disturb the carpet.

(c) Damp the roller wheels to prevent the Premix from adhering and picking up.

OPENING TO TRAFFIC :

1155. Traffic may be allowed on the road 24 hours after completion of rolling.

SEAL COAT :

1156. A seal coat should be applied 2 to 3 months after laying the carpet.

F. BITUMEN EMULSION (Cold application).

1157. Bitumen Emulsions are fluid enough to be applied at atmospheric temperatures without heating, and are not materially affected by changes of temperature; unlike hot applied binders, they remain fluid immediately after application. The viscosity of emulsion used on a steep gradient should therefore be as high as is compatible with the conditions and method of application in order to prevent undue flow of emulsion down the gradient. Bitumen Emulsions can normally be applied to damp surfaces with satisfactory results but since they contain water, they are liable to be adversely affected by frost. Work therefore should not be carried out in frosty weather. In surface dressing and premixing, abnormally hot weather may also cause difficulty and traffic should, if possible, be kept off the road for a few hours after the work is completed.

1158. It is necessary for a bitumen emulsion to remain fluid long enough to permit it to be spread and yet to give up its water content in the shortest possible time. This process is known as "breaking". Bitumen Emulsion is chocolate-brown in colour, but after the emulsion has broken, the colour changes to black. The change in colour can be taken as an indication that the emulsion has broken.

1159. When the break of the emulsion is likely to be delayed (for instance, when evaporation is slow) it is desirable that traffic should be kept off the work for as long as possible after rolling or at least until it is clear that the emulsion has broken. If the treated section cannct be closed to traffic, then a temporary speed limit of 16 Km. p.h. is desirable until the emulsion has broken.

1160. A "Quick-breaking" emulsion is used for surface dressing and grouting. This emulsion separates into its component parts very shortly after spreading on the road surface, covering the aggregate and leaving a coating of pure bitumen, which cannot be disturbed, even by immediate showers of rain.

1161. A "slow-breaking" emulsion is used for pre-mixing with coarse aggregate or sand. In all cases of premixing, the emulsion must be slower breaking to ensure that all prticles are well coated before the emulsion breaks.

1162. Both for surface dressing as well as for Premix Carpet, bitumen emulsion may be used. The method of construction is similar to that of road tar, except that there is no heating required in this case.

1163. Since no heating is required, construction can be conveniently carried out on platforms, foot tracks etc. or at places prone to fire hazard.

1164. Over compacted moorum base, 25 mm. Premix carpet is recommended. Over well compacted brick or stone metal, 20 mm. Premix carpet is recommended.

CHAPTER - XII

STRUCTURAL STEEL WORK

A. ERECTION OF STRUCTURAL STEEL WORK IN BUILDING & OF GIRDERS.

1201. (a) The material on receipt, at site, shall be carefully unloaded, examined for defects, checked, sorted and stacked securely on a level bed out of danger from flood or tide and out of contact with water or ground moisture.

(b) Materials shall be varified with the marking shown on the marking plan or part list which shall be supplied by the manufacturers.

(c) Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be painted in distinctive colour.

(d) Such materials is to be dealt with under the orders of the Engineer without delay. Badly damaged portions may require replacement. Slightly distorted parts may be straightened by gradual pressure (as directed).

1202. Labour Rates include the cost of handling, once the iron-work has been unloaded as near the site of work as possible as well as cost of all temporary works connected with the erection. Plant will not be supplied by the Railway unless definitely specified in tender conditions.

1203. The surface of all joints must be thoroughly scraped and then coated with paint approved by the Engineer (to be supplied by the Rly.) before joining up, which should be done while the paint is stillwet. This is included in the rate for erection.

1204. Care must be taken to see that all the component parts fit correctly and according to the distinguishing joint or match marks. No interchange of pieces shall be made unless permitted by the Engineer to avoid chipping and fitting or serious delay.

1205. (a) Slight bends in members shall not be straightened unless strictly necessary on account of the danger of over-straining connections and rivets. Connection plates, if slightly bent or twisted, shall be straightened cold; if bent so sharply as to require heating the whole piece thus heated shall be subsequently annealed. All shop rivets of any piece open or member, thus straightened, shall be properly tested by the Engineer.

(b) No straightening whatever is to be carried out without the previous sanction of the Engineer who may supervise all such straightening personally.

1206. Girders are to be carefully fitted together and must rest properly on their beds, and will not be taken over as erected until completely finished and straightened in every respect, both as regards each girder itself and as regards each other girder in the work. The camber, if any, is to be carefully maintained, as set out by the Engineer.

1207. Rivetting shall not be started until such time as the Engineer has personally satisfied himself that the alignment is correct, the vertical plumb, the camber correct with all camber jacks screwed tight, all joint and cover plates well up, service bolts tight and field rivet holes coinciding.

1208. Particular care must be taken to ensure free expansion and contraction wherever provided for in drawings or special specifications.

1209. All machine fitted or other bolts must be perfectly tight and should be burred, or otherwise checked, to prevent nuts from becoming loose, and no unfilled rivet or bolt holes are to be left in any part of the structure.

1210. Fitting and rivetting of connections specially angles in cases where pieces are short or full shall be done in such a manner that the metal is not unduly strained or cracks caused.

1211. Dishonest or incompetent workmen frequently fill cracks with paint, putty, cinders, dirt, oil or fillings for the purpose of deception. A close inspection must be made for this.

1212. Wooden mallets shall be used in forcing members to position, in order to protect metal from injury or shocks.

1213. Chipping of rivets, angle flanges, and edges of plates, must be done without breaking out metal. Chipped edges shall be finished off with a file, and all concave corners shall be rounded off. Chipping with a sledge shall only be permitted in exceptional cases and must be done without leaving fractured edges.

1214. Should any parts of a girder or structure be lost or spoilt by the Contractor they will be replaced at his expense.

1215. A point of supreme importance is to see that all structural iron-work in buildings, tank stagings, etc. (excluding girders), is thoroughly scrapped, cleaned; and given the first coat of Red Lead Paint before erection. It is practically impossible to do the scraping efficiently after erection of structural iron-work. This point must be carefully attended to by the Engineers concerned.

1216 (a) Painting of the structure shall not be done till such time as the Engineer has satisfied himself that the rivetting has been completed in a workmanlike manner and all defective rivets have been replaced.

(b) The entire structure shall then be thoroughly cleaned of all original paint as done by the manufacturing Contractors unless otherwise ordered, and the surface so exposed shall be painted.

B. RIVETTING:

1217. Tools and plants will not be supplied by the Railway unless definitely specified in the tender conditions. The Contractor must supply the coal required for heating the rivets and will erect and maintain all plankways and platforms necessary for the work.

1218. Great care must be taken to see that the snaps are correct to size during the progress of the work. An undersized snap will make too small a head, while an oversized snap will cut into the girder plate. Snaps should correspond to the size of the rivet used and not to the size of the holes in which the rivets are used.

1219. Before rivetting is commenced, every alternate hole in the joint plate must be tightly service-bolted up so as to ensure tight rivetting.

1220. The holes, through all the plates to be rivetted together, must be quite clear and absolutely concentric. For this reason all the holes in a joint must be inspected after service bolting. Slight inaccuracies may be adjusted by "Drifting" but too severe drifting especially in the case of thin plates, will enlarge the hole so much that the length of rivet prescribed will not give sufficient metal to fill the hole. No drift having a diameter larger in any part than the hole in which it is used, shall be allowed.

1221. The edges of the rivet holes must be clean of all arises, and must be reamed if this has not been done in shops beforehand.

1222. (a) The shank length of rivets required are roughly (1.3 to 1.7) $1\frac{1}{2}$ times the diameter for forming rivet head plus the thickness of plates to be rivetted. This length will of course vary slightly with the shape of the snap head.

(b) The diameter of the cold rivet shank must not be more than 2 mm. less than the diameter

of the hole it is intended to fill. For rivets of smaller diameter that is 25 mm. or less this tolerance of 2 mm. is to be reduced to $1\frac{1}{2}$ mm.

1223. The rivet is to be heated all over equally to just below welding heat, quickly inserted in the hole and driven while at an orange heat. Sparking or burnt rivets must not be used.

1224. If there are high tensile steel rivets for some portion of the work, special care must be taken to ensure their right location.

1225. The riveting must be done in the best workmanlike manner, usually by pneumatic or hydraulic riveting, unless hand riveting has been agreed to. In driving rivets the dolly and die or snap must be placed directly opposite each other, at right angles to the rivetted surface to ensure straight driving. A point to remember is that bad rivetting is more often due to bad holding up or due to inadequate service bolting, than to bad work in clinching the rivet.

1226. Care must be taken to use rivet of correct dimension, but burrs or lips round the rivet heads are not to be removed.

N.B. There should be no surplus material, if the correct length of rivet has been used and the head properly set.

1227. It sometimes happens that rivet holes are made in places where it is impossible to rivet effectively. In such a case it is preferable to fill the holes with a bolt, properly tightened and painted, and the end of the bolt tightened to prevent the latter working loose.

1228. After rivetting, each rivet shall be tested by tapping with a hammer of 225 gr. in weight to ensure that each rivet is tight. Slack rivets give a hollow sound and a jar. Rivets not passed are to be painted white and shall be replaced at once, care being taken not to disturb adjacent rivets.

1229. All rivet heads must be inspected, they must be well formed, concentric with centre of rivet and therefore usually in a good straight line with adjacent rivet heads in the same row, closely fitted against the rivetted surfce and unburnt.

1230. All loose rivets and rivets with cracked, badly formed or dificient heads or with heads whioh are unduly eccentric with the shanks must be immediately cut out and replaced by others at the Contractor's expense.

1231. Cutting out of faulty rivets must be done by means of cold set and flogging hammer. The head or point must be divided into four by means of two cross cuts before it is cut off sideways and the rivet shank punched out. The plates must on no account be cut into. Rivet busters should not be used for this work, the use of these tools being limited to the complete dismantlement of steel work. After cutting out it must be seen that the rivet holes are not deformed and that the surrounding rivets have not been loosened. If holes are not clean, they may be reamered to a very small extent. The new rivets are to be painted red.

1232. All tightened up, recapped or cauiked rivets, or rivets with spilt heads will be rejected, except that under the orders and supervision of the Engineer concerned occasional recapping of shop rivets will be allowed, provided such rivets do not form part of important connections, and do not directly transmit stresses.

1233. Countersunk rivets must be inspected after chipping heads and no unnecessary chipping is to be permitted.

1234. When the rivets have been finally inspected and passed the heads are to be painted with red lead. This is inciuded in the rate for rivetting.

1235. The contractor must account for all rivets made over to him and any damaged rivets must be surrendered before others are issued. If, however, the lost or damaged rivets exceed 5 percent of the whole, then the Contractor will pay for those required to repiace the excess.

CHAPTER-XIII

SPECIFICATIONS FOR TRACK BALLAST

1301. *Scope :* These specifications will be applicable for stone ballast to be used for all types of sleepers on normal track, turnouts, tunnels and deck slabs etc. on all routes.

1302. DETAILED SPECIFICATIONS

1302.1. GENERAL

1302.1.1. *Basic Quality :* Ballast should be hard, durable and as far as possible angular along edges/corners, free from weathered portions of parent rock, organic impurities and inorganic residues.

1302.1.2. *Particle Shape :* Ballast should be cubical in shape as far as possible. Individual pieces should not be flaky and should have generally flat faces with not more than two rounded/sub-rounded faces.

1302.1.3. *Mode of Manufacture :* To ensure uniformity of supply, machine crushed ballast should be preferred for Broad gauge and Metre gauge routes. Procurement of hand broken ballast shall be resorted to only with the prior personal approval of CTE/CE, CTE/CE. should record reasons while granting such approval before calling of tender in each case for ballast supply on Broad gauge and Metre gauge routes.

However, no such approval need be taken for supply on Narrow gauge routes.

1302.2. PHYSICAL PROPERTIES

1302.2.1. Ballast sample should satisfy the following physical properties in accordance with IS:2386 Pt. IV-1963 when tested as per the procedure given in Annexures-1&2.

	BG & MG	NG
-Aggregate Abrasion value -	30% Max.*	35% Max.
-Aggregate Impact Value -	20% Max.*	30% Max.

* Relaxable upto 35% & 25% respectively on technoeconomic grounds by CTE/CE.

1302.2.2. The shape parameter "Flakiness Index" as determined in accordance with IS ; 2386 Pt. I-1963 following the procedure given in Annexure-3 should not be more than 50%. This test may be dispensed with for ballast supply on Narrow gauge routes.

1302.2.3. The water absorption tested as per IS : 2386 Pt. III. 1963 following the procedure given in Annexure-4 should not be more than 1%.

This test may be dispensed with for ballast supply on narrow gauge routes.

1302.3. SIZE AND GRADATION :

1302.3.1. Ballast should satisfy the following size and gradation:

a.	Retained on 65mm sq. mesh sieve-	Nil.
b.	Retained on 40mm sq. mesh sieve-	40% to 60%
c.	Retained on 20mm sq. mesh sieve-	Not less than 98% for machine crushed. Not less than 95% for hand broken

1302.3.2. *Oversize ballast :*

I) In case ballast retained on 65mm square mesh sieve is at variance from 2.3.1 (a) specified above, the stack shall be rejected.

ii) In case ballast retained on 40mm square mesh sieve exceeds 60% limit prescribed in 2.3.1 (b) above, payment at following reduced rates shall be made for the full stack.

- 95% of quoted rates if retention on 40mm sq. mesh sieve is between 60% (excluding) and 65% (including).

- 90% of quoted rates if retention on 40mm sq. mesh sieve is between 65% (excluding) and 70% (including).

Iii) In case retention on 40mm sq. mesh sieve exceeds 70% the stack shall be rejected.

1302.3.3. Undersize ballast :

The ballast shall be treated as undersized and shall be rejected if-

i) retention on 40mm square mesh sieve is less than 40%.

ii) retention on 20mm square mesh sieve is less than 98% (for machine crushed) or 95% (for hand broken).

1302.3.4. *Method of Sieve Analysis :*

i) The screens for sieving of ballast shall be of square mesh and shall not be less than 100 cm in length, 70 cm in breadth and 10 cm in height on sides.

ii) While carrying out sieve analysis, the screen shall not be kept inclined, but held horizontally and shaken vigorously. The pieces of ballast retained on the screen shall not be pushed through the screen openings.

iii) The percentage passing through or retained on the sieve shall be determined by weight only.

1303. CONDITIONS FOR SUBMISSION OF TENDER

1303.1. Each tenderer at the time of tendering shall submit the following ;

a) Three samples of ballast in sealed transparent jars containing three kg. each.

b) One bag containing 45 kg. of above sample duly sealed.

c) Test reports of impact value, abrasion value, flakiness index and water absorption value from reputed laboratory/institution.

d) The above samples received from the tenderer shall be signed by the tender opening members. Label as per the following format shall be pasted by the tenderer on all the above four sample containers.

Tender no :
Name of the work :
Name of the tenderer :
Is the test certificate enclosed. Yes/No

Date _____ Signature of Tenderer

Signature of Tender Opening Officials : _____

Date : _____

1303.2. The tenderers shall also furnish an undertaking that the ballast supply at all times will conform to specifications for Track Ballast as specified by Railway.

1303.3. Railway reserves the right to retest the ballast sample of any on all the tenderers before finalisation of tender at Railway's cost.

1304. METHOD OF MEASUREMENT

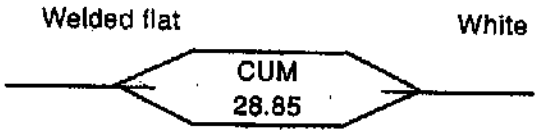
1304.1. STACK MEASUREMENT :

Stacking shall be done on a neat, plane and firm ground, with good drainage. The height of stack shall not be less than 1 m. except in hilly areas where it may be 0.5m. Top width of stack shall not be less than 1.0m. Top of stack shall be kept parallel to the ground plane. The side slopes of stack should not be flatter than 1.5 : 1 (Horizontal : Vertical). Cubical content of each stack shall normally be not less than 30cum. in plain areas and 15cum. in hilly areas.

1304.2. WAGON MEASUREMENT :

1304.2.1. In case of Ballast supply taken by direct loading into wagons a continuous white line should be painted inside the wagon to indicate the level to which ballast should be loaded. The cubical content in cubic metre corresponding to white line should also be painted on both sides outside the wagon.

1304.2.2. In addition to painted line, mentioned in para 4.2.1. short pieces of flats (cut pieces of tie bars or otherwise) with the cubical contents punched, shall be welded at the centre of all the four sides as shown below as permanent reference.



1304.3. SHRINKAGE ALLOWANCE : Payment shall be made for the gross measurements either in stacks or in wagons without any deduction for shrinkage voids.

1305. SAMPLING AND TESTING

1305.1. On acceptance of tender, three samples in sealed jars submitted by the successful tenderer as per clause 3.1. will be kept one each in Divisional/Dy. Chief Engineer's (C) Office, Assistant Engineer's Office and PWI's Office. This will provide visual guidance to check uniformity of supply. However, fulfilment of size, gradation, shape and physical properties shall be the criteria for acceptance of supply in the field. Rest of the samples submitted at the time of tender can be disposed off after finalisation of the tender.

1305.2. In order to ensure supply of uniform quality of ballast, the following norms shall be followed in respect of sampling, testing and acceptance.

1305.2.1. On supply of the first 100 cum, the tests for Size, Gradation, Abrasion value, impact value, *Flakiness Index and *Water Absorption shall be carried out by Railway. Further supply shall be accepted only after this ballast satisfies the Specifications for these tests. Railway reserves the right to terminate the contract as per GCC at this stage itself in case the ballast supply fails to conform with any of these Specifications.

*(Note : Not applicable for ballast supply on Narrow Gauge routes.)

1305.2.2. Subsequent tests shall be carried out as follows :-

		Supply in stacks		Supply in wagons
		For each stack of volume less than 100 cum	For each stack of volume more than 100 cum	
a)	Size and Gradation Tests			
	Testing Frequency	One for each stack	One for each stack	One for each wagon
	size of sample	** 0.027 cum	** 0.027 cum for every 100 cum or part thereof	** 0.027 cum
b)	Abrasion value, Impact value, Flakiness Index and water Absorption Tests			
	Testing Frequency @		One for every 2000 cum	
	size of sample		45 Kg.	

** This sample should be collected using a wooden box of internal dimensions 0.3mx0.3mx0.3m from different parts of the stack/wagon.

@ These tests shall be done for the purpose of maintaining quality during supply. In case of the test results not being as per the prescribed specifications at any stage, further supplies shall be suspended till suitable corrective action is taken and supplies ensured as per specifications. Tests for Flakiness Index and Water Absorption are not applicable for ballast supply on Narrow Gauge routes.

The above tests may be carried out more frequently if warranted at the discretion of Railway.

1305.2.3. If the quality of ballast is noted to have changed during supply, as revealed by visual comparison with the approved sample, the tests shall be redone to confirm that it satisfies the properties as per clause 2.2. The approved sample of the changed supply should be preserved, for future checks, in three sealed transparent jars jointly signed by the contractor and Assistant Engineer and distributed as given in clause 5.1.

1305.2.4. All tests for Abrasion Value, Impact Value, Flakiness Index and Water Absorption conducted subsequent to award of contract shall be done at Railways cost.

1306. Tools and implements :- Contractor shall supply all tools, baskets, carts and explosives required for excavation, quarrying, leading, loading, unloading and stacking, weights & Balance for assessment of over size & under size ballast.

1307 When blasting is necessary, it will be carried out in accordance with the notes on Explosives and Blasting vide Appendix 'A'.

1308 Royalty : (a) The contractor's relationship with Railway is that of an independent contractor and he may under no circumstances act or hold himself out as an Agent of the Railway

or make or purport to make any contract or arrangement for or on behalf of the Railway but on every contract or arrangement made by him he shall incur full and sole liability as a principal.

(b) The Contractor shall make his own arrangements on his own sole account for procuring all materials to be supplied or to be used on works to be done under his agreement.

(c) The rates in this schedule are entirely inclusive so as to cover any purchase price and/or/Royalties and/or compensation for surface damage paid or payable by the Contractor to landowners and all other charges incurred by him whatever.

(d) If the Contractor enters on land not belonging to or held by the Railway for collection or quarrying of materials or any other purpose whatever he shall make his own arrangements with the owner or owners of such with regard to, and shall be solely personally liable for the payment of any purchase price and/or Royalties and/or compensation for surface damage and the Railway shall in no circumstances be or purport to be made party to any such arrangements or be liable for any such payment and/or compensation.

(e) Payment of on Account and Final Bills for materials supplied, or for work done with material collected, from outside Railway land shall be subject to the submission by the Contractor of a certificate in the following form :-

"I do hereby acknowledge and declare that in the payment of on account/final Bill No. _____ dated :_____ of _____ Sub-division _____ District: I have received, included in the rates in that bill, the full amount payable by me under clause 1304 of the conditions governing my tender for ballast on account of Royalties surface damage and claims of any nature whatsoever arising from the supply of materials charged for in that bill. I certify that I have correctly and full satisfied all claims on this account as required under Clause 1304 of the conditions for ballast and do hereby indemnify the Railway against all claims that may arise at any time on account of Royalties, surface damages etc. payable by me in respect of materials included in, or used for work done as per that Bill."

(f) Without the sanction of the Railway, no material of any kind whether required for the performance of this Agreement or not, shall be quarried and/or collected from land belonging to or held by the Railway or any land under that held by the Railway.

(g) If and when the Contractor quarries and/or collects materials from or from under Railway land for the purpose of supply of materials and/or of work under this agreement he shall be liable to pay a Royalty at the rate prescribed by the state govt. authorities and inforce during the period the contract is ourrent. Such Royalty shall be recovered by deduction from the Contractor's bill for the supply of materials and/or work done under this agreement or from any other sums due to him from the Railway.

STACKING OF BALLAST

1309. (a) Sites for stacks shall be located as directed by Engineer & shall be selected with a view to convenient loading into ballast train in case of depot ballast. Stacks on sites not so approved may be rejected and the Contractor ordered to restack the ballast at a convenient site.

(b) As far as possible ballast stacks are to be made on level stretch of ground.

1310. The Contractor is strictly forbidden to do any excavation or filling at the site so offered for stacking to him or in their proximity. Any attempt to do so will render the oontract liable to summary termination and the ballast collected or stacked upto that time will be rejected by the Railway withcut any compensation and the contractor will be required to remove such stacks around or near which raising or excavation of existing ground level have been attempted to be made by the

contractor. No compensation will be paid for such removal which will be as if the ballast was not to specification and has, therefore, not to be kept in Railway premises.

1311. INSPECTION.

1311.1. At any time required by the Engineer while stacking is in progress and at the time of measurement is taken, the contractor shall supply at his own cost, labour to open out to original ground level, all or any of the stacks for the purpose of inspection. Should it be found during such inspection, that stacks contain defective materials in quality or dimension beyond the permissible limit as provided in the specification, they shall be rejected.

1311.2. The rejected stacks of ballast shall be removed from Railway land by the Contractor at his cost within two weeks of receiving formal notices to do so. If the contractor fails to remove the ballast within the specified time the Administration may remove the ballast from Railway land and deduct the cost of so doing plus 12½% supervision charges from any money due to the contractor.

1311.3. Results of the sieve analysis of the ballast stacks shall be recorded in a "Record Measurement book" specially meant for the purpose.

1311.4. The ballast for new cutting shall, if directed by the Engineer, be stacked on the formation.

1312. Under Inspection : The accepted rate for ballast is for materials which conform to all particulars of quality, stack measurements, sieve analysis and extent of permissible amount of deleterious substances. If the Engineer or his authorised representative deputed to measure ballast supplied by Contractor is not satisfied that the above prescribed condition and specification have been duly complied with, the Engineer is at liberty either to :

a. Refuse to measure up any ballast collected after giving his reason in writing to the contractor, and

b. Call upon the contractor in writing to bring the ballast upto the specification to enable it to be re-inspected and measured within the time limit imposed by the agreement.

1313. Moorum Ballast shall be of approved quality and shall be usually measured in stacks. The settlement allowance for moorum ballast to be deducted shall be 1/6th of height of stack. This will also apply in case of cinder.

1314. (a) When sand is measured in stacks, the gross measurements will be entered in the Measurement Book and a deduction of 1/12th made for shrinkage.

b. If stacks have been sodden with heavy rain, shrinkage will not be deducted. Waival of the shrinkage allowance, which is dependent on the extent of moistures in the sand will be at the sole discretion of the Engineer.

1315. Training of ballast will be paid finally only on net stack measurement although on account bills may be paid on wagon, measurement (in the way of approximation).

Annexure-I

Aggregate Abrasion Value
(Based on IS:2386 Part IV-1963)

1. Apparatus

1.1. The abrasion test for track ballast shall be carried out using Los-Angeles machine as per fig.-1.

1.2. The abrasive charge shall consist of 12 Nos. cast iron from or steel spheres approx. 48mm dia. and each weighing between 390 and 445 gm. ensuring total weight of charge as 5,000+25gm.

1.3. IS sieves of sizes 50mm., 40mm., 25mm. and 1.70mm.

1.4. Drying Oven

2. Test Sample

2.1. The test sample of 10,000 gm. shall consist of clean ballast conforming to the following grading :

— Passing 50mm. and retained on 40mm. square mesh sieve — 5,000gm@

— Passing 40mm. and retained on 25mm. square mesh sieve — 5,000gm@

@ A tolerance of ± 2% permitted.

2.2. The sample shall be dried in oven at 100-110°C to a constant weight and weighed (Weight 'A').

3. Test Procedure

The test sample and the abrasive charge shall be placed in the Los-Angeles abrasion testing machine and the machine rotated at a speed of 20 to 33 revolutions/minute for 1000 revolutions. At the completion of test, the material shall be discharged and sieved through 1.70mm. IS sieve.

4. Analysis and Reporting of the Result

4.1. The material coarser than 1.70mm. IS sieve shall be washed, dried in oven at 100-110°C to a constant weight and weighed (Weight 'B').

4.2. The proportion of loss between Weight 'A' and Weight 'B' of the test sample shall be expressed as a percentage of the original weight of the test sample. This value shall be reported as :

$$\text{Aggregate Abrasion Values} = \frac{A - B}{A} \times 100$$

Annexure-2

Aggregate Impact Value
(Based on IS:2386 Part IV-1963)

1. Apparatus

The apparatus shall consist of the following :

a. Impact testing machine conforming to IS:2386 part IV-1963 as per fig.-2.
b. IS sieves of sizes 12.5mm, 10mm and 2.36mm.
c. A cylindrical metal measure of 75mm dia. & 50mm depth.
d. A tamping rod 10mm circular cross section and 230mm length, rounded at one end.
e. Drying Oven.

2. Test Sample

2.1. The test sample shall be prepared out of track ballast so as to conform to following grading :

— Passing 12.5mm IS sieve 100%
— Retained 10mm IS sieve 100%

2.2. The sample shall be oven dried for 4 hours at a temperature of 100-110°C and cooled.

2.3. The measure shall be filled about one-third full with the prepared aggregate and tamped with 25 strokes of the tamping rod. A further similar quantity of aggragate shall be added and a further tamping of 25 strokes given. The measure shall finally be filled to overflowing, tamped 25 times and the surplus aggregate struck off, using the tamping rod as a straight edge. The net weight of the aggregate in the measure shall be determined to the nearest gm. (Weight 'A')

3. Test Procedure

3.1. The cup of impact testing machine shall be fixed firmly in position on the base of the machine and the whole of the test sample placed in it and compacted by 25 strokes of the tamping rod.

3.2. The hammer shall be raised 380mm above the upper surface of the aggregate in the cup and allowed to fall freely on to the aggregate. The test sample shall be subjected to a total of 15 such blows, each being delivered at an interval of not less than one second.

4. Analysis and Reporting of the Result

4.1. The sample shall be removed and sieved through 2.36mm IS sieve. The fraction passing through shall be weighed. (Weight 'B'). The fraction retained on the sieve shall also be weighed (Weight 'C') and if the total weight (B+C) is less than the initial weight (Weight 'A') by more than one gm, the result shall be discarded and a fresh test made.

4.2. The ratio of the weight of the fines formed to the total sample weight shall be expressed as a percentage.

$$\text{Aggregate Impact Value} = \frac{B}{A} \times 100$$

4.3. Two such tests shall be carried out and the mean of the results shall be reported to the nearest whole number as the Aggregate Impact Value of the tested material.

Annexure-3

Flakiness Index
(Based on IS : 2386 part 1-1963)

1. General

The flakiness index of an aggregate is the percentage by weight of particles in it whose least dimension (thickness) is less than three-fifth of their mean dimension.

2. Apparatus

The apparatus shall consist of the following :

a. Metal gauge for measuring thickness as per fig. 3.
b. Sieves-IS sieves of sizes as shown in table-1.

3. Test Sample

A sufficient quantity of track ballast shall be taken to provide a minimum number of 200 pieces of each fraction as per Table-1, which should be weighed (Weight 'A').

4. Test Procedure

4.1. The sample shall be sieved through sieves specified in table-1.

4.2. Separation of Flaky material :- Each fraction shall be gauged in turn for thickness on a metal gauge of the pattern shown in fig. 1. The width of the slot used in the gauge shall be of the dimensions specified in Table-1.

Table 1 - IS Sieves and dimensions of thickness Gauge

Size of Aggregate		Thickness Gauge
Passing through IS sieve mm.	Retained on IS sieve mm.	mm.
63	50	33.90
50	40	27.00
40	25	19.50
31.5	25	16.95
25	20	13.50
20	16	10.80

4.3. The total amount of flaky material, which is passing through the gauge shall be weighed (Weight 'B')

5. Analysis and Reporting of the Result

5.1. The Flakiness index is the total weight of the material passing the various thickness gauges, expressed as a percentage of the total weight of the sample gauged.

$$\text{Flakiness Index} = \frac{B}{A} \times 100$$

Annexure-4

Water Absorption
(Based on IS:2386 part III-1963)

1. Apparatus

The apparatus shall consist of the following :

a. Wire Basket-Perforated, electroplated or plastic coated, with wire hangers for suspending it from the balance.
b. Water tight container for suspending the basket.
c. Dry soft Absorbent cloth 75x45cm. size 2 Nos.
d. Shallow Tray of minimum 650 square cm. area.
e. Air tight container of capacity similar to basket.
f. Drying Oven

2. Test Sample

A sample of not less than 2000gm. shall be used.

3. Test Procedure

3.1. The sample shall be thoroughly washed to remove finer particle and dust, drained and then placed in the wire basket and immersed in distilled water at a temperature between 22-32°C.

3.2. After immersion the entrapped air shall be removed by lifting the basket and allowing it to drop 25 times in 25 seconds. The basket and sample shall remain immersed for a period of 24±1/2 hours afterwards.

3.3. The basket and aggregate shall then be removed from the water, allowed to drain for few minutes, after which the aggregate shall be gently emptied from the basket on to one of dry cloths and gently surface dried with the cloth, transferring it to second dry cloth when the first will remove no further moisture. The stone aggregate shall be spread on the second cloth and exposed to atmosphere (away from direct sunlight) until it appears to be completely surface dry. The aggregate then shall be weighed (weight 'A').

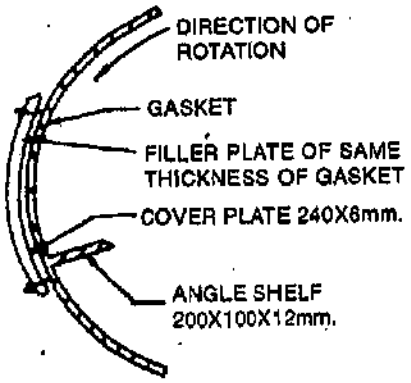
3.4. The aggregate shall then be placed in an oven at a temperature of 100-110°C for 24 hours. It shall then be removed from oven, cooled and weighed (weight 'B').

4. Analysis and Reporting of the Result

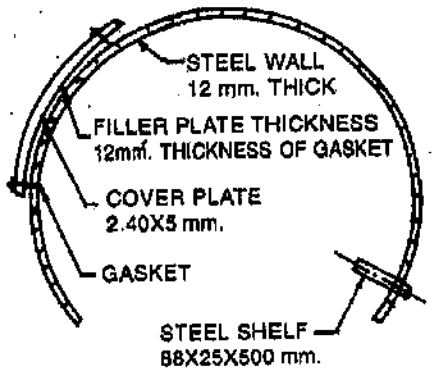
$$\text{Water Absorption} = \frac{(A-B)}{B} \times 100$$

4.1. Two such tests shall be made and individual and mean results shall be reported.

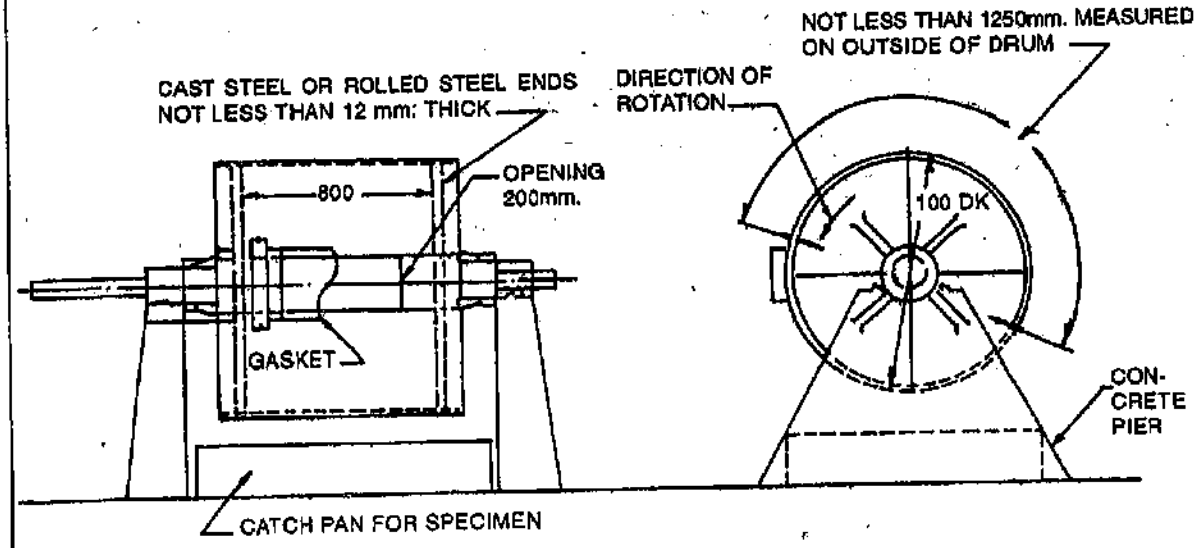
FIG. — 1



ALTERNATIVE DESIGN OF ANGLE SHELF



PREFERRED DESIGN OF PLATE SHELF AND COVER

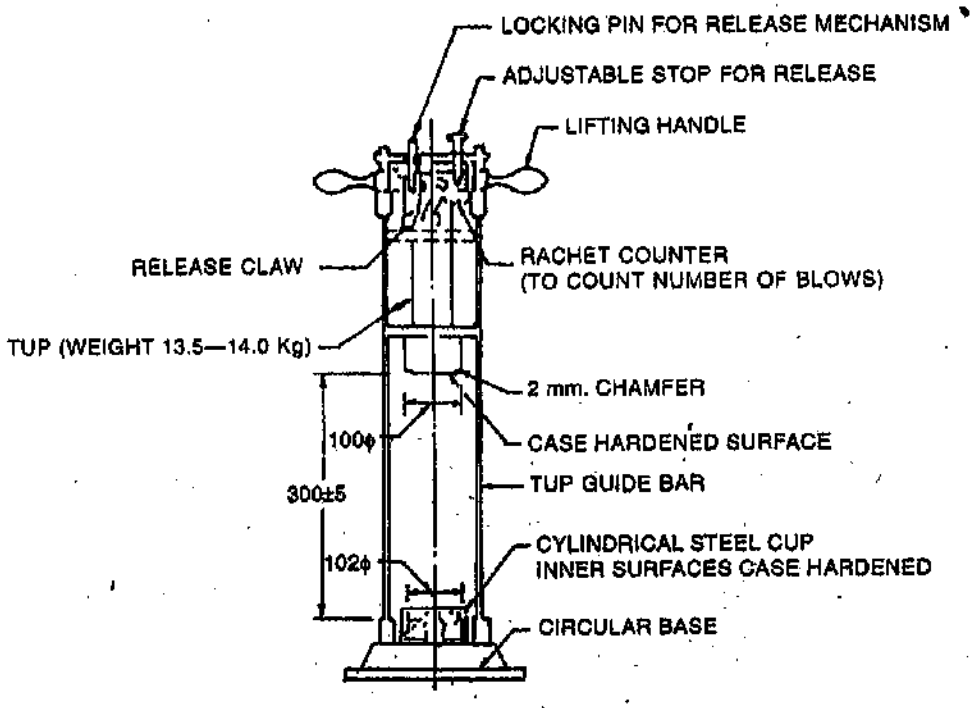


NOTE 1 — SHAFT BEARING WILL BE MOUNTED ON CONCRETE PIERS OR OTHER RIGID SUPPORTS.
NOTE 2 — SUGGESTED HORSE POWER FOR MOTOR IS NOT LESS THAN ONE

ALL DIMENSIONS ARE IN MILLIMETRES

LOS ANGELES ABRASION TESTING MACHINE

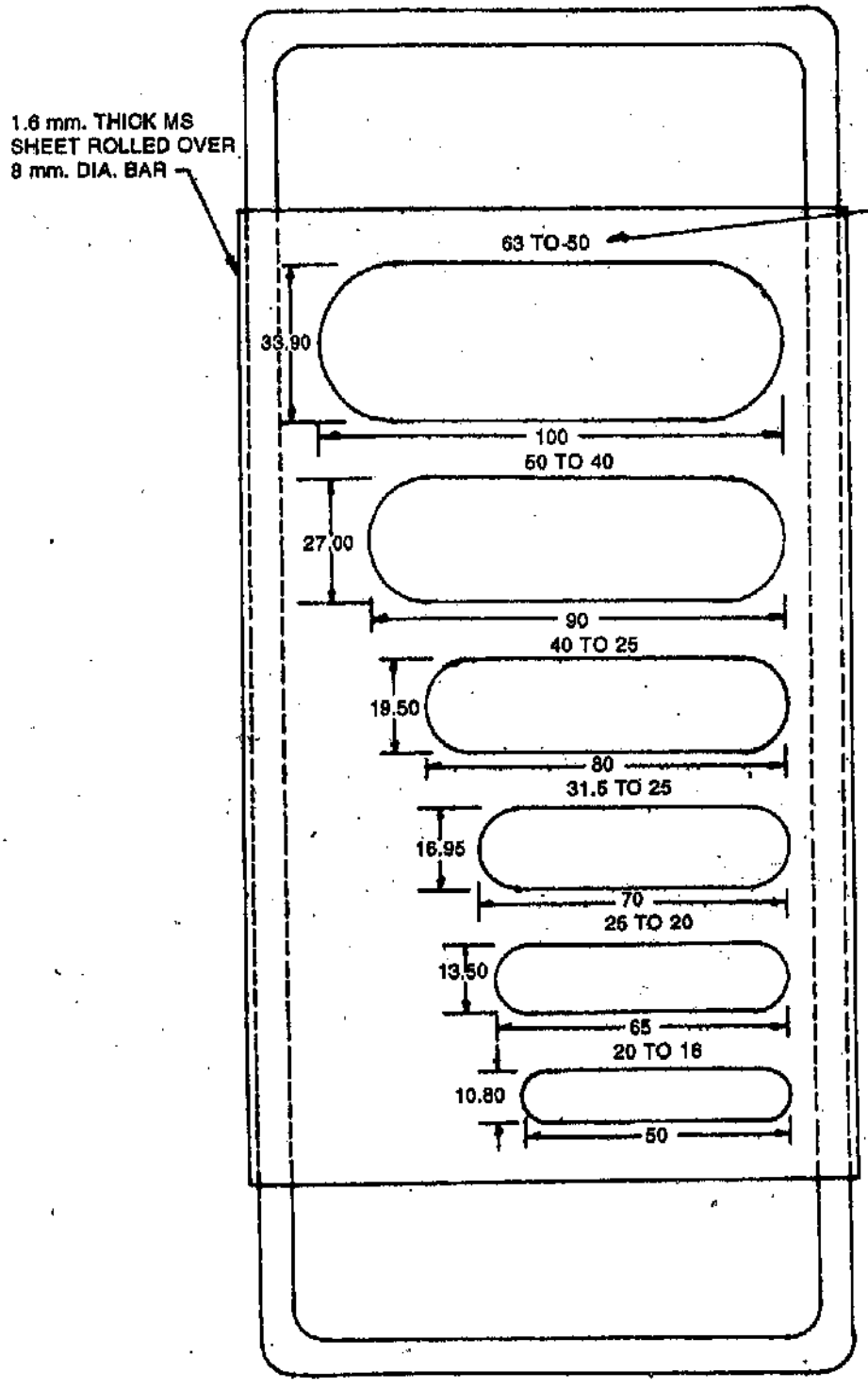
FIG. — 2



ALL DIMENSIONS ARE IN MILLIMETRES

AGGREGATE IMPACT TEST MACHINE

FIG. — 3



ALL DIMENSIONS ARE IN MILLIMETRES

THICKNESS GAUGE

CHAPTER - XIV

STONE PITCHING

1401. *Pitching Stone :-* The stone for pitching shall be collected only from sources approved by the Engineer. It shall be sound, hard and durable. No stone should weigh less than 30 Kg. each. The depth of individual stone must not be less than the ordered depth of pitching upto a limit of 30 cm. If the specified thickness of pitching is more than 30 Cm. stones of greater depth may be used. But if done in two layers or more individual depth of stone must not be less than 25 Cm. A sample of stone tendered is to be deposited with the Engineer.

1402. *Consolidation of banks :-* Unless otherwise ordered by the Engineer, the pitching shall not be laid until the bank on which it is to be laid has been consolidated either by natural process or by ramming to his complete satisfaction.

1403. *Profile :-* The sides of the bank shall be trimmed to the required shape, and profiles put up at the required intervals to ensure regular work and a uniform slope throughout. Unless otherwise ordered by the Engineer sample sections of pitching work shall be put up at every 5 or 6 metres intervals and got approved by the Engineer before starting the work, & the work shall strictly conform to the sample Sections approved by the Engineer.

1404. *Toe of pitching :-*

At the toe of the bank, before commencing the pitching, a trench shall be dug 45 Cm. depth and to the width shown on the drawings and 8 cm. thick layer of quarry dust laid into bed of the pitching stone. No extra payment will be made for this. If ordered by the Engineer, the toe shall be secured from slipping by any other arrangement considered suitable by him, but in such cases special rate shall be worked out and paid for.

1405. *Backing :-* If the earth surface to be pitched is subjected to severe action of running water, waves or tides, it shall be covered by a layer of quarry dust or ballast or gravel to a depth of 8 cm. as directed by the Engineer and the pitching bedded on it. The backing of quarry dust etc. shall be carried up simultaneously with the face work well watered and rammed. The backing will be paid for separately when ordered.

1406. *Workmanship :-*

a(i) The pitching stones shall be laid by hand closely in position with voids as minimum as possible and firmly bedded, the length being made perpendicular to the face of the bank. The stones shall break joints as much as possible and firmly packed by filling all interstices which are left even after careful hand packing with stone chips driven tight with rammers or hammers.

(ii) The stone shall be roughly hewn or squared with hammer to ensure their fitting fairly one into the other so as not to expose the earthwork below. No pinning is to be allowed between the sides of the stones and the use of chips should be confined to hollows and inequalities in the bed to form uniform slope and for packing the surface (as specified above) after the stones are laid. The surface packing shall not be carried out till the previous work is inspected and approved.

(b) The pitching shall be laid correct to the section as shown in the drawings or as ordered by the Engineer. The surface of the work when complete shall be fairly uniform and left clean of all refuse.

1407. *The top most course :-* The top most course shall consist of roughly dressed headers and shall be laid in a continuous level line.

1408. *Stone pitching below water level :-*

For pitching below water level, the stone will be thrown carefully so that it may be spread as uniformly as possible. For this reason, men with poles must be engaged to take frequent soundings to guide the work people for throwing the stone at proper place. The cost of bamboo and plankpathways will be borne by the contractor, and if floating bridges are necessary, their erection and maintenance cost will also be borne by the Contractor, the Railway supplying the necessary materials, unless stated otherwise in the contract agreement.

CHAPTER XV

SANITARY INSTALLATIONS

GENERAL

1501. All sanitary installations shall compiy with bye-laws and rules and regulations laid down by the local bodies or State Government from time to time.

1502. For items such as Earthwork, Concrete, Brickwork, Plaster, etc. specifications in relevant chapters shall appiy.

1503. All damage done to floors, walls, etc. during the course of these works shall be restored to original condition by the contractor without any extra charge.

1504. Installations which are supplied, by the contractor must be of best Indian make. If supplied by Railways, Contractor shall be responsible for its safe custody. Any damage or breakage must be made good by the Contractor at his own expense.

A. SANITARY FITTINGS (Complete Items)

(a) INDIAN TYPE W.C.

1505. *Indian Type W.C. pans :* The W.C. pan shall be of white glazed earthenware 60 cm. to 70 cm. in size, "wash down type" unless otherwise specified. The pan shall be of the approved make and shall bear the mark of the firm manufacturing it. It shall have 100 mm, H.C.I. trap. "P" or "S" type with effective seal and 50 mm.vent arm as required for building more than one storey height.

1506. The W.C. pans intended to be fixed in bungalows, and service buildings shall be of Vitreous China or of white glazed fireclay with integral foot-treads and trap or with separate foot rest. Rates provided in the schedule will apply for respective items of work.

1507. *Fixing :* The W.C. pan shall be sunk in floor sloped towards the pan in a workmanlike manner care being taken not to damage the pan in the process of fixing. If damaged in any way, it shall be replaced. It shall be fixed on proper cement concrete base of 1:2:4 mix (1 cement: 2 sand : 4 coarse aggregate of 20 mm. gauge) taking care that the cushion is uniform and even without having any hollows between the concrete base and the pan.

1508. The joint between the pan and trap shall be made with cement mortar 1: 1 (1 cement : 1 sand) and shall be leak proof.

1509. When supplied by the contractor, the following tolerances in dimensions of Indian type W.C., European type W.C., white glazed urinals and sinks shall be permissible :

(i) on dimensions of 76 mm. and over ...5 mm. per 25 cm.

(ii) on dimensions of less than 76 mm. ... 1.2 mm.

1510. *Flushing cistern:-* The flushing of the W.C. pan shall be done by flushing cistern. The cistern shall be of best cast iron, mosquito proof of 14 litres capacity together with cover, lever, C.I. chain and pull 12 mm. ball valve with copper float and necessary unions etc. for connection with inlet and outlet pipes and overflow.

1511. *Brackets :-* The cistern shall be fixed on C.I. or Rolled Steel cantilever brackets which shall be firmly embedded in the wall or fixed by using wooden plugs and screws.

1512. *Overflow :-* The cistern shall be provided with 20 mm. G.I. overflow pipe with fittings which shall terminate into mosquito proof coupling of the approved municipal design with perforations.

1513. *Flush Pipe :-* The outlet or flush pipe from the cistern shall be of 30 mm. telescopic or galvanised iron pipe which shall be connected to the W.C. pan by means of cement or putty joint. The flush pipe shall be fixed to wall by using holder clamps.

1514. If connection between cistern and W.C. pan is made with G.I. pipe, the bends and offsets shall be made cold.

1515. *Painting :-* Inside of cistern and fittings shall be painted with approved bitumastic paint and outside of the cistern, brackets, overflow and flush pipe etc. shall be painted with priming coat of red oxide, and finishing two or more coats of white zinc or any other tint to match with the colour scheme of the surroundings.

(b) EUROPEAN TYPE W.C.

1516. *European Type W.C. pan :-* The W.C. pan shall readily flushed, of 'wash down type' and shall be of best Indian manufacture. The pan shall be of approved design. The closet shall be of white glazed earthenware or white vitreous china.

1517. *Seat :-* The seat with lid shall be of well seasoned teakwood or mahagony varnished or polished or of good quality plastic with rubber buffers and shall be fixed in position by using chromium plated brass hinges and screws.

1518. *Flushing :-* The flushing of the W.C. pan shall be done by "pull and let go" or 'low level' flushing cistern. In the former case the connection between the flush pipe of the cistern and the W.C. pan shall be made by using G.I. inlet conection. The other specifications will be same as those for Indian type W.C. pans. In the latter case there shall be white glazed earthenware 14 litres cistern with internal fittings, brackets and C.P. brass flushing handle, which shall be fixed at low level and connected to the W.C. pan by means of 35 mm. to 40 mm. diameter white enamelled porcelain bend and G.I. inlet connection.

1519. There shall be 20 mm. overflow with mosquito proof coupling of approved design which shall conform to the specification as stated under Indian W.C. pan.

(c) LIPPED URINAL

1520. *Lipped Urinal :-* The urinal shall be flat back or angular lipped front basin 450 mm. high of white glazed earthenware, of the approved make. It shall be fixed in the position by using wooden plugs embedded in wall and screws of proper size. Each urinal shall be connected to 35 mm. to 40 mm. diameter waste pipe which shall discharge into a channel or a floor trap.

1521. *Flushing :-* The flushing of the urinals shall be done by automatic flushing cistern 5 litres capacity. The cistern shall be of best cast iron having valveless syphon automatic flushing arrangement of 5 litres capacity. It shall be supported on a pair of R.S. or C.I. cantilever brackets which shall be embedded or fixed to wall by means of wooden plugs and screws. The cistern shall be fixed by using proper holder-bat clamps.

1522. The joint between the urinal basin and flush and waste pipes shall be made by means of putty or white lead mixed with chopped hemp.

1523. *Painting :-* The inside and the outside of the cistern, the fittings and brackets shall be painted as that of flushing cistern for Indian type W.C. pan.

(d) URINAL STALLS

1524. *Urinal Stalls :-* The urinal stalls shall be of white glazed fire-clay or white vitreous china of an approved make unless otherwise specified. The size of the stall shall be as under :-

Height from tread to top of division = 1.1 metre

Width centre to centre of division=0.5 to 0.6 metre

1525. *Flushing :-* The stalls shall be provided with white glazed fire-clay or white vitreous china automatic flushing cistern of proper capacity. In case of cistern having more than 5 litres capacity, a pet-cook shall also be provided. The cistern shall be complete with fittings and brackets which shall be fixed to the wall. The cistern shall be connected to the stall through standard size, C.P. brass flush pipe with spreader arrangement and clamps.

1526. *Outlet :-* Each range of stalls shall be provided with C.I. urinal trap with vent arm having C.P. brass outlet grating of size 50 mm. for one or two stalls and 75 mm. for more stalls.

(e) WASH HAND BASIN

1527. *Lavatory Basins :-* The basins shall be of white glazed earthenware of the slotted pattern. The size of the basin varies from 360x250 mm. to 630 x 450 mm. The basins shall be of an approved make. Angle lavatory basins of size 600 x 450 mm. may also be used, where required.

1528. *Fittings :-* Each Lavatory basin shall be provided with single or a pair of 12 mm. C.P. pillar taps, 30 mm. C.P. brass waste of standard pattern with C.P. brass chain and 30 mm. rubber plug and 30 mm. diameter M.I. or C.P. brass trap and union which shall be connected to 30 mm. diameter waste pipe. The fittings shall be of an approved make.

1529. *Fixing :-* The basin shall be supported on a pair of R.S. or C.I. cantilever brackets embedded or fixed in position by means of wooden cleats and screws. These (brackets) shall be painted to the required shade as specified under flushing cistern. The wall plaster on the rear shall be cut to overhang the top edge of the basin.

1530. *Waste connection :-* The waste pipe shall discharge into an open drain leading to a gully trap or direct into gully trap, on ground floor and shall be connected to a waste pipe stack on upper floors and C.P. brass trap and union may not be provided where surface drain or a floor trap is placed directly under lavatory basin and waste discharged into it vertically.

1531. Deleted.

(f) SINKS.

1532. *Sinks :-* The sink shall be of white glazed fire-clay with weir overflow. The size of the sink shall be 600 mm. x 450mm. x 200 mm., 550 mm. x 400 mm. x 200 mm., 500mm. x 400 mm. x 150mm., 450mm. x 380mm. x 150 mm., 280 mm. x 230 mm. x 150 mm. as specified. The sink shall be of an approved make.

1533. *Fittings :-* Each sink shall be provided with 35 to 40 mm. C.P. brass waste of standard pattern with C.P. brass chain and 40 mm. rubber plug and 35 to 40 mm. M.I. or C.P. brass trap and union which shall be connected to 35 to 40 mm. diameter waste pipe. The fittings shall be of an approved make.

1534. *Fixing :-* The sink shall be supported on R.S. or C.I. cantilever brackets embedded or fixed into position by means of wooden cleats and screws. These brackets shall be painted to the required shade as specified. The wall plaster on the rear shall be cut to support the top edge of the sink.

1535. *Waste Connection :-* The waste pipe shall discharge into an open drain leading to a gully trap or direct into gully trap or ground floor and shall be connected to a waste pipe stack or upper floor. M.I. or C.P. brass trap and union may not be provided where surface drain or a floor trap is placed directly under the sink and waste discharged into it vertically.

1536. Deleted

(g) WATER CONNECTIONS

1537. Water connections to flushing cistern, lavatory basins, and bath tubs shall be by means of lead pipe connections pieces, with brass stop cocks. The size of the lead pipe connection and stop cock will depend upon the size of water connection. The lead connection may be replaced by G.I. Pipe with central cocks at unimportant places with the approval of the Engineer.

B. H.C.I. SOIL, WASTE AND VENT PIPES AND FITTINGS.

1538. *H.G.I. Pipes and fittings:-* All soil waste and vent pipes and fittings shall be to the Indian standard specifications No. 1729-1779. They shall be free from cracks and other flaws. Painting is to be done with approved anti-corrosive paint if so directed.

1539. The access door fittings shall be of proper design so as not to form any cavities in which filth may accumulate. Doors shall be provided with 3 mm. rubber insertion packing, and when closed and bolted they shall be watertight.

1540. *Fixing :-* The pipes and fittings shall be fixed to walls by using proper holder-bat clamps. The pipes shall be fixed perfectly vertical or in a line as directed. The spigot end shall butt the shoulder of the socket and leave no angular space in between. All soil pipes shall be carried up above the roof and shall have H.C.I. terminal guard.

1541. Connections between main pipe and branch pipes shall be made by using proper branches and bends with access doors for cleaning.

1542. *Lead caulked joints :-* The annular space between the socket and spigot will be first well packed in with spun yarn leaving 25 mm. from the lip of the socket for the lead. The joint may be leaded by using peoper leading rings or if they are not available by wrapping a ring of hemp rope covered with clay round the pipe at the end of the socket, leaving a hole thrcugh which lead shall be poured in (for pipes with socket facing upwards 12 mm. high small clay bund on tne socket edge may be used).

1543. The lead shall be rendered thoroughly fluid and each joint filled in one pouring. Before caulking, the projecting lead shall be removed by flat chisels and then the joint caulked round with proper caulking tools and a hammer of 2 to 3 kilogram in weight in such a manner as to make the joint quite sound. After being well set up the joint is to be left flush, neat and even with the socket.

1544. *Testing :-* (a) All H.C.I. pipes and fittings including joints will be tested by a smoke fest and left in working order after completion. The smoke test shall be carried out as stated under :-

(b) Smoke shall be pumped into the drains at the lowest end from a smoke machine which consists of a beflow and a burner. The materials usually burnt are greasy cotton waste which form clear pungent smoke which is easily detected by sight as well as by smell if leaking at any point of the drain.

1545. *Floor traps :-* The traps shall be of self cleaning design provided with 25 mm. puff-pipe where the length of the waste is more than 1.5 m. or the floor trap is connected to a waste stack with bends. The other specifications for these shall be the same as those for H.C.I. soil, waste and vent pipes and fittings.

1546. *Waste Connections :-* Waste from lavatories, floor traps, sinks and baths shall separately discharge over gully traps on the ground floor and shall be separately connected to waste stack on higher storeys.

1547. Every starting manhole will have a 100 mm. H.C.I. vent terminating at 1 Metre above parapet of nearest building.

1548. *Anti-syphonage pipes :-* Anti-syphonage pipes shall be H.C.I. pipes with lead caulked joints. The main antisyphonage pipes shall be of 50 mm. internal diameter.

1549. *Painting :-* All the exposed H.C.I. pipes and fittings shall be painted to match the colour of the surroundings or as per decision of the Engineer.

1550. The surface of the pipes and fittings to be painted shall be cleaned thoroughly. Red oxide or other primer shall be painted and allowed to dry. The finishing shall be done by painting 2 or more coats with paint of any shade matching with surrounding.

C. LEAD PIPES.

1551. *Lead pipes :-* All lead pipes shall be hydraulic drawn and of uniform thickness throughout. When not supported on bearers, all lead pipes shall be supported by strong lead tacks at least 35 to 40 mm. wide soldered on to the pipes at suitable intervals.

1552. *Wiped solder joints :-* All joints of lead pipes shall be wiped solder joints as described below :-

The pipe ends to be jointed shall be cleaned with wire brush and freed from oxide if any. Chalk shall then be rubbed to kill the greasy nature of the lead. After this plumbers black shall be applied. The length of the joint as given below shall then be marked on the pipe. A fine shaving of lead shall be removed from this length with shave hook. Tallow shall then be smeared over the prepared surface. The molten solder, an alloy composed of 3 parts of tin and 7 parts of lead, shall be poured in a thin stream from a ladle moved in an elliptical direction over the joint position including a portion of the soiled pipe at each end beyond the mark. When sufficient solder had been poured, the joint shall be wiped with pad of wiping cloth with long continuous movements in one direction only, so as to leave a neatly formed elliptical shaped joint. Surplus solder remaining on the joint shall be removed with a tool called "draw off".

1553. The length of the wiped solder joint shall be as follows :-

Size of pipe	Length of joint.	
	Minimum	Maximum
12mm.	60mm.	70mm.
20mm.	70mm.	70mm.
25mm.	70mm.	75mm.
30mm.	70mm.	80mm.
40mm.	70mm.	80mm.
50mm.	75mm.	85mm.
75mm.	75mm.	85mm.
100mm.	80mm.	85mm.

1554. The joints shall be watertight, airtight and shall be free from tears, burrs, strings, ribands or droppings.

1555. *Lead pipe connections* :-The joints between lead pipe and C.I. or stoneware pipe shall be made as under :-

One end of the brass ferrule or thimble shall be slipped into or over the lead pipe and jointed to it by means of a wiped solder joint. The other end of the ferrule shall then be inserted into the socket of the cast iron or stoneware pipe. In the case of former, the joint shall be made with molten lead (lead caulked) and in case of the latter with cement mortar as in stoneware pipe drains.

1556. The joints between outgo of a W.C. pan and a lead pipe shall be made as under :-

The lead pipe shall be slipped into a brass socket and jointed to it by wiped solder joint. The outgo of a W.C. pan shall then be inserted into the socket and jointed by using cement mortar as in stoneware pipe drains.

1557. *Painting* :- All exposed lead pipes shall be painted as in H.C.I. pipes and fittings.

CHAPTER XVI

WATER SUPPLY

A. G.I. PIPES & FITTINGS

1601. *G.I. Pipes and fittings :* The pipes shall be of galvanised wrought iron and of water quality manufactured by a firm of repute. Tne fittings may either be of galvanised wrought iron or galvanised malleable iron. Pipes and fittings shall conform tc the Indian Standard Specifications No: 1239-1979. Pipes and fittings of which the galvanising has been damaged shall not be used.

1602. *Laying and fixing :-* Where pipes have to be cut or rethreaded, ends shall be carefully filled out so that no obstruction to bore is offered.

1603. In jointing the pipes, the inside of the socket and the screwed end of the pipe shall be rubbed over with white lead and a few turns of hemp yarn wrapped round the sorewed end of the pipe which shall then be screwed home in the socket with pipe wrench. Care must be taken that all pipes and fittings are kept at all times free from dust and dirt during fixing.

1604. *Internal work :-* For internal work, G.I. pipes and fittings inside and outside the walls shall be fixed visible (not in chase) by means or standard pattern holder-bat clamps keeping the pipe 12 mm. clear of the wall everywhere. Wnen it is imperative to fix the pipe in front of a house or in any conspicuous position, where it looks unsightly, chasing may be adopted.

1605. All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable.

1606. *External work :-* For external work, G.I. pipes and fittings shall be laid in trenches. The width of the trench shall be the minimum width required for the working. The pipes laid underground shall not be less than 60 cm. from tne ground level. The work of excavation and refilling shall be done in accordance wifh the general specifications for earth work.

1607. *Testing :-* All G.I. pipes and fittings may be tested to a minimum pressure of 7 KG per sq. cm. or to a pressure appropriate to the requirements to ensure that pipes have proper threads and that proper materials (such as white lead and hemp) have been used in jointing. All leaky joints must be made leak-proof by tightening or redoing.

1608. *Pipes for unfiltered water :-* For unfiltered water supply the minimum size of G.I. pipe used shall be 25 mm. diameter.

B. BRASS WATER FITTINGS :

1609. *Brass water fittings :-* All water fittings shall be of standard manufacture and shall in all respects comply with the Indian Standard Specifications. The brass fittings shall be fixed in the pipe line in a workmanlike manner. Care shall be taken to see that joints between fittings and pipes are made leak-proof. The fittings and joints shall be tested to a pressure of 7 Kg/ Sq. cm. unless otherwise specified. The defective fittings and the joints shall be repaired, redone or replaced.

C. CAST IRON PIPES AND SPECIALS.

(a) Pipes and specials.

1610. *Pipes :-* All pipes shall be of cast or spun iron, straight with spigot and socket ends and shall conform to the latest edition of Indian standard specification No. 1536-1976 for class 'D'

pipes. Heavy duty pipes may be used when the water pressure exceeds 121 Metre of Head. Flanged end pipes may also be used where required.

1611. *Specials :-* All specials shall be of cast Iron and shall conform to the latest edition of Indian Standard Specification No. 1538-1976 for the Class of pipes to be used. Heavy duty specials may be used when the water pressure exceeds 121 Metre of head. Flanged end specials may also be used, when required. As far as possible standard specials should be used.

(b) Trenches for C.I. Pipes and specials

1612. *Excavation :-* The trenches for the pipes shall be excavated to lines and levels as directed. The bed of the trench shall have to be truly and evenly dressed throughout from one change of grade to the next.

1613. The gradient is to be set out by means of boning rods and should the required depth be exceeded at any point, the trench shall be regraded as directed by the Engineer.

1614. The bed of the trench, if in soft or made up earth, shall be well-watered and rammed before laying the pipes and depressions thus formed shall be filled with sand or other suitable materials as the Engineer may direct.

1615. If rock is met with, it shall be removed to 15 cm. below the level of the pipe and the trench will be refilled with sand or other suitable materials.

1616. The excavated materials shall not be placed within 1 metre or half of the depth of the trench, whichever is greater from the edge of the trench.

1617. The trench shall be kept free from water. Shoring and timbering shall be provided whenever required.

1618. The trench must be taken out of a width not less than 50 cm. and not more than 50 cm. greater than the diameter of the pipe.

1619. *Road Crossing :-* All road crossings will be excavated half at a time the second half being commenced after the pipes have been laid in the first half and the trench refilled. The trench at existing road crossings shall be filled properly and rammed and the road surface properly restored.

1620. *Protection of existing service :-* All pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported. Such mains will be hung from timbers placed across the trench. Care shall be taken not to disturb the electrical communication cables, removal of which, if necessary, shall be arranged by the Engineer.

1621. *Lighting and watch :-* The open trenches shall be provided with fencing and watchmen to guard against accidents. Red flags during day and red lights during night shall be provided at the ends and at intervals along the sides of the trenches. Necessary sign boards will also be put up.

(c) Lead caulked joints.

1622. *Lead for joints :-* It shall be bluish grey in colour, very soft and malleable, readily melted, free from mixture of zinc or tin.

1623. *Spun yarn for joints :-* This shall be best quality, preferably white. It shall be free from dust etc. It shall be soaked into hot coaltar or bitumen and dried before use.

1624. *Jointing* :- The spigot shall be carefully centered in the socket by two or three laps of treated spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket, leaving the requisite depth for the lead. The laps of the yarn must be longer than the circumference of the pipe. No making up of the pieces shall be allowed.

1625. The leading of the pipes etc. shall be done by means of ropes covered with clay or by using special leading rings. The lead shall be rendered thoroughly fluid and each joint shall be filled in one pouring.

1626. Approximate weight of lead and yarn required for joints for various sizes of C.I. pipes and specials shall be as under :-

Dia. of pipe	Qty. of lead	Qty. of yarn
Cm.	KG.	KG.
7.5	1.80	0.10
10	2.90	0.18
12.5	3.60	0.20
15	4.20	0.22
17.5	4.80	0.24
20	5.40	0.26
22.5	6.30	0.30
25	6.60	0.35
30	7.90	0.40
35	9.10	0.50
37.5	10.00	0.60
40	10.40	0.70
45	11.80	0.80

1627. *Caulking* :- After the joints have been run they must be thoroughly caulked until they are perfectly watertight. Caulking of joints will be done after a convenient length of pipes has been laid and leaded. The leading ring shall first be removed and any lead outside the socket shall be removed with a flat chisel and then joint caulked round three times with caulking tools of increasing thickness and a hammer of 2 to 4 KG. weight. Lead joints shall not be covered till the pipe line has been tested under pressure but the rest of the pipe line may be covered up, to prevent expansion and contraction due to variation in temperature.

1628. When it is inconvenient or dangerous to use molten lead for joints, they may be made with lead wool inserted in strings not less than 6 mm. thick and very thoroughly caulked.

1629. *Testing* :- (a) The lead joints shall be tested to a pressure of 7 KG/ Sq. CM or such head as otherwise specified depending on the class of pipe, after being caulked, and should any leakage occur, the leaky joint or joints shall be remade and section retested.

(b) The testing is to be done either by fitting on the end of the completed section, a valve which shall be rapidly closed while water is running through the pipe, thus causing a momentary increase of pressure in the pipes.

or

(c) By temporarily closing both ends of the pipe, filling with water and by means of a

hydraulic pump and pipe connection to one end, subjecting the pipe to a predetermined hydraulic test pressure.

(d) Any leaky joints must be made good before the joints are finally covered over with the refill.

(e) *Joints in flanged pipes :* In laying these the faces of flanges or raised strips as the case may be, must be thoroughly cleaned and in bolting up after the specified "insertion" has been placed in position, care must be taken to tighten the flange bolts gradually and evenly all round. When washers of rubber or other materials, are used, they must be held in position by loops of thin twine through the bolt holes before the flanges are brought together, care being taken that the washer is not allowed to encroach in the least on the bore of the pipe. Chalk rubbed upon the faced strips of flanged joints before inserting the washer facilitates subsequent removal, by preventing the latter from adhering to the metal faces. Leaks through bolt holes of flanged joints can be stopped by the insertion of lead washer under the head or nut of the bolt, as may be required.

CHAPTER XVII

DRAINAGE & SEWERAGE

A. Stoneware Pipe Drainage.

(a) Stoneware Pipe.

1701. *Pipes* :- All pipes must be new and perfectly sound, free from fire cracks and imperfections of glazing, cylindrical, straight and of standard nominal diameter, length, and depth of socket. They shall be made of hard burnt stone ware of dark grey colour and thoroughly salt-glazed inside and outside.

(b) Trenches for S.W. Pipe Drains.

1702. *Excavation* :- The trenches for the pipes shall be excavated to lines and levels as directed. The bed of the trenches shall be truly and evenly dressed throughout from one change of grade to the next.

1703. The gradient is to be properly set out and should the required depth be exceeded at any point, the trench shall be regraded by means of cement or lime concrete of the specifications of the bed concrete.

1704. The bed of the trench, if in soft or made up earth shall be well watered and rammed and depressions thus formed filled with sand or other suitable materials as directed by the Engineer before laying the bed concrete.

1705. If the rock is met with, it will be removed to 15 cm. below the level of the pipe and the trench will be refilled with concrete, sand or other suitable material as directed by the Engineer to bring it to required bed level.

1706. The excavated materials shall be kept away from the edge of the trench at a distance equal to 90 cm. or equal to half the depth of the trench, whichever is greater.

1707. The trench shall be kept free from water. Shoring and timbering shall be provided wherever required.

1708. The width of the trench shall be as under and no greater width than this will be paid for unless ordered otherwise by the Engineer.

Nominal dia. of pipe	Width of the trench
10 cm.	55 cm.
15 cm.	55 cm.
22.5 cm.	60 cm.
30 cm.	70 cm.
37.5 cm.	75 cm.
45 cm.	85 cm.
60 cm.	100 cm.

1709. Wherever the drain runs in deep trench the width of the trench in upper reaches may be increased as per direction of the Engineer.

1710. Road crossings :- Specifications as for cast iron pipes will apply.

(c) Laying and Jointing S.W. Pipe.

1711. *Laying :-* The pipes shall be carefully laid to the levels and gradients shown on the plans and sections. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in straight line without vertical or horizontal undulations.

1712. The pipes will be laid "Socket up" the gradient. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be excavated in the concrete to receive the socket of the pipe.

1713. *Jointing :-* In each joint, spun yarn soaked in neat cement wash shall be passed round the joint and inserted in it by means of a caulking tool. A little more quantity of yarn should be added and rammed home to completely fill the gap.

1714. The object of the yarn is to centre the spigot of one pipe within the socket of the other and to prevent the cement mortar of the joint penetrating into the pipes.

1715. *Cement mortar* 1:1 (1 cement : 1 sand) shall be slightly moistened and must on no account be soft or sloppy and shall be carefully inserted by hand into the joint. The mortar shall then be punched and caulked into the joint and cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45°.

1716. Any surplus mortar projecting inside the joint shall be removed and to guard against any such projections, sack or gunny bag shall be drawn past each joint after completion.

1717. *Curing :-* The cement mortar joints shall be cured at least for seven days.

1718. All joints shall be tested to a test pressure of at least 1.5 m., head of water at the highest point of the section under test between 2 manholes.

1719. The lowest end of the pipe shall be plugged water tight. Water shall then be filled in manhole at the upper end of the line. The depth of water in the manhole shall be 60 cm. plus the diameter of the pipe. The joints shall then be examined. Any joint found leaking or sweating shall be remade or embedded into 15 cm. layer of cement concrete 1:2:4(1 cement: 2 sand and 4 stone chips 20 mm. gauge) 30 cm. in length and section retested.

(d) S.W. Gully traps.

1720. *Gully trap :-* This must be perfectly sound, free from fire cracks and other imperfections of glazing, of standard nominal diameter and other dimensions. It shall be made of hard burnt stoneware of dark grey colour and thoroughly salt glazed inside and outside.

1721. Each gully trap shall have one C.I. grating 15 x 15 cm. and one water tight C.I. cover with frame 30 x 30 cm. (inside dimensions) with machined seating faces.

1722. *Excavation :-* The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Engineer.

1723. *Fixing :-* The gully trap shall be fixed on cement concrete foundation 65 cm. square and not less than 10 cm. thick. The mix for the concrete will be 1:5:10 (1 cement:5 sand and 10 stone ballast 40 mm. gauge). The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipes.

B :- MANHOLES, VENT SHAFT, ETC.

1724. *Size of Manhole :-* The size specified shall be the internal size of the manhole. The work shall be done strictly as per standard drawings.

1725. *Manhole covers :-* The covers shall be of tough homogeneous cast iron, of heavy or light type as specified. The sizes specified are clear internal dimensions. The approximate weights of the various types of manhole covers with frames and their internal sizes will be as given below. Variation in weight to the extent of 5 percent, on either side shall be permissible.

	Size :	Approximate weight.
(a)	60 cm. x 50 cm. (Rectangle)	55 KG.
(b)	45 cm. to 50 cm. dia (light type)	50 KG.
(c)	50 cm. to 55 cm. dia. (heavy type)	200 KG.

1726. Manhole covers with double seal shall be used near buildings and within compounds.

1727. The covers used in manholes on sewer lines shall invariably bear word 'sewer' on the top, and those used for storm-water drains shall bear word 'S.W.D.' These marking shall be done during casting of the covers.

C. ROAD GULLY CHAMBER.

1728. *Size of Chamber :-* The masonry chamber shall be 50 cm. x 45 cm. internal size.

1729. *C.I. Grating :-* The grating and frame shall be of tough homogenous cast iron size of 50 cm. x 45 cm. (inside). It shall be fixed on the top of masonry walls in 15 cm. thick cement concrete 1:2:4 (1 cement: 2 sand : 4 stone chips 20 mm. gauge). The approximate weight of gully grating including frame shall be 55 KG. The gully grating cover shall be hinged to the frame to facilitate its opening for cleaning and repairs.

1730. After the completion of the work, the exposed surface of the grating and the frame shall be painted with coaltar.

1731. *Connection pipe :-* From the anti-malaria point of view the length of the connection pipe in centimetre between the road-gully chamber and the manhole of the drain shall not be less than twice the nominal diameter of pipe in millimetre i.e. for 150 mm. connection pipe, the length shall not be less than 300 cm. and for 200 mm. connection pipe it shall not be less than 400 cm.

CHAPTER - XVIII

P. WAY WORKS.

1801. Unless otherwise specified in the Tender/contract, the scope of work, workmanship and standard specifications will be as per provisions of Indian Railways Parmanent Way Manual, Schedule of dimensions, standard drawings issued by RDSO and Chief Engineer, General & subsidiary rules and other administrative circulars.

1802. No extra payment is admissible for intermediate loading/unloading of dip-lorry if warranted due to less duration of block.

1803. The Contractor shall be responsible for maintainihg and repairing the dip-lorry during execution of the Job.

1804. In case haulage by dip-lorry over running lines, protection and supervision shall be provided by Railway (By deputing flagmen with detonators).

1805. All materials shall be kept clear of infringements during loading/unloading and handling.

1806. Operation of dip-lorry is inclusive of spreading the materials along the route in specified manner.

1807. The work of welding shall be carried out in accordance to IRS specification T-19, 1984 and prescribed specification of SKV Welding.

1808. All other terms & conditions provided under Notes of the preamble of Section-Z (P. Way Works) of the Schedule of Labour and Material Rates, Revised Edition 1992, Volume-I shall be treated as part and parcel of the specifications of this Chapter.

CHAPTER XIX

SPECIAL WORKS

A. Marble stone flooring.

1901. *Materials :* Marble stone slabs : The slabs shall be of the kind of marble specified in the item. The marble from which the slabs are made, shall be of selected quality, hard, sound, dense, and homogeneous in texure, free from cracks, declay weathering and flaw. The sample of Marble stone slabs shall be got approved from the Engineer-in-charge before starting the work.

1902. The slabs shall be hand or machine cut to the requisite dimensions.

1903. *Workmanship :* Dressing of slabs :- Every stone shall be cut to the required size and fine chisel dressed to give a smooth and even surface on all sides to the full depth. A straight edge laid along the side of the stone shall be fully in contact with it. Chisel dressing shall also be done on top surface to remove any waviness. The sides and top surface of marble slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of the slabs shall be true, square and free from chippings.

1904. *Thickness :* Thickness shall be 20 mm. to 26 mm. or as specified in the item. While allowable tolerance in thickness shall be + 2 mm., it shall be ± 5 mm. in length and breadth.

1905. *Subgrade :* Base concrete or R.C.C. slab shall serve as the subgrade.

1906. *Bedding :* Bedding for the marble slabs shall be cement mortar 1: 4 (1 cement : 4 coarse sand) of average thickness 20 mm. as given in the description of the item. Minimum thickness at any place shall be not less than 10 mm.

1907. *Laying :* Sub grade shall be cleaned, wetted and mopped. Mortar of the specified and thickness shall then be spread on an area sufficient to receive one marble slab. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped gently to bring it in level with the other slabs. It shall then be lifted and laid aside. Top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar is then allowed to harden a bit. Over this surface, cement slurry of honey like consistency at 4.4 Kg. of cement per square metre. The edges of the slabs already paved shall be buttered with grey or white cement with or without pigment to match the shade of the marble slabs as given in the description of item. The slab shall then be gently placed in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slab. The joint shall be as fine as possible. Surplus cement on the surface of the slab shall be removed. The slabs fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster, skirting or dado. The junction between the wall and shall be finished neatly. The finished surface shall be true to levels and slopes as instructed by the Engineer-in-charge.

1908. *Curing :-* The floor shall be cured for a minimum period of seven days.

1909. *Polishing and finishing :* Unevenness at the meeting edges of slabs shall be removed by fine chiselling. Grinding shall normally be commenced after 14 days of laying the slabs. Except for skirting or small areas machine shall be used for the purpose.

First grinding shall be done with carborandum stones of 48 to 60 grade grit fitted in the machine. Water shall be properly used during grinding. When the floor has been uniformly rubbed, it shall be cleaned with water. Thereafter second grinding shall be started with carborandum of 120 grit. Final grinding shall be done when other works are finished. The machine shall be fitted with carborandum of grit 220 to 350 using water in abundance. The floor shall then be washed clean with

water. Oxalic acid powder shall then be dusted at 33 grams per square metre on the surface and the surface rubbed with machine fitted with hessian bobs or rubbed hard with pad of woollen rags. The floor shall then be washed clean and dried with a soft cloth or linen. The finished floor shall not sound, hollow when tapped with a mallet. If any slab is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished.

Cement slurry with or without pigments shall not be applied on the surface before each polishing.

B. Marble stone in risers of steps and skirting.

1910. *Materials :* Marble stone slab and dressing : The specification shall be same as in paras 1901 to 1903. A tolerance of ± 2 mm. shall be allowed unless otherwise specified in the description of the item.

1911. *Workmanship :* Preparation of surface :- In case of brick masonry wall, the joints shall be racked out to a depth of at least 15 mm. while the masonry is being laid. In case of concrete wall, the surface shall be haulled and roughened with wire brushes. The surface shall be cleaned and wetted thoroughly before commencing the laying work.

The wall surface shall be cut uniformly to the requisite depth so that skirting face shall have the projection from the finished face of wall as shown in drawings or as required by the Engineer-in-Charge.

1912. *Laying :* The risers of steps and skirting shall be set in grey or white cement admixed with or without pigment to match the shade of the stone, as specified in the description of the item. The slab shall be so placed that the back surfce is at a distance of 12 mm. from the wall, subject to a minimum of 10 mm. at any place. If necessary the slab shall be held in position with the help of M.S. hooks temporarily fixed in wall for the purpose at suitable intervals.

1913. The skirting or riser, face shall be checked for verticality and corrected. The gap between the rear of slab and the wall shall be filled and packed with cement mortar 1:3 (1 cement : 3 coarse sand) or other Mix as specified in the item. After the mortar in the gap has acquired sufficient strength, the hooks holding the slab shall be removed.

1914. The joints in between the slabs shall be as fine as possible. The top line of skirting and risers shall be truely horizontal and the joints truely vertical or as per desired pattern. The risers and skirting slab shall be matched as shown in drawings or as instructed by the Engineer-in-Charge.

1915. Curing, polishing and finishing: The surface shall be kept wet for a minimum of 7 days so that bedding and joints set properly.

Grinding shall normally be commenced after 14 days of laying the slabs. Polishing shall be done only manually. The face and top of skirting shall be polished. First grinding shall be done with carborandum stones of 48 to 60 grade grit. Water shall be properly used during grinding. When the surface has been uniformly rubbed, it shall be cleaned with water. Thereafter second grinding shall be started with carborandum of 120 grit. Final grinding shall be done when other works are finished. In final grinding carborandum of grit 220 to 350 is to be used with water in abundance. The surface shall then be washed clean with water. Oxalic acid powder shall then be dusted at 33 grams per square metre on the surface and the surface rubbed with hessian bobs or rubbed hard with pad of woollen rags. The surface shall then be washed clean and dried with a soft cloth or linen. The finished surface shall not sound hollow when tapped with a mallet. If any slab is disturbed or damages it shall be refitted or replaced properly jointed and polished.

C. Kota Stone flooring.

1916. *Materials :* Kota stone slabs : The slabs shall be selected quality, hard, sound, dense and homogeneous in texture, free from cracks, decay, weathering and flaws. These shall be hand or machine cut to the requisite thickness, they should be of the colour indicated in the drawings as instructed by the Engineer-in-Charge.

The slabs shall have the top (exposed) face polished before being brought to site.

The slabs shall conform to the size required . Before starting the work, the contractor shall get the samples of slabs approved by the Engineer-in-Charge.

1917. *Workmanship :* Dressing of slabs:- Each slab shall be cut to the required size and shape and fine chisel dressed at all the edges to full depth. The sides thus dressed shall have a full contact if a straight edge is laid along. The sides shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true square and free from chippings giving a plane surface.

1918. *Thickness :* Thickness shall be 20 mm. to 25mm. as specified in the item. Tolerances allowed shall be as under :-

a) on dimensions more than 10 cm. = ± 5 mm.

b) on dimensions less than 10 cm. = ± 2 mm.

1919. *Preparation of surface :* Specification shall be same as in para 1906 for marble flooring.

1920. *Laying :* Specification shall be same in para 1907 for marble flooring except that the edges of the slabs shall be buttered with grey cement, with admixture of pigment to match the shade of the slab.

1921. *Curing, polishing and finishing :* The floor shall be kept wet for a minimum of 7 days so that bedding and joints set properly.

Grinding shall normally be commenced after 14 days of laying the slabs. Except for skirting or small areas machine shall be used for the purpose. The specifications shall be same as in Para 1909 under marble stone flooring except that -

a) First polishing with coarse grade carborandum stone shall not be done.

b) Cement slurry with or without pigment shall not be applied to the surface before polishing.

D. Kota stone in risers of steps, skirting and dado.

1922. *Material :* Kota stone slab & dressing :- The specifications shall be the same as in para 1916 and para 1917, the slabs may be of uniform size of required.

1923. *Workmanship :* Preparation of surface:- Specifications in para 1911 as applied to 'Marble stone in risers of steps and skirting' shall hold good.

1924. *Laying :* Specifications shall be same as in para 1912 except that the joints of the slab shall be set in grey cement with pigment to match the shade of the slabs.

1925. *Curing, polishing and finishing :* The specification shall be same as laid in para 1921 except that first polishing with coarse grade carborandum stone shall not be done.

E. Marblex flooring

1926. *Materials :* Marblex tiles shall be of homogeneous flexible type, conforming to I.S. 3462-1966. The marblex tiles shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour. Thickness of flexible type tiles shall be as specified in the description of the item.

The flexible type may be backed with hessian or other woven fabric. The following tolerances shall be applicable on the nominal dimensions of the tiles.

a)	Thickness	± 0.15 mm.
b)	Length or width -	
	i) 300 mm. square tiles	± 0.20 mm.
	ii) 600 mm. square tiles	± 0.40 mm.
	iii) 900 mm. square tiles	± 0.60 mm.

1927. *Adhesive* - The adhesive for marblex flooring shall be of the type and make recommended by the manufacturers of Marblex tiles.

1928. *Workmanship* : General - Marblex tiles shall be laid on clean, firm and dry base. An irregular sub floor surface creates poor adhesion between the sub floor and the marblex, therefore, the subfloor surface should be level. For testing dryness of sub floor refer Appendix 'A' of I.S. 5318-1969.

1929. *Laying* - Marblex tiles shall be brought to the temperature of the area in which it is to be laid by stacking in a suitable manner within or near the laying area for a period of about 24 hours. Where air conditioning is installed, the flooring shall not be laid on the sub floor until the conditioning units have been in operation for at least a week. During this period the temperature range shall be between 20°C to 30°C and this shall also be maintained during laying and for 48 hours thereafter. The layout of the Marblex flooring shall first be marked with guidelines on the sub floor and Marblex tiles shall be first laid as a trial to required pattern without adhesive. The adhesive, recommended by the manufacturers of Marblex tiles shall then be applied by using a notched trowel to the sub floor and to the back side of Marblex tile flooring. When set sufficiently for laying the adhesive will be tacky to the touch, but will not mark the fingers. The adhesive will normally require about half an hour for setting, it should not be left for too long a time after setting as the adhesive properties will be lost. Marblex flooring shall be carefully taken and placed in position from one end onwards slowly so that no air pockets are left between the tiles and the back ground surface. It shall then be pressed with a suitable roller to develop proper contact. The next tile shall be laid edge to edge with the tile already laid so that there is minimum gap between the joints and fixed in exactly the same manner as the first tile was fixed and the alignment should then be checked after laying of each row of tiles is completed.

Tiles shall be laid from centre of the area in the same manner as sheets with minimum gap between joints. Tiles should always be lowered in position and no slided on the surface. After laying these shall be rolled with a light wooden roller weighing about 5 Kg. to ensure full contact with the underlay. Work should be constantly checked against guidelines in order to ensure that all the four edges of adjacent tiles meet accurately.

1930. *Finishing* - Any excess adhesive which may squeeze out on the surface of tiles shall be wiped off immediately with a wet cloth before it hardens. If by chance the adhesive becomes hard it should then be removed with a solution of one part of commercial Butyle Acetate and three parts of turpentine oil. A minimum period of 24 hours shall be given after laying before cleaning the surface with a wet cloth soaked in warm soap solution (2 spoons of soft soap powder in 5 litres of warm water).

1931. *Precautions* - Marblex flooring shall not be laid under high humidity conditions. Where the edges of the Marblex tiles are exposed, as for example in doorways and on stair treads, it is important to provide protection against damage of the flooring material. Metallic edge strips may be used and should be securely fastened to the sub floor to protect edges of the flooring. Marblex flooring shall not be put to service at least for 24 hours after it is laid. It is preferable to lay the marblex flooring after the completion of plastering, painting and other decorative finish works so as to avoid any accidental damage to the flooring.

CHAPTER XX

HORTICULTURAL WORKS

2001. Horticultural operations shall be started on ground previously levelled and dressed to required formation levels and slopes.

In case where unsuitable soil is met with, it shall be either removed and replaced or it shall be covered over to a thickness decided by the Engineer-in-Charge with good earth.

In the course of excavation of trenching during horticultural operations, any walls, foundations, etc. met with shall not be dismentled without premeasurement and prior to the written permission of the Engineer-in-Charge.

A. Material.

2002. **Dump Manure :** Dump Manure shall be of well decayed organic or vegetable matter obtained in the dry state from the municipal dump or other similar source approved by the Engineer-in-Charge. The manure shall be free from earth, stone, brick bats or other extraneous stuff.

Manure sieved through sieve of I.S. designation 16 mm., is generally used for mixing with the excavated soil to be refilled in trenches for shrubbery, rose and vegetable gardens and trees and lawns while that sieved through sieve of I.S. designation 4.75 mm. is used for forming lawns for tennis courts, sports etc.

2003. **Doob Grass :** Grass shall be fresh Doob grass free from weed and rank vegetation but having 'Rhizemes' with sufficient nodes and shall be approved by the Engineer-in-Charge, before planting.

2004. **Good Earth :** The soil shall be agricultural soil of loamy texture, free from kankar, mocrum, shingle, rocks, stone, brick bats, building rubbish and any other foreign matter. The earth shall be free from clods or lumps of sizes bigger than 75 mm. in any direction. It shall have P.H. value ranging between 6 to 8.5

2005. **Sludge :** It shall be obtained from approved sewage disposal works.

B. Supplying and stacking Materials.

2006. **Dump Manure :** Manure shall be supplied at site well screened through sieve of designation 16 mm. or 4.75 mm. as specified. The screened manure shall be stacked at site in stacks of not less than 50 cm. height and of volume not less than 3 cu.m.

2007. **Good Earth :** The material shall be stacked at site in stacks not less than 50 cm. high and of volume not less than 3.0 cu.m.

2008. **Sludge :** It shall be transported to the site in lorries, with efficient arrangements to prevent spilling enroute. It shall be stacked at site in stacks of not less than 50 cm. height and of volume not less than 3 cu.m.

C. Excavation in dumped stone or Malba, Bajri path and Water Bound Macadam Road.

2009. As directed by the Engineer-in-Charge, the serviceable and unserviceable material shall be stacked properly where the unserviceable material, is disposed off, it shall be neatly dressed.

D. Trenching in ordinary soil.

2010. Trenching of soil is done in order to loosen the soil, and turn over and buried the top layer containing weeds etc, in the base and to bring up the lower layers of good earth to form a proper medium for grassing, regrassing, hedging and shrubbery.

Trenching shall be done to the depth ordered by he Engineer-in-Charge. The depth is generally 30 cm. for grassing and 60 cm. for re-grassing in good soil.

2011. The trenched ground shall after rough dressing, be flooded with water by making small kiaries to enable the soil to settle down. Any local depression, unevenness etc. shall be made good by dressing and/or filling with good soil.

2012. Weeds or other vegetation which appear on the ground are then uprooted and removed and disposed off and paid for separately. The surface when hard enough is fine dressed. These operations when carried out are, however, payable separately from trenching.

2013. **Trenching** :- Trenching shall consist of the following :-

(1) The whole plot shall be divided into narrow rectangular strips of about 1.5 m. width or as directed by the Engineer-in-Charge.

(2) These strips shall be sub-divided lengthwise into about 1 m. long sections. Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceeding it.

(3) In excavation and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layers of trenched area, the dead plants so buried incidentally being formed into humus.

(4) The excavated soil shall be straightway dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with leads is practically eliminated.

E. Rough Dressing the Trenched Ground.

2014. Rough dressing the area shall include making kiaries for flooding.

2015. The trenched ground shall be levelled and rough dressed and if there are any hollows and depressions resulting from subsidence which cannot be so levelled, these shall be filled properly with earth brought from outside to bring the depressed surface to the level of the adjoining land and to remove discontinuity of slope and then rough dressed again. The supply and spreading of soil in such depressions is payable separately. In rough dressing, the soil at the surface and for 75 mm. depth below, shall be broken down to particle of size not more than 10 mm. in any direction.

F. Spreading Good Earth.

2016. Good earth sludge shall be removed from stacks by head load and spread evenly over the fine dressed surface to the thickness ordered by the Engineer-in-Charge. It shall be spreaded with a twisting motion to avoid segregation and to ensure that spreading is uniform over the entire area.

G. Uprooting Weeds from Trenched Areas.

2017. After 10 days and within 15 days of flooding rough dressed trenched ground with water, the weeds appearing on the ground shall be rooted out carefully and the rubbish disposed off as directed by the Engineer-in-Charge.

H. Spreading sludge/manure

2018. The specifications shall be as described under 2016 except that the stacks shall be reduced by 8% for looseness.

I. Fine Dressing the Ground.

2019. Slight unevenness, ups and downs and shallow depressions resulting from the settlement of the flooded ground, in drying and from the subsequent weeding operations, shall be removed by fine dressing the surface to the foundation levels of the adjoining land as directed by the Engineer-in-Charge, and by adding suitable quantities of good earth, brought from outside, if necessary such supply and spreading of good earth stacked at site is however, payable separately. In fine dressing, the soil at the surface and for 40 mm. depth below shall be broken down to particles of size not exceeding 6 mm. in any direction.

J. Excavation and Trenching for preparation of Beds for Hedge and Shrubbery.

2020. Beds for hedges and shrubbery are generally prepared to width of 60 cm. to 125 cm. and 2 to 4 metres respectively.

2021. Beds for hedges and shrubbery shall be prepared in the following manner.

The beds shall first be excavated to a depth of 60 cm. and the excavated soil shall be stacked on the sides of the beds. The surface of the excavated bed shall then be trenched tc a furher depth of 30 cm. in order to loosen the soil, in the manner described in 2010 to 2013. No flooding will be done at this stage but the tcp surface shall be rough dressed and levelled. The excavated soil from the top 60 cm. depth of the bed stacked at the sides shall then be thoroughly mixed with sludge or manure in the proportion 8:1 by volume (8 parts of stacked volume of earth after reduction by 20% to 1 part of stacked volume of sludge or manure after reduction by 8%) or other proportion as described in the item. The mixed earth and manure shall be refilled over the trenched bed, levelled neatly and profusely flooded so that the water reaches even the bottom most layers of the trenched depth of the bed. The surface after full subsidence shall again be refilled with the earth and manure mixture, watered and allowed to settle and finally fine dressed to the level 50 mm. to 75mm. below the adjoining ground or as directed by the Engineer-in-Charge. Surplus earth if any, shall be disposed off as directed by the Engineer-in-Charge. Any surplus earth if removed beyond initial lead, shall be paid for separately.

Stones, brick bats and other foreign matter if met with during excavation or trenching shall be removed and stacked within initial lead and lift, such material as is declared unserviceable by the Engineer-in-Charge shall be disposed by spreading and levelling at places ordered by him. If disposal is outside the initial free lead and lift, then the transport for the extra leads will be paid for separately. If a large proportion of material unsuitable for the hedging and shrubbery operations is met with and earth from outside is required to be brought in for mixing with manure and filling, the supply and stacking of such earth will be paid for separately.

K. Mixing of Good Earth and Sludge/Manure.

2022. The stacked earth shall before mixing, be broken down to particles of sizes not exceeding 6 mm. in any direction. Good earth shall be thoroughly mixed with sludge or manure in specified proportion as described in the item or as directed by the Engineer-in-Charge. The mixing shall be spreaded as described in 2016 to the thickness ordered by the Engineer-in-Charge.

L. Uprooting Rank Vegetation and Weeds and preparing the ground for planting "Doob" Grass.

2023. Initially the area shall be dug upto a depth of 30 cm. and Weeds and rank vegetation with roots removed therefrom by repeated forking. The whole area then shall be retrenched to a depth of 60 cm. in the same manner as described in 2013.

Clods of excavated earth shall then be broken upto the size not more than 75 mm. in any direction. The area shall then be flooded with water and after 10 days and within 15 days of flooding, weeds that regerminate shall be uprooted carefully.

The rubbish arising from the above operations shall be removed and disposed off in the manner directed by the Engineer-in-charge, away from the site. The earth shall then be rough dressed, and fine dressed as described in 2015 & 2019.

M. Grassing with "Doob" Grass.

2024. The area from where the grass roots are to be obtained shall be specified by the Engineer-in-Charge at the time of the execution of the work and no royalty shall be charged on account from the contractor.

2025. The soil shall be suitably moistened and then the operation of planting grass shall be commenced. The grass shall be dibbled at 15 cm., 10 cm., 7.5 cm., 5 cm. apart in any direction or other spacing as described in the item. Dead grass and weeds shall not be planted. The Contractor shall be responsible for watering and maintenance of levels and the lawn for 30 days or till the grass forms as thick lawn free from weeds and fit for mowing which-ever is later. Generally planting in either direction at 15 cm., 10 cm. spacing is done in the case of large open spaces, at 7.5 cm. spacing in residential lawns and at 5 cm. spacing for tennis courts and sport ground lawns.

2026. **Precautions :** During the maintenance period, any irregularities arising in ground levels due to watering or due to trampling by labour or due to cattle straying thereon, shall be constantly made up to the proper levels with earth as available or brought from outside as necessary. Constant watch shall be maintained to ensure that dead patches as replanted and weeds are removed.

N. Renovating Lawns.

2027. The area shall be first weeded out of all undesirable growth. The entire grass shall be scraped (cheeled) without damaging roots and levels of the ground. Slight irregularities in surface shall be levelled off and the area shall then be forked so as to aerate the roots of the grass without however up-rooting them.

Specified quantity of sludge or manure shall then be spreaded uniformly with wooden straight edge (Phatti) as directed by the Engineer-in-Charge. The area shall then be slightly sprinkled with water so as to facilitate proper integration of the manure or sludge with the soil and later flooded. The contractor shall be responsible for watering, proper maintenance and tending of the lawn for 30 days or till the grass form a lawn fit for mowing whichever is later.

During the above operations all undesirable growth shall be constantly weeded out and all rubbish removed and disposed off as directed by the Engineer-in-charge.

2028. The precautions shall be same as described in 2026 as far as applicable.

O. Digging Holes for Planting Trees.

2029. **In ordinary soil including refilling earth after mixing with manure and watering.**

2030. Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and the excavated soil, broken to clods of sizes not exceeding 75 mm. in any direction, shall be stacked outside the hole. Stones, brickbats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the site as directed. Useful material if any shall be stacked properly and separately. Good earth in quantities as required to replace such discarded stuff shall be brought and stacked at site by the Contractor which shall be paid for separately.

The tree hole shall be manured with dump manure/screened through sieve i.e. designation 16 mm. or sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particles not to exceed 6 mm. in any direction) in the specified proportion. The mixure shall be filled into the hole upto the level of adjoining ground and then profusely watered to enable the soil to subside. The refilled soil shall then be dressed evenly with its surface about 50 to 75 mm. below the adjoining ground level or as directed by the Engineer-in-charge.

2031. **In soil other than ordinary soil.**

2032. Where holes are dug in (a) Hard soil (b) Ordinary rock or (c) Hard rock, the above soils occurring independently or in conjunction with each other and/or ordinary soil in any hole, the different excavated soil shall be stacked separately. Excavation in hard rock, shall be carried out by chiselling only.

2033. The stack measurement of ordinary or hard rock shall be reduced by 50% and of hard soil by 20% to arrive at the excavated volume. These excavations shall be paid for as extras over the rate for holes dug in ordinary soil above, at rates appropriate to the particular soil concerned.

2034. Sufficient quantity of good soil to replace solid volume of stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth ordinary and hard stacks shall be brought and stacked at site but the supply and stacking of such earth shall be paid for separately.

2035. The useless excavated stuff shall be disposed off by spreading at places ordered by the Engineer-in-Charge. If such places are outside initial lead, carriage for the extra lead shall be paid for separately.

2036. The ordinary soil excavated from the hole and the earth brought from outside shall then be mixed with manure screened through sieve of I.S. designation 16 mm. in the proportion specified in the description of the item and filled into the pit and the same watered and finally dressed as described in 2030.

2037. Measurements :- The pits shall be enumerated. The volume of excavation in soil other than ordinary soil shall be determinated by reducing the stack volume of the relevant soil with the respective parcentage reduction for voids.

2038. Rate :- The rate shall include the cost of labour and materials involved in all the operations described above including mixing, refilling, watering, dressing etc. but shall not include (a) cost of manure or sludge (b) cost of supplying and stacking good earth for replacement and (c) the cost of carriage beyond initial lead for disposing off useless materials. The excavation other than that of ordinary soil shall be paid for extra over and above the rate of excavation in ordinary soil.

P. Tree Guards

2039. **Circular Brick Tree Guard :**

The internal diameter shall be 1.25 metre, height above ground level 1.20 metre and depth below ground level 0.20 metre walls half brick thick.

2040. This shall be built of bricks of class designation. Bricks shall comply with the specifications described in specification No. 9 (Bricks) with the exception that they may not be well burnt and may have a redish yellow colour throughout or may be over burnt. The first two courses from bottom shall be built dry (without mortar) with the bricks laid close to each other, without honeycomb. Subsequent courses upto 0.30 metre from top of tree guard shall be built dry in honeycombed pattern, using 15 bricks in each course, with equal opening in between. Thereafter the top three courses shall be built without honey-combing, in cement mortar 1:6 (1 cement : 6 fine sand) as directed. In the bottom most 2 courses and in the top most 3 courses bricks in adjacent courses

shall be laid with 10 cm. laps. In the honey combed portion of the work, the vertical edges of bricks in alternate courses shall be in the same line. The laps of bricks on either side of openings shall be equal.

2041. **Providing and fixing M.S. flat iron tree guard 60 cm. dia. x 2.0m. high.**

2042. **M.S. flat iron tree guard and its fixing:-**

The tree guard shall be formed of 8 nos. 25 x 3mm. M.S. flat verticals 2.0m. long, 4 nos. 25 x 6 mm. flat verticals 2.25m. long, and 3 Nos. 25 x 6mm. flat iron rings at top, middle and bottom. Each ring shall be in two semicircular halves with their ends turned out radially for a length of 4 cm. at which they are bolted together with 8mm. dia. and 30mm. long M.S. bolts and nuts.

The verticals shall be rivetted to the rings at equal spacing along the circumference with 6 mm. dia. rivets, each 25 x 6 mm. M.S. flat verticals being placed after every two 25 x 3 mm. M.S. flat verticals. The top ends of all the verticals both 25 x 3 mm. and 25 x 6 mm. shall be cut to form pointed ends at the top and shall be at the same level. The circular rings shall be at 10 cm., 1.0m. and 1.9m. above ground. The bottom 5 cm. of the extra 25cm. length of the 25 x 6mm. M.S. flat verticals projecting below the 25 x 3 mm. M.S. flat vertical, shall be turned horizontally at right angles, the 4 Nos. 20cm. long legs thus formed being buried below ground. The entire tree guard shall be given two coats of ordinary paint over a priming coat of red, the portions buried under ground being painted with bitumastic or anticorrosive paint before fixing. The tree guard as fixed shall be truly vertical.

2043. **Empty Bitumen/Coal Tar Drum Tree Guard.**

Tree guards shall be made from empty bitumen or coal tar drum supplied free by the Railway. These shall be of 50 cm. average diameter and 1.30 metre or 2.0 metre height as specified in the description of the item. The ends of the drums shall be cut and the coal tar or bitumen sticking inside the drum shall be burnt off. The tree guard shall then be fabricated as per design approved by the Engineer. The 1.3/2 metre high tree guard shall have four legs formed of M.S. flat sections 30 mm. X 3.0 mm. of 40 cm. length rivetted to the tree guard with 6mm. dia. rivets and projecting sufficiently below for being buried in the ground. Tree guard shall be finished with a coat of coal tar, or two or more coats of ready mixed paint of approved quality and shades after applying a priming coat inside and outside, before fixing.

Q. Brick Edging.

2044. Bricks of specified class designation shall be used. These shall be laid in one of the following patterns:- (i) Vertical bricks, half brick projecting above ground (ii) Alternate bricks laid horizontally and vertically (iii) Brick inclined at 60° to the horizontal (iv) Brick laid lengthwise with half brick depth.

Trenches of specified width and depth shall first be made along the edging line to accommodate the bricks in one of the above patterns. The bottom of the trench shall be consolidated to form a firm base for the brick edging. Bricks shall be laid true to line and gradient, as directed. The trench shall then be refilled with excavated earth and consolidated by hand packing. The adjacent earth surface shall be then neatly levelled. Surplus earth shall be disposed off by spreading at places directed within 50 m. lead.

APPENDIX 'A'

EXPLOSIVES AND BLASTING.

Chapter XXXVI of the Way and Works Manual of Indian Railways should be followed.

The additional aspects mentioned below should also be looked into.

1. No explosives shall be stored except under, and in accordance with, the conditions of a licence granted under the Explosives Rules, 1940, with subsequent amendments. No dynamite or othe explosives shall be stored anywhere but in a special magazine to be built for the purpose in accordance with the Explosives Rules, 1940, with subsequent amendments and in accordance with C.E.'S Drawing No. 8835. Explosives shall not be exposed to the sun, but shall always be kept under cover. It is highly dangerous to place any explosive near fires, stoves, steam pipes or heated metal.

2. Dynamite should be kept dry as, if exposed to damp, the nitroglycerine exudes and becomes most dangerous.

3. A service supply shall be issued, as and when required, by the storekeeper, on indent, to the authorised shortfirer, and such supply shall be stored in a special magazine to be built at a site in accordance with Government rules on the subject.

4. To prevent explosives being disposed of unlawfully the authorised shotfirer in charge of the work shall be responsible for all explosives issued and shall sign for all explosives received from the store-keeper.

5. The authorised shotfirer shall maintain register in which the details of the explosives used shall be entered up regularly each day. The agent of the contractor shall maintain a register in which the explosives used each day will be entered regularly the same evening, and a statement at the end of each month should be prepared and sent to the Engineer or his representative (as may be directed). The registers maintained by the contractor's staff should be made available to the Engineer and his representatives for inspection, whenever required, by the latter.

6. The contractor shall appoint an agent who shall personally superintend the firing and all operations connected therewith. The ocntractor shall satisfy himself that the person so appointed is fully acquainted with the responsibilities imposed on him and that he thoroughly understands all orders and instructions on the subject.

7. Likewise, should the nature of the work necessitate the appointment of a shot-preparer, such person shall also be fully acquainted with the responsibilities imposed on him and shall thoroughly understand all orders and instructions on the subject.

8. The contractor shall appoint the above staff & duly authorise them in writing and will be held personally liable for prosecution, if any neglect on the part of himself or his staff is established.

9. The preparing of the charge and the fitting of the fuse to the detonators shall be done in a small clean room, hut or tent, in which no person, other than the authorized shot-preparer and the authorized shotfirer, shall be allowed.

Note:- If charges are not prepared by a special shot-preparer, then the authorized shot-firer shall himself prepare them.

10. (a) THE FUSE AND DETONATOR

(i) Insert the square end of the fuse in the detonator and secure in position by means of nippers only. On no account must this operation be done with the teeth.

11. (a) No smoking, steam locomotive, or fire of any description shall be allowed near the place where shotfiring is being carried out during the time allotted to loading and shotfiring.

(b) Only such quantities of explosive as are required for the particular amount of work to be done shall be brought on to the works. Should any surplus remain when all holes have been charged, it shall be carefully removed to a point at least 305 metres from the firing point.

12. Blasting shall only be carried out at certain specified times to be agreed jointly by the contractor and the Engineer, or by such person as may be authorised by him.

13. A danger zone of at least 150 metres radius from the firing point shall be specially flagged out, and all workmen excluded therefrom at least ten minutes before the time of firing, a warning bell, whistle, or bugle being sounded for the purpose.

14. (a) In the case where the shots are fired electrically.

(i) The exploder shall not be connected to the shotfiring table until the warning above has been given and all persons have retired to safety.

(ii) The authorized shotfirer shall himself only connect the exploder to the shotfiring table and fire the blast.

(iii) He shall, if he requires to leave the exploder, whether during or after a blast, disconnect the exploder from the shotfiring table and remove it to a place of safety.

15. (a) After the blast, the authorized shotfirer shall carefully inspect the work and satisfy himself that all charges in all holes have exploded.

(b) In case of a misfire, the authorized shotfirer shall first examine the same and at once mark a red cross over the hole. One shall, in such case, approach the place after at least half an hour, or when fired electrically, after ten minutes.

16. If a misfire has been found to be due to defective fuse, detonators or explosive, special notice shall be sent to the office so that the whole quantity or box from which the defective article was taken can be inspected.

17. In the case of quarries, before leaving his work, the authorized shotfirer shall inform the authorized shotfirer of the next shift relieving him, of any case of misfire and shall point out the position of the red cross denoting the same, also stating what action, if any, he has taken in the matter.

18. All accidents shall be reported to the Engineer as soon as possible after occurrence.

19. The above rules are subject to any modifications or amplifications that may be rendered necessary by later orders of Government on the subject of explosives, their custody, issue, storage etc.

20. The Engineer shall personally satisfy himself that the contractor and his responsible agent are fully acquainted with, and thoroughly understand, the orders and instructions given in the above rules or any subsequent modifications thereof.

APPENDIX 'B'

SCALE OF CONSUMPTION OF VARIOUS BUILDING MATERIALS

1. **Cement Mortar.**

Mix	Quantity of cement in 50 Kg. bags per 1 cu.m. of Mortar
1 : 1	20.76 bags
1 : 1½	16.46 "
1 : 2	13.65 "
1 : 2½	11.65 "
1 : 3	10.16 "
1 : 4	8.12 "
1 : 5	6.89 "
1 : 6	5.74 "
1 : 7	4.98 "
1 : 8	4.43 "

2. **Cement Concrete.**

Dry materials required for one cu.m. of cement concrete :

Mix	Cement in 50 Kg. bags	Sand in Cu.m.	Aggregate 20 mm. to 50 mm. in cu. m.
1 : 1½ : 3	8.09 bags	0.425	0.85
1 : 2 : 4	6.37 "	0.445	0.89
1 : 2½ : 5	5.26 "	0.460	0.92
1 : 3 : 6	4.49 "	0.470	0.94
1 : 4 : 8	3.46 "	0.485	0.97
1: 5 : 10	2.78 "	0.485	0.97

Note :— (a) where gravel is used as aggregate, the quantities of cement shall be reduced by 5%.

3. **Brick Masonry in Cement.**

3. (a) Materials required for one cu.m. of brick masonry using 25% wet mortar.

Mix.	Cement	Bricks in Nos.				
	50Kg. bags	25.4 cm. x 12.7 cm. x 7.6 cm.	25.4 cm. x 12.4 cm. x 7.3 cm.	24.8 cm. x 12.1 cm x 7.0 cm.	22.9 cm. x 11.4 cm. x 7.6 cm.	19 cm. x 9 cm. x 9 cm.
1 : 2 ..	3.41	335	360	388	415	530
1 : 3 ..	2.54	335	360	388	415	530
1 : 4 ..	2.03	335	360	388	415	530
1 : 5 ..	1.72	335	360	388	415	530
1 : 6 ..	1.44	335	360	388	415	530
1 : 7 ..	1.25	335	360	388	415	530
1 : 8 ..	1.11	335	360	388	415	530

APPENDIX 'B' - (Contd.)

3. (b) Materials required for one cu.m. of brick masonry using 28% Wet mortar.

Mix.	Cement 50Kg. bags	Bricks in Nos. 25.4 cm. x 12.7 cm. x 7.6 cm.	25.4 cm. x 12.4 cm. x 7.3 cm.	24.8 cm. x 12.1 cm. x 7.0 cm.	22.9 cm. x 11.4 cm. x 7.6 cm.	19 cm. x 9 cm. x 9 cm.
1 : 2 ..	3.82	322	345	380	398	512
1 : 3 ..	2.85	322	345	380	398	512
1 : 4 ..	2.27	322	345	380	398	512
1 : 5 ..	1.93	322	345	380	398	512
1 : 6 ..	1.61	322	345	380	398	512
1 : 7 ..	1.39	322	345	380	398	512
1 : 8 ..	1.24	322	345	380	398	512

4. **Stone Masonry**

Materials required for one cu.m. of stone masonry :-

	Mix.	Cement in 50 Kg. bags
(a) Masonry Ashlar with 20% wet mortar	1 : 3	2.03 Bags
	1 : 6	1.15 "
(b) Masonry coursed rubble with 30% wet mortar	1 : 4	2.44 "
	1 : 6	1.72 "
(c) Masonry uncoursed rubble with 35% wet mortar	1 : 6	2.01 "
	1 : 8	1.55 "
(d) Masonry Random rubble with 35% wet mortar	1 : 6	2.01 "
	1 : 8	1.55 "

5. **Granolithic Flooring**

Cement concrete granolithic flooring 1 : 2 : 4 with Railway's cement and Contractor's coarse and fine agreegate for ten square metre of area.

Thickness of flooring	Cement in 50 Kg. bags
20mm.	1.27 bags
25mm.	1.59 "
40mm.	2.54 "
50mm.	3.18 "

6. **Plaster**

Cement plaster with 0.305 cu.m. wet mortar for ten square metre of plaster.

(a) **25mm. thick.**

Mix	Cement in 50 Kg. bags
1 : 2	4.01 bags
1 : 3	3.10 "
1 : 4	2.48 "
1 : 5	2.10 "
1 : 6	1.75 "

APPENDIX 'B' - (Contd.)

6. **Plaster**

Cement plaster with 0.248 cu.m. wet mortar for ten square metre of plaster.

(b) **20 mm. thick.**

Mix.	Cement in 50 Kg. bags
1 : 2	3.26 bags
1 : 3	2.52 "
1 : 4	2.01 "
1 : 5	1.61 "
1 : 6	1.42 "

Cement plaster with 0.229 cu.m. wet mortar for ten square metre of plaster.

(c) **19.05 mm. thick.**

Mix.	Cement in 50 Kg. bags
1 : 2	3.01 bags
1 : 3	2.33 "
1 : 4	1.86 "
1 : 5	1.58 "
1 : 6	1.31 "

Cement plaster with 0.187 cu.m. wet mortar for ten square metre of plaster.

(d) **15 mm. thick.**

Mix.	Cement in 50 Kg. bags
1 : 2	2.46 bags
1 : 3	1.90 "
1 : 4	1.52 "
1 : 5	1.29 "
1 : 6	1.07 "

Cement plaster with 0.152 cu.m. wet mortar for ten square metre of plaster.

(e) **12.7 mm. thick.**

Mix.	Cement in 50 Kg. bags
1 : 2	2.00 bags
1 : 3	1.54 "
1 : 4	1.23 "
1 : 5	1.05 "
1 : 6	0.87 "

APPENDIX 'B' - (Contd.)

6. **Plaster.**

Cement plaster with 0.140 cu.m. wet mortar for ten square metre of plaster.

(f) **10 mm. thick.**

Mix.	Cement in 50 Kg. bags
1 : 2	1.84 bags
1 : 3	1.42 "
1 : 4	1.14 "
1 : 5	0.96 "
1 : 6	0.80 "

Note :— For punning add extra at 0.27 bag per 10 sq.m.

7. **Cement Pointing.**

Mix.	No. of 50 Kg. cement bags required for 100 sq.m. area	
	Pointing flush over brick/stone work using 0.457 cu.m. of wet mortar	Pointing ruled on brick or stone or tiled work using 0.305 cu.m. of wet mortar
1 : 2 ..	6.24 bags	4.16 bags
1 : 3 ..	4.64 "	3.10 "
1 : 4 ..	3.71 "	2.46 "
1 : 5 ..	3.10 "	2.10 "
1 : 6 ..	2.62 "	1.75 "

8. **White and Colour Wash.**

(a) White washing for one square metre of white wash.

	Shell lime (in Kg.)	Quick lime (in Kg.)
One coat work ..	0.05	0.10
Two coats works ..	0.08	0.17
Three coats works ..	0.12	0.23

N.B. — For colour wash colour matter (Pigment) may be used as desired for colour shade.

(b) Distemper for one Square metre of distemper.

1st coat	0.122 Kg.
2nd and subsequent coats	0.073 Kg./coats.

APPENDIX 'B' - (Contd.)

9. **Varnishing.**

Varnishing for 100 square metre area.

One coat work	7.5	Litres
Two coat work	12.5	"

10. **Oiling (Linseed Oil)**

Oiling for 100 square metre of area.

One coat work	7.0	litres
Two coat work	11.6	"

11. **Coal Tarring**

Coal tarring for 100 square metre area (wood work)

One coat work	9.76	Kg.
Two coat works	17.93	"

12. Quantity of water to be used in cement concrete as per I.S. 456-1978 (Third revision).

Nominal mixes of concrete	Quantity of water in litres per 50 Kg. of cement. (Max.)
1: 3 : 6	34
1 : 2 : 4	32
1 : $1^1/_2$: 3	30
1 : 1 : 2	27

APPENDIX 'C'

MEMORANDA OF MEASUREMENTS

The method of measuring building works should be followed according to the latest edition of Indian Standard Specification No. 1200-1958 published by Indian Standard Institution, Manak Bhavan, New Delhi.

Some of the important items which are common in use are mentioned below

1. Concrete —

The measurement of concrete will be as per detailed drawings, shapes and sizes based on net structural sizes as per drawings (i.e. exclusive of plaster).

2. Masonry —

(a) All openings greater than 1/10th sq. metre in area will be deducted from the quantity of masonry.

(b) No extra for masonry will be paid for any projections of plinth, coping or unmoulded cornices, string courses, etc. but will be paid only as part of masonry.

(c) *Thickness of walling* :- Brick-walls upto and including three bricks in thickness shall be measured in multiples of half-brick which shall be deemed to be inclusive of the mortar joints, where fractions of half-brick occur due to architectural or other reasons, the measurement shall be taken as follows :

(i) For fractions of 2 cm. and under - actual measurement.

(ii) For fractions exceeding 2 cm. - full half brick.

(d) The following shall be taken as half-brick measurement.
For bricks 19 x 9 x 9 cm. = 10 cm.

Note : The above clause pertains to bricks of moulder size 19x9x9 cm. conforming to IS:1077-1957. During the change over period, the half-brick size shall be governed by existing nominal sizes such as 22.9cm. x11.4cm. x 7.6 cm., 24.8 cm. x 12.1 cm. x 7.0 cm., 25.4 cm. x 12.4 cm. x 7.3 cm. and 25.4 cm. x 12.7 cm. x 7.6 cm. and half-brick size shall be taken as 11.4 cm., 12.1 cm., 12.4 cm. and 12.7 cm. respectively.

In case other than metric standard bricks are used in the work, the measurements for masonry will be in F.P.S. units and the quantity of work done is converted from cft. to cu.m. or sq. ft. to sq. m. as the case may be and the payment made at the rates given for C.G.S. units.

(e) For walling which is more than three bricks in thickness, the actual thickness of wall shall be measured to the nearest one centimetre, namely fractions including 0.5 cm. and above shall be measured as one centimetre and fractions below 0.5cm. shall be ignored.

(f) In new masonry work with openings under R.C.C. lintels, the full openings including the lintel is to be deducted, the R.C.C. Lintel being measured and paid for separately.

(g) Similarly in new masonry work with openings under arches, (including relieving arches) the full openings including the arch spaces is to be deducted, the masonry in the arch being measured and paid for separately.

(h) All chamfers are to be measured as square and in addition the chamfering is to be paid for separately.

3. Deleted.

4. Plastering, white washing, distempering, colour washing and pointing for Jambs, reveals, soffits, sills etc. for opening not exceeding 0.5 sq.m. each in area, end of joists, beams, posts, girders, steps etc. and opening exceeding 0.5 sq.m. each in area but not exceeding 3 sq. m. each deductions and additions shall be made as follows :-

(i) No deductions to be made for ends of joists, beams, posts, girders, steps etc. and openings not exceeding 0.5 sq.m. each & no addition to be made for reveals, jambs, soffits, slfls etc. of those openings.

(ii) Deductions for openings exceeding 0.5 sq.m. but not exceeding 3 sq.m. each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of those openings.

(a) When both faces of wall are treated with same finish, deduction shall be made for one face only.

(b) When two faces of wall are treated with different finishes, deduction shall be made from the finish on the sides of frames for doors, windows etc. on which the width of reveals is less than that on the other side but no deductions shall be made from finish on the other side. In case of openings of area above 3 sq.m. each deduotions shall be made for the openings, but jambs, soffits and sills shall be measured and paid for.

(c) In white washing flat ceiling, no deduction is to be made for strips covered by joists, T. irons etc. painting of this, if done is to be paid for separately.

5. Olling, painting and varnishing —

(a) The method of measurement as well as the multiplying factor for painting work in doors, windows, grills, gratings, collapsible gate etc. is indicated in the table below :—

EQUIVALENT PLAIN AREAS OF UNEVEN SURFACES

Sl. No.	Description of work.	How measured.	Multiplying factor.
i)	Panelled or framed and braced joinery.	Measured flat (not girthed) including chowkat or frame edges, chocks, cleats, etc. shall be deemed to be included in the frame.	$1\frac{1}{8}$ (for each side)
ii)	Ledged and battened or ledged, battened and braced.	Measured flat (not girthed) including chowkat or frame edges, chocks, cleats, etc. shall be deemed to be included in the frame.	$1\frac{1}{8}$ (for each side)
iii)	Flush	Measured flat (not girthed) including chowkat or frame edges, chocks, cleats, etc. shall be deemed to be included in the frame.	1 (for each side)

Sl. No.	Description of work.	How measured.	Multiplying factor.
iv)	Fully glazed or wire gauged.	Measured flat (not girthed) including chowkat or frame edges, chocks, cleats, etc. shall be deemed to be included in the frame.	$\frac{1}{2}$ (for each side)
v)	Part panelled and part glazed or wire gauged.	Measured flat (not girthed) including chowkat or frame edges, chocks, cleats, etc. shall be deemed to be included in the frame.	1 (for each side)
vi)	Fully venetianed or louvered.	Measured flat (not girthed) including chowkat or frame edges, chocks, cleats, etc. shall be deemed to be included in the frame.	$1\frac{1}{2}$ (for each side)
vii)	Weather boarding	Measured flat (not girthed). Supporting frame work shall not be measured separately.	$1\frac{1}{8}$ (for each side)
viii)	Wood Single roofing	Measured flat (not girthed)	$1\frac{1}{8}$ (for each side)
ix)	Boarding with cover fillets and match boarding.	Measured flat (not girthed)	1.05 (for each side)
x)	Tile & Slate battening.	Measured flat over all, no deduction shall be made for open spaces.	$\frac{3}{4}$ (for painting all over).
xi)	Trellis or jaffri work one way or two way.	Measured flat over all, no deduction shall be made for open spaces (supporting members shall not be measured separately).	2 (for painting all over).
xii)	Guard bars, balustrades, gratings and railings.	Measured flat over all, no deduction shall be made for open spaces (supporting members shall not be measured separately)	1 (for painting all over.)
xiii)	Gates and open palisade fencing including standards, braces, rails stages etc.	Measured flat over all, no deduction shall be made for open spaces (supporting members shall not be measured separately).	1 (for painting all over.)
xiv)	Carved or engraved work.	Measured flat	2 (for each side)
xv)	Expanded metal.	Measured flat over all etc. same as item (xii).	$\frac{3}{5}$ for both the faces.

Note :— The height shall be taken from the bottom of the lowest horizontal-runner if the palisades do not go below it(or from the lower end palisades, if they project below the lowest horizontal runner) upto the top of palisades, but not up to the top of standards, if they are higher than the palisades.

b) For doors and windows, no separate payments shall be made for the frame (chowkats); the "Area" in such cases represents the area of the wall openings covered by the frames (including the frames). For Grills, Gratings etc. the "Area" represents the area of the opening covered by the outer frames.

c) The multiplying factor for painting corrugated sheets shall be 1.14 for one side only and 2.28 for both sides.

d) Painting of Dados - Deduction should be made on all occasions.

6. WOOD WORK

Door and window shutters :- Measurements to be taken over all i.e. inside the rebate to rebate of frames. No tolerance is admissible in the thickness of wooden shutters leaves specified in the section. In case of frames, no deductions will be made for rebates. No deduction will be made for joinery and overall measurements should be taken.

7. Truck & stack measurements:-

a) Sinkage to be deducted from actual measurements at the time of loading as under -

i)	Earth, Moorum, Cinder	..	1/6th
ii)	Sand	..	1/12th
iii)	Surkhi	..	1/8th.
iv)	Ballast or stone 25 mm. or 40 mm. or 50 mm. gauge.	..	1/12th
v)	Shingle fine 20 mm. Stone chips 20 mm. or down gauge.	..	1/12th.
vi)	Brick bats	..	20% void
vii)	Boulders	..	25% void

b) If stacks of item (i), (ii) & (iii) have been sodden with heavy rains, sinkage will not be deducted.

c) If above materials, for item (i) to (v) are measured in wagons after a journey, it will be assumed to have sunk and the measurement made without sinkage.

d) If measurements are taken in wagons and after a journey at the unloading point for item (vi) brick bats 20% void and for item (vii) boulders, 25% void should be made.

8. *Road work* :—

All materials supplied by the Contractor which are required for Road work such as boulder, stone metals, stone chips, stone grits, moorum & cinder should first be stacked along side the Road & measurements entered in the M.B. before use in the work. It should be ensured, that the materials so stacked and measured are fully utilised within the least possible time lapse. A certificate should be recorded in the final bill by the Inspector of works to the effect that the materials so supplied have been fully utilised on the road work and Countersigned by the Assistant Engineer incharge of the work. The rates given in Section 'P' for items 3,4,5 & 6 are for stack measurement excluding voids.

APPENDIX "D"

Extracts from "Guide to good concrete Road construction" issued by the Concrete Association of India.

SPECIFICATION AND DRAWINGS

Construction of concrete roads calls for exactness in attaining the requirements of specifications and high accuracy in its geometric features, such as cross-section, grade, super-elevation, jointing arrangements, etc. This is necessary because concrete roads once constructed have an uninterrupted service life varying from 3 to 5 decades and also because defects cannot be as easily rectified as in the case of other less permanent road surfacings.

SUBGRADE PREPARATION

Though the concrete pavement materially reduces the effects of loads before they are transferred to the subgrade, care in the preparation of subgrade is still essential for ensuring uniformity of support. A suitable subgrade for a concrete pavement should have no soft spots; it shall be uniformly compacted over the entire area of the pavement including side margins of at least one foot; and the material of the subgrade shall be such as not to cause waterlogging below the pavement and get easily drained.

Where the soil conditions permit, concrete can be laid directly on the soil subgrade. In such cases, to obtain satisfactory results, the top layers should be compacted at or slightly above the optimum moisture content. In the absence of standard testing equipment, evaluation of moisture content can be made by squeezing a ball of damp soil in hand. If the ball is so dry that it crumbles easily, additional water should be added. If it is so set that free water come to the surface when kneaded, the subgrade should be allowed to dry before compaction. The subgrade can be compacted by a flat steel-wheeled roller of adequate weight. Special care must be taken in the compaction of fills in trenches and around manholes and other permanent structures in the paved area.

Where concrete slabs are to be laid on existing macadam roads or other construction such as roads surfaced with bitumen they constitute the sub-base for the slabs and as stated earlier, elimination of soft spots and adequate coverage of the sub base material have to be looked into. Small undulations of the sub-base and local depressions could be made good by using either a lean mix of cement concrete or by proper compaction of fresh macadam material.

In cases where concrete slabs are to be laid on the top of existing bituminous surface, no special treatment is necessary where the surface is uniformly covered or worn under traffic. However, where soft spots are caused by excessive shoving of bitumen or where thick pre-mix carpets have been rutted under traffic, such surfacing material shall be removed up to the top of the compacted macadam surface and after removal of all loss material, the concrete shall be laid as in the case of macadam sub-base.

FORMS

All care should be taken to see that proper forms are selected and securely fixed so that they maintain their position, shape and levels during the process of laying and compaction of concrete. Steel forms are recommended for all concrete paving work, except on short radii curves where the use of wooden forms is pemissible. Forms that are bent, have battered top surfaces or defective fasteners, or are other wise defective should be removed from the job and left at the work site till they have been adequately repaired.

FINAL GRADING

Where concrete is laid directly on a newly prepared macadam surface left for a short period in traffic service, the minor undulations of the sub-base shall be made good by spreading a thin layer of sand which shall be struck off to proper level by a scratch template to the full depth of concrete. Where the concrote is to be laid on an old macadam surface where pct holes and ruts are proposed to be made good in lean concrete, then such lean concrete shall be laid well in advance of the pavement concrete and dressed to proper levels after oompaction. It is not a good practice to lay lean concrete alongside the pavement concrete as it is desirable not to bond the concrete slab to lean concrete to permit its easy movement with volume changes in concrete.

Just before concrete for the pavement laid, the subgrade or sub-base, as the case may be, should be uniformly dampened to prevent it from absorbing water from the concrete mix. Alternatively, a layer of water-proof paper may be spread on the subgrade or sub-base prior to concreting.

PAVING WITH QUALITY CONCRETE.

PROPORTIONING

Concrete mixes for road construction are decided on the basis of specified minimum strength. Such mixes also aim at achieving maximum economy by a proper combination of the ingredients of concrete, viz. cement, fine and coarse aggregate and water, without encroaching on the minimum strength or workability.

The workability of the mix should be checked with a slump cone, and for manually compacted concrete, it shall not exceed 5 cm. and for vibrated concrete 2.5 cm.

PLACING AND COMPACTING

The mixed concrete should be distributed over the area of the pavement to the required depths as uniformly as possible so as to avoid dragging of the freshly placed concrete. After uniformly placing the concrete, it shall be compacted with a suitable temper resting on side forms or by a vibrating hand screed. Then the top shall be evened up with a strike-off screed resting on the side forms. Dragging along heaps of concrete through rakes or similar tools is injurious, as the coarse material is dragged leaving a weak mortar mix for the surface resulting in excessive wear under traffic. Where local unevenness by heaving is to corrected, the concrete shall be reshovelled and dragged by a board of at least 45 cm. length and 7.5 cm. depth fitted with a suitable handle. The most satisfactory arrangement for spreading is a combination of compaction and screeding as if achieved with a mechanical spreader. Uniform spreading will also improve riding quality of the surface as it ensures uniform compaction.

Some special compaction is also neoessary along the side forms to prevent honeycombing. Use of an internal vibrator or special rodding, by means of pointed M.S. bars, will satisfactorily accomplish this. Such special consolidation is also necessary at expansion joints and at all bulk heads. Over-vibration to the point of segregation in concrete is to be avoided particularly with high slump mixes. Before start of compaction, enough head of concrete should be maintained ahead of the screed to ensure consolidation.

FINISHING

Immediately following the compaction, the surface of the concrete shall be floated with wooden flat at least 1.2 metres long and 10 cm. wide, the movement of such floats being regulated longitudinally. Whilst floating, oare should be taken to see that the masons are provided with proper

wooden bridges to span the wet concrete so as to prevent damage to the surface of the concrete. The practice of putting planks directly on concrete should be deprecated. Since the final riding characteristics of the road depend on the finishing of the surface, it should be checked with a straight edge 3 metres long, and any unevenness of more than 3 mm. should be corrected by additional concrete or by screeding off the excess as may be necessary. Care should be taken particularly at joints so that levels across the joints maintain the same tolerance as in the remaining areas. Use of mortar to correct the unevenness of surface should be prohibited. The checking with straight edge should be at every 0.6 metre interval across the lane width and should be advanced 1.5 metres or one-half the length of the straight edge for successive checks.

After the surface has been floated and checked with straight edge, the edges of the slab along the forms and at joints should be rounded off with a M.S. edging tool to a radius of 9 mm. The final surface texture should be produced by drawing a coir brush or edge of a moistened gunny bag transversely across the lane to form uniform transverse ridges that will produce a surface with good skid-resistant and light -reflecting properties. Both these surface finishes could be produced after the water sheen had disappeared from the surface and before the concrete has hardened too much to permit good finishing.

JOINTS

Joints in concrete pavements are necessitated both by design and for facilitating construction.

LONGITUDINAL JOINTS

These joints are formed in the slab edge by side forms and their trueness depends purely on the care taken in setting of side forms and maintaining them in position by careful checking during construction. The sides of the forms should be well oiled before each use to prevent adhesion of concrete. If tongue-and-groove type joint is to be formed, the wooden keyway of designed shape should be properly secured to the side forms and maintained in good condition. Where tie bars are to be located across the longitudinal joints, they are so bent that onehalf of the tie bar lines along the form and the other half will project into the concrete to be placed. When the forms for the first lane are removed and when the preparation of the subgrade for the adjacent lane is completed, the portion of the tie bar along the form is straightened so that it will be embedded in the concrete of the second lane. The tie bars should be of approved quality of steel, which will resist bending and straightening without breaking.

TRANSVERSE CONSTRUCTION JOINTS

These are usually spaced at relatively short intervals across the pavement. These may be either of the full-depth type, dummy-groove type or sometimes formed by sawing a groove after the concrete has hardened sufficiently to prevent ravelling during sawing. The dummy-groove type of joint is formed in the plastic concrete by leaving a mild steel plate of required thickness and depth in the wet concrete during compaction and finishing. This should be slackened gently, immediately after compaction and removed after the concrete is stiff enough to form the joint. Alternatively, it is also formed by pressing, tamping or vibrating a T-section of mild steel fitted with handles at each end. Same care is necessary as in the case of insertplates, for removal of the T-section and forming of the joint. After the removal of the mild steel insert, the sharp corners of the joint are rounded off with a suitable edging tool. If proper care is taken, this operation of edging may be obviated when the T-section is used, as the fillets of the section provide the necessary rounding off of the edges. The surface of the inserts and T-iron coming in contact with the concrete should be well oiled before each use.

Usually the depth of swan or grooved joints varies from 1/2 to 1/6 thickness of the slab and proper size of inserts or T's should be selected according to the specifications.

Sometimes, dummy contraction joints are also formed by leaving a premoulded strip of bitumen or requisite-sized impregnated hard wood during the progress of concreting. This does not necessitate edging as in the case of preformed groove-type of joint, but care must be taken to see that the strips are continuous from slab edge to slab edge; also they must be held properly to prevent bending or tipping cut of vertical by final surface finishing operations.

All the above types of dummy joints are intended to weaken the cross-section of the slab at given points sc that any cracking arising out of contraction stresses will take place at the joints instead of elsewhere in the slab. These joints must be formed with care or spalling will result at these locations.

When a full-depth transverse contraction joint is formed, a wooded bulkhead of full depth is employed against which concrete is placed. The surface of the bulkhead should be well oiled and maintained truly vertical by stakes on both sides of it. If dowel bars are to be provided at such joints, the bulk head should be provided with slots of suitable size and spacing to enable their proper positioning. Before placing the concrete of the adjoining slab, the complete face of concrete is painted with bitumen.

The contraction joint either of the dummy-type or of the full depth-type must be carried through adjacent kerb sections. The type of joint in the kerb should be constructed to match the joint in the pavement.

TRANSVERSE EXPANSION JOINTS

Expansion joints are provided at longer intervals than contraction joints along the length of roadway and also at other speoial locations such as at bridge approaches, abrupt changes in pavement width, and junction with other types of pavements, so as to reduce compressive stresses that may develop because of expansion of the concrete. Expansion joints usually consist of a premoulded filler either of a non-extruding bituminous-tread fibre or hard board. These fillers must be continuous from slab edge to slab edge and through kerbs or kerb and gutter section. They must extend through all but 1.9 cm. to 2.5 cm. from the top of the joint if they are to function properly as expansion joints. Any concrete plug that extends over the joint filler will cause spalling of the concrete at the upper edge of the joint. Likewise, any plug extending under through, around or between the sections will prevent movement due to expansion and may lead to undesirable cracking. Usually, the fillers are held in place by stakes against the bulk head or against the finished end of concrete. The groove of proper size above the joint filler should be maintained by fixing a steel or wooden capping piece so that no concrete overhanges the filler from either side. The filler and the bulk head would need to be perforated if dowel bars are proposed across expansion joint.

REINFORCEMENT

Often, reinforcement is incorporated in the construction of concrete roads. It consists either of mild steel bars of specified sizes and spacing in either direction or alternatively welded-wire fabric. There are two methods by which the reinforcement is positioned in the depth of the concrete slab; firstly by supporting the pre-fabricated bar mat or welded-wire fabric on suitable supports at the required elevation prior to placing of the concrete; or secondly by first placing a layer of concrete and compacting the same to the level of reinforcement, thereafter placing the reinforcement and followed by placing the remaining depth of concrete. The latter method is more frequently employed as, in the first method, extra labour would be involved in taking care to see that the concrete below

the level of reinforcement is properly packed and compacted, and also it would not permit workmen approaching the place of concreting except through proper bridges provided across the bays. Irrespective of the method employed for placing of reinforcement, the quantity, quality and location or reinforcement should be properly checked and maintained.

DOWELS:

Either contraction or expansion joints may include the use of dowels to ensure load-transfer across the joints. Such dowels, when specified, are smooth round steel bars of a prescribed length and diameter and at a specified spacing. The dowels must be painted and greased on one-half length when placed at expansion joints and on full length when placed at contraction joints to prevent bond with concrete. In expansion joints, the slipend must be provided with a cap either of cardboard or metal stuffed with grease and/or cotton wood to ensure adequate expansion space for the dowel. Dowels must be accurately placed, parallel to the centreline and surface of the slab, to permit free longitudinal movement across the joint. Many times, dowels are installed assemblies, tied together by steel stirrups and staked to the subgrade to ensure proper alignment. Crooked or bent dowels will cause restraint, preventing the joint from opening and closing during volume changes in the concrete which may result in spalling or cracking near the joint.

KERBS, KERB AND GUTTER.

In the construction of urban roads, very often the sides of the road are provided with gutters for surface drainage, and a kerbing to separate the footpath from the roadway. Best results are obtained when these are also built of concrete to the same specifications as the main roadway.

CURING:

All concrete must be cured in order to ensure proper gain of strength with age and durability. Curing is done by two alternative methods-(a) wet curing and (b) membrane curing.

(a) *Wet Curing :* In the wet curing method, the concrete surface, as soon as it is still enough to prevent formation of imprints, should be covered with wet hessian fabric or other alternative material like cotton mats or straw extending both over the surface and the sides. These mats should be kept moist for the entire curing period lasting from 7 to 10 days to ensure proper curing. However, as commonly employed, these covers may be removed after a period of about 24 hours after placing of concrete and replaced by ponding or wet earth cover.

(b) *Membrane curing :* Membrane curing consists of covering the surface of concrete with a water-proof or plastic film or by spraying a curing compound. Such covers should extend over the entire surface and edges of the slab and must be free from cuts, tears or holes that would permit loss of moisture by evaporation. Where curing compounds are employed, they should preferably be light in colour to minimise temperature change in the concrete and should be distributed by a method ensuring uniform coverage over the entire surface.

Regardless of the method used for curing, it must be applied early enough to prevent excessive moisture loss which could result in development of shrinkge cracks when the concrete is in plastic stage. As a practical hint, curing can be started as soon as final surface texture is obtained with a broom or brush.

SEALING OF JOINTS :

After the curing period is completed, all joints of the pavement should be cleaned and sealed with an approved sealing compound. The joint can usually be cleaned with a sharp pointed tool and

then blown out with compressed air either from a hand-operated pump, compressor or exhaust of a truck. All foreign material such as grit, sand and dirt must be removed, otherwise any obstruction to the closure of joints later will result in spalling. If any dust or curing compound is present in the joint, the sealing compound will not bond to the concrete. Sometimes, it would be desirable to prime the surface of the joint with a solvent like kerosene oil by means of cotton waste dipped in the same. The joint should be completely filled with the sealing compound flush with the surface. All excessive material should be removed since it creates a bump that is annoying to the motorist. If hotpoured sealing compounds are used, they should be heated in a double-boiler type of kettle to prevent over -heating which would damage the properties of the sealing compound and reduce its effectiveness and life. The maximum temperature specified by the manufacturers should be strictly adhered to.

OPENING TO TRAFFIC.

The entire pavement area should be prevented from being used by traffic during the period called for in the specifications, usually about 10 to 14 days after placing of the concrete or 5 days if rapid hardening cement is used. This restriction on traffic applies to the contractor's construction equipment and vehicles as well as general traffic. Early traffic use before the slab has gained adequate strength to support the loads can cause cracking of the new slab. Heavy concrete pavers, if used, should never be allowed to operate on the completed slab until it has acquire adequated strength.

It is important that the work should be cleared up early and thoroughly. As soon as curing and sealing are completed, the slab should be cleared of all debris and construction equipment.

APPENDIX 'E'

TESTING OF CEMENT CONCRETE

Specimen :— Test specimens shall be either cubes or cylinders whose sizes shall be as given below :—

1.1. *Size of test specimens :—* Test specimens cubical in shape shall be 15 x 15 x 15 Cm. If the largest nominal size of the aggregate does not exceed 2 cm., 10 cm. cubes may be used as an alternative. Cylindrical test specimens shall have a length equal to twice the diameter. They shall be 15 cm. in diameter and 30 cm. long. Smaller test specimens shall have a ratio of diameter of specimen to maximum sizes of aggregate of not less than 3 to 1, except that the diameter of the specimen shall be not less than 7.5 cm. for mixtures containing aggregate more than 5 percent of which is retained on IS Sieve Designation 4.75 mm. IS: 460 - 1985 and 385 - 1979.

1.2. MOULDS :—

1.2.1. *Cube Moulds :* the mould shall be of metal, preferably steel or cast iron, and strong enough to prevent distortion. It shall be constructed in such a manner as to facilitate the removal of the moulded specimen without damage, and shall be so machined that, when it is assembled ready for use, the dimensions and internal faces shall be accurate within the following limits.

The height of the mould and the distance between opposite faces shall be the specified size+0.2 mm. The angle between adjacent internal faces and between internal faces and top and bottom planes of the mould shall be 90° + 0.5°. The interior faces of the mould shall be plane surfaces with a permissible variation of 0.30 mm. Each mould shall be provided with a metal base plate having a plane surface. The base plate shall be of such dimensions as to support the mould during the filling without leakage, and it shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together, and suitable methods of ensuring this both during the filling and on subsequent handling of the filled mould, shall be provided.

In assembling the mould for use, the joints between the sections of mould shall be thinly coated with mould oil and a similar coating of mould oil shall be applied between the contact surfaces of the bottom of the mould and the base plate in order to ensure that no water escapes during filling. The interior surfaces of the assembled mould shall be thinly coated with mould oil to prevent adhesion of the concrete.

1.2.2. *Cylinder Moulds :* The cylindrical mould shall be of metal which shall be not less than 3 mm. thick. Each mould shall be capable of being opened longitudinally to facilitate removal of the specimen and shall be provided with means of keeping it closed while in use. The ends shall not depart from a plane surface, perpendicular to the axis of the mould by more than 0.05 mm. when assembled ready for use the mean internal diameter of the mould shall be 15.0 cm. + 0.2 mm. and in no direction shall the internal diameter be less than 14.95 cm. or more than 15.05 cm. The height shall be 30.0 cm. + 0.1 cm. Each mould shall be provided with a metal base plate, and with a capping plate of glass or other suitable material. The base and the capping plate shall be at least 6.5 mm. thick, and such that they do not depart from a plane surface by more than 0.02 mm. The base plate shall support the mould during filling without leakage and shall be rigidly attached to the mould. The mould and base plate shall be coated with a thin film of mould oil before use in order to prevent adhesion of the concrete.

2. *Sampling of Concrete :* samples of concrete for test shall be taken at the mixer, or in the case of ready mixed concrete from the transportation vehicle during discharge. The sample of concrete from which test specimens are made shall be representative of the entire batch. Such samples shall be obtained by repeatedly passing a scoop or Pail through the discharging stream of concrete, starting the sampling operation until the entire batch is discharged. The sample thus obtained shall be transported to the place of moulding of the specimen and to counter act segregation, the concrete shall be mixed with shovel until it is uniform in appearance. The location in the work of the batch of concrete thus sampled shall be noted for future reference. In case of paving concrete, samples may be taken from the batch immediately after depositing on the sub-grade. At least 3 samples shall be taken from different portions of the work and these samples shall be thoroughly mixed before being used to form the test specimen.

3. PREPARATION OF TEST SPECIMENS :

3.1 The interior surfaces of the mould and plate shall be lightly oiled before the concrete is placed in the mould, from the samples of concrete obtained as described under 2. The test specimen shall be immediately moulded.

4. *Compacting :* The test specimens shall be made as soon as practicable after mixing, and in such a way as to produce full compaction of the concrete with neither segregation nor excessive laitance. The concrete shall be filled into the mould in layers approximately 5cm. deep. In placing each scoopful of concrete, the scoop shall be moved around the edge of the mould as the concrete slides from it, in order to ensure a symmetrical distribution of the concrete within the mould. Each layer shall be compacted either by hand or by vibration as described below. After the top layer has been compacted, the surface of the concrete shall be finished level with the top of the mould, using trowel, and covered with a glass or metal plate to prevent evaporation.

5. *Compacting by hand :* When compacting by hand, the standard tamping bar shall be used and the strokes of the bar shall be distributed in an uniform manner over the cross section of the mould. The number of strokes per layer required to produce specified conditions will vary according to the type of concrete. For cubical specimens, in no case shall the concrete be subjected to less than 35 strokes per layer for 15 cm. cubes or 25 strokes per layer for 10 cm. cubes. For cylindrical specimens, the number of strokes shall not be less than thirty per layer. The strokes shall penetrate into the underlying layer and the bottom layer shall be rodded throughout its depth. Where voids are left by the tamping bar, the sides of the mould shall be tapped to close the voids.

5.1. *Compacting by Vibration :* When compacting by vibration each layer shall be vibrated by means of an electric or pneumatic hammer or vibrator or by means of a suitable vibrating table until the specified condition is attained.

Note : The mode and quantum of vibration of the field laboratory specimen shall be as nearly the same as those adopted in actual concreting operations at site.

6. *Capping of cylindrical specimens :* The ends of all cylindrical test specimens that are not plane within 0.05 mm. shall be capped. Capped surfaces shall not depart from a plane by more than 0.05 mm. and shall be approximately at right angle to the axis of the specimens. The planeness of the cap shall be checked by means of a straight edge and feeler gauge, making a minimum of three measurements on different diameters. Caps shall be made as thin practicable and shall not flow or fracture when the specimen is tested. Capping shall be carried out according to one of the methods detailed in clauses 2.11.1, 2.11.2 and 2.11.3 of I.S. 516-1959.

7. *Curing :* The test specimens shall be stored in a place, free from vibration, in moist air of at least 90 percent relative humidity and at a temperature of 27°C + 2°C for 24 hours + 1/2 hour

from the time of addition of water to the dry ingredients. After this period, the specimens shall be marked and removed from the moulds and, unless required for test within 24 hours, immediately submerged in clean, fresh water or saturated lime solution and kept there until taken out just prior to test. The water or solution in which the specimens are submerged shall be renewed every seven days and shall be maintained at a temperature of 27°C+2°C. The specimens shall not be allowed to become dry at any time until they have been tested.

8. *Number of specimens :* At least three specimens, preferably from different batch, shall be made for testing at each selected age.

9. *Age at test :* Tests shall be made at recognised ages of the test specimens, the most usual being 7 and 28 days. Ages of 13 weeks and one year are recommended if tests at greater ages are required. Where it may be necessary to obtain the early strengths, tests may be made at the ages of 24 hours + 1/2 hour and 72 hours + 2 hours. The ages shall be calculated from the time of the addition of water to the dry ingredients.

10. *Methods of testing :* Specimens stored in water shall be tested immediately on removal from the water and while they are still in the wet condition. Surface water and grit shall be wiped off the specimens and any projecting fins removed. Specimens when received dry shall be kept in water for 24 hours before they are taken for testing. The dimensions of the specimens to the nearest 0.2 mm. and their weight shall be noted before testing.

A correction factor according to the height/diameter ratio of specimen after capping shall be obtained from the curve shown in sketch No. 35 of Annexure XV. The product of the correction factor and the measured compressive strength shall be known as the corrected compressive strength, this being the equivalent strength of a cylinder having a height/diameter ratio of two. The equivalent cube strength of the concrete shall be determined by multiplying the correct cylinder strength by 5/4.

11. *Report :* The following information shall be included in the report on each test specimen :-

a) identification mark,
b) date of test,
c) age of specimen,
d) curing conditions, including date of manufacture of specimen in the field.
e) weight of specimen,
f) dimension of specimen,
g) cross-sectional area,
h) maximum load,
i) compressive strength, and
j) appearance of fractured faces of concrete and type of fracture, if these are unusual.

12. *Standard of Acceptance :—* The number of test specimens required the frequency of sampling and the criteria for acceptance of a concrete as conforming to the specified grade shall be in accordance with the table given below for both ordinary concrete and controlled concrete. No preliminary tests are, however, necessary in the case of ordinary concrete.

TABLE: ACCEPTANCE CRITERIA FOR CONCRETE
(For all grades of concrete)

Works Test

Minimum No. specimen taken from same days work		Minimum Frequency		Criteria for Acceptance
Cubes				
7-day compressive strength as an optional test, if desired....	28-day compressive strength test.	In terms of the quantity of concrete.	In terms of period.	
(1)	(2)	(3)	(4)	(5)
3	3	For every 150m³ of concrete or part thereof.	At such interval as the Engineer-in-Charge may decide. However in the case of controlled concrete samples shall be drawn on each day for the first four days of concreting and thereafter at least once in seven days of concreting.	Accept if average strength of the specimens tested is not less than the strength specified in Table-I subject to the condition that the one out of the 3 consecutive tests may give a value less than the specified stregth but this shall not be less than 90% of the specified strength.
	OR		OR	
5	5	for every 150m³ of concrete or part thereof.	At such interval as the Engineer-in-Charge may decide. However, in the case of controlled concrete samples shall be drawn on each day for the first four days of concreting and thereafter at least once in seven days of concreting.	Accept if average strength of the specimens tested is not less than the strength specified in Table-I subject to the condition that one out of five consecutive tests may give a value less than the specified strength.

TABLE I

Concrete Mix.	Compression strength at 28 days		Permissible stress in compression	
	Preliminary test	Work test	Direct	Due to bending
	Kg./ Sq. cm.	Kg./ Sq. cm.	Kg./ Sq. cm.	Kg./ Sq. cm.
Ordinary concrete using cubic test specimens.				
1 : 1 : 2	323.4	242.6	64.7	80.8
1 : 1½ : 3	267.1	200.4	53.4	66.8
1 : 2 : 4	210.9	158.2	42.2	52.7

13. STANDARD METHOD OF TEST FOR CONSISTENCE OF CONCRETE (SLUMP TEST):-

The test is to be used both in the laboratory and during the progress of work for determining the consistence of concrete.

The test specimen shall be formed in a mould in the form of a frustram of a cone with internal dimensions as follows :-

Bottom diameter 20 cm. : Top diameter 10 cm., Height 30 cm.

The bottom and the top shall be open, parallel to each other and at right angles to the axis of the cone. The moulds shall be provided with suitable foot pieces and handles. The internal surface shall be smooth.

Care ahall be taken to ensure that a representative sample is taken.

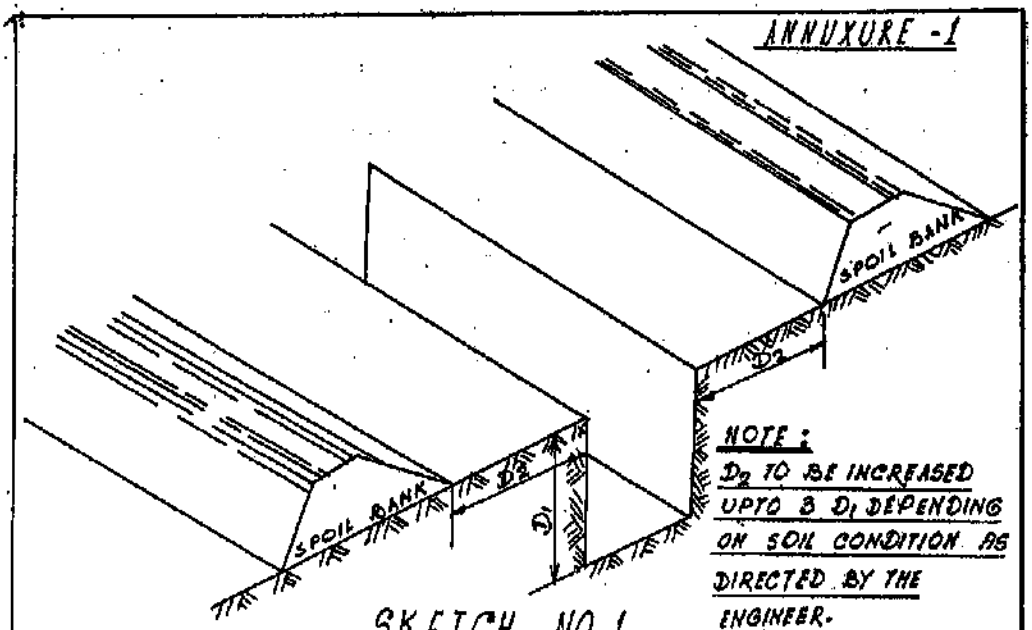
The internal surface of the mould shall be thoroughly clean, dry and free from set cement before commencing the test. The mould shall be placed on a smooth, flat, non-absorbant surface and the operator shall hold the mould firmly in place, while it is being filled, by standing on the foot pieces. The mould shall be filled to about 1/4th of its height with concrete, which shall then be puddled using 25 strokes of 16 mm. rod, 60 cm. long, bullet pointed at the lower end. The filling shall be completed in successive layers similar to the first and the top struck off that the mould is exactly filled. The mould shall then be removed by raising vertically, immediately after filling. The moulded concrete shall then be allowed to subside and the height of the specimen measured after coming to rest.

The consistence shall be measured in terms of centimetre of subsidence of the specimen during the test (Known as the slump). A careful record of all consistence tests shall be maintained.

13.1 RECOMMENDED SLUMPS FOR VARIOUS TYPES OF CONSTRUCTION :

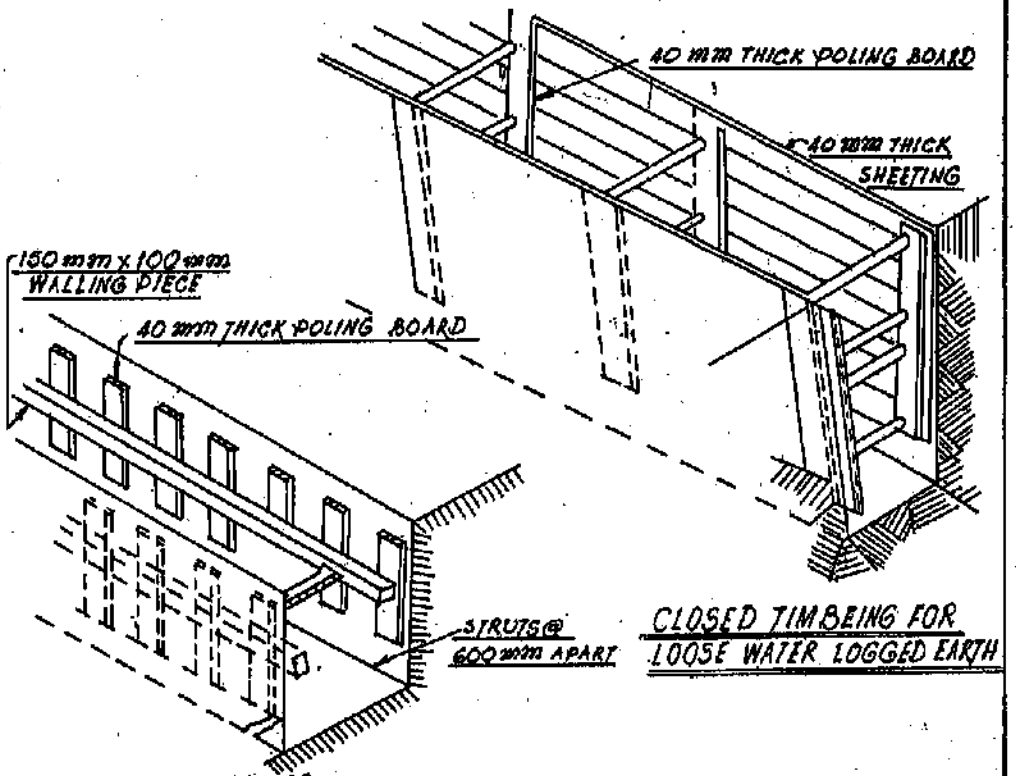
Type of construction	Non-vibrated concrete. Slump centimetres		Vibrated concrete. Slump centimetres
	Maximum	Minimum	Maximum
Reinforced foundation walls and footings	10	5	3.8
Plain footings, caissons and substructure walls	10	2.5	3.8
Slabs, beams and reinforced walls	10	7.5	3.8
Building columns	10	7.5	3.8
Pavements	7.5	5	3.8
Heavy mass construction	7.5	2.5	3.8

ANNUXURE -1



NOTE :
D_2 TO BE INCREASED UPTO 3 D_1 DEPENDING ON SOIL CONDITION AS DIRECTED BY THE ENGINEER.

SKETCH NO. 1

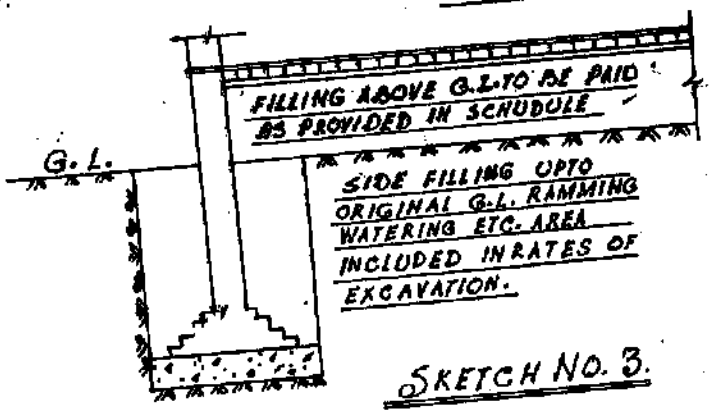


CLOSED TIMBERING FOR LOOSE WATER LOGGED EARTH

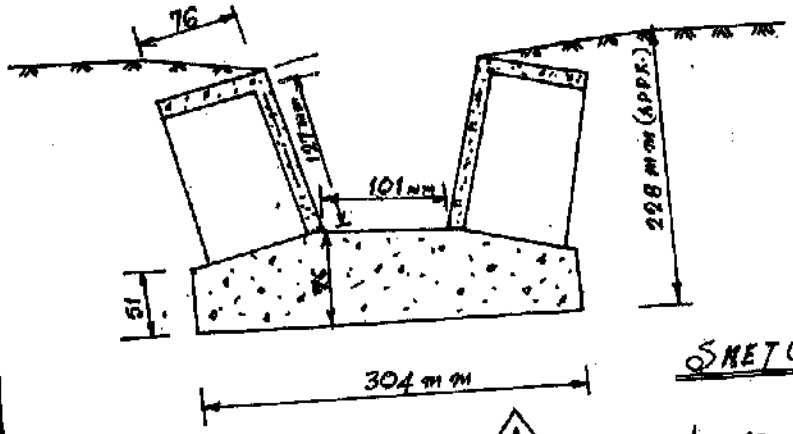
OPEN TIMBERING FOR LOOSE SOIL

SKETCH NO. 2.

ANNEXURE - II

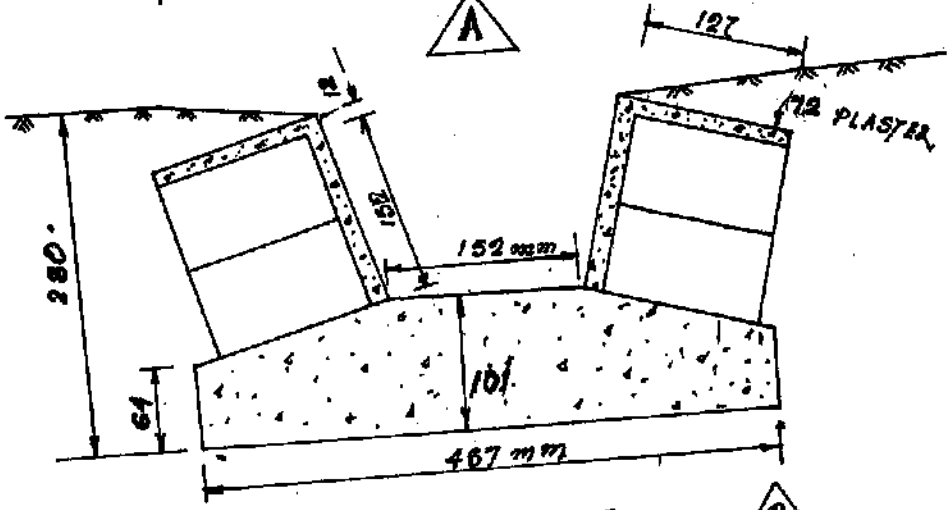


SKETCH NO. 3.



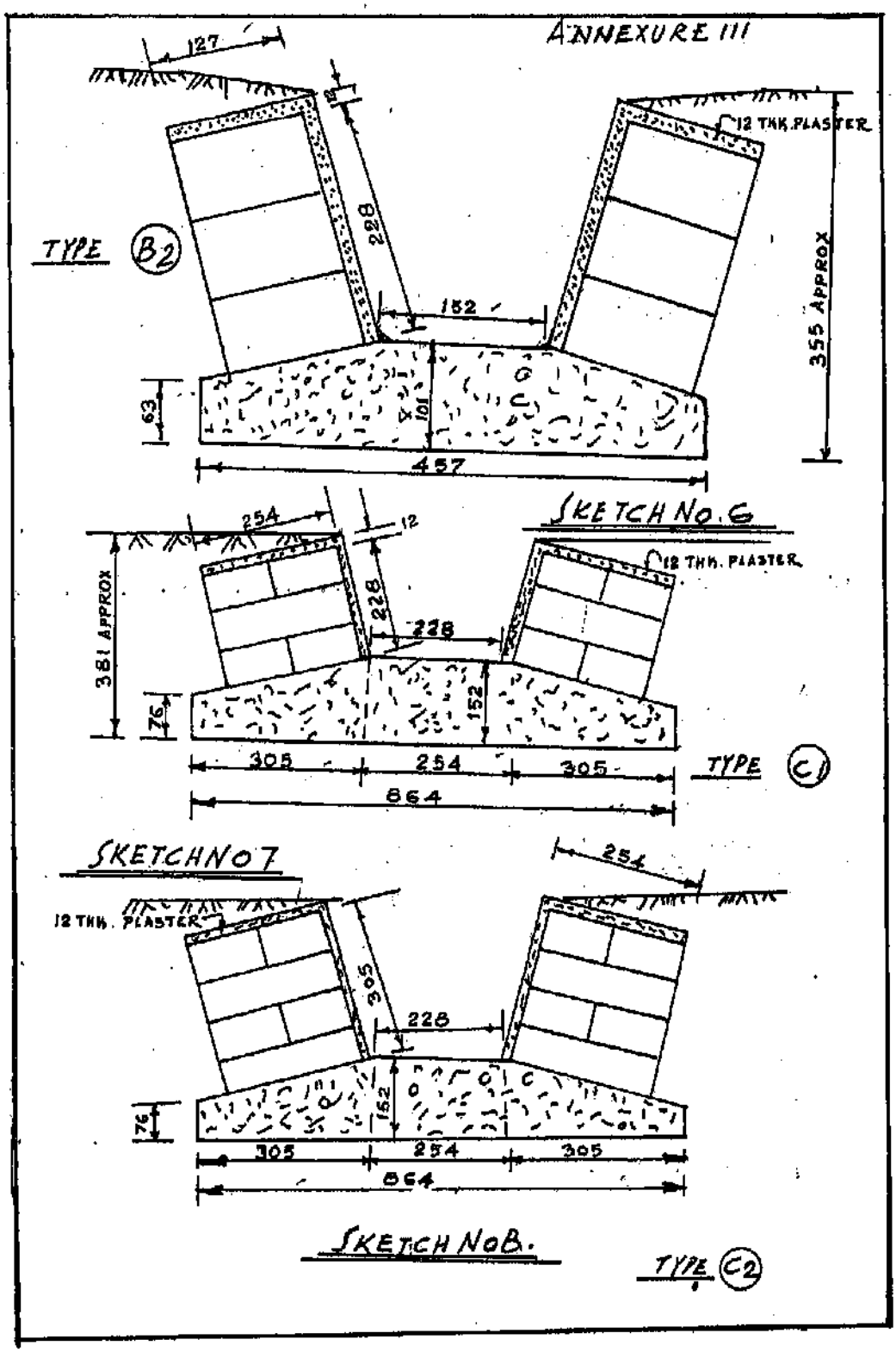
SKETCH NO. 4

A

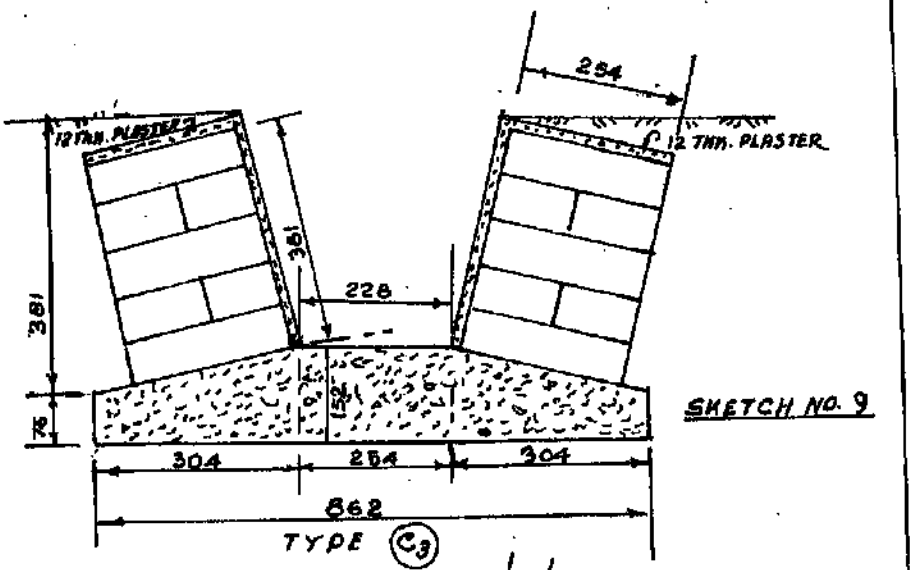


SKETCH NO. 5.

B

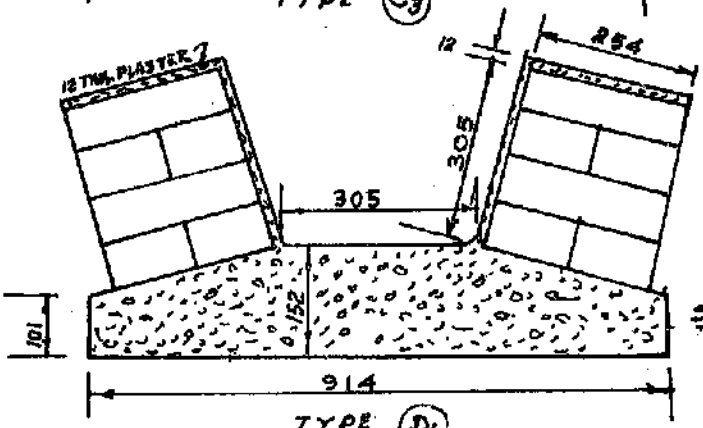

ANNEXURE III
127
12 THK. PLASTER
228
TYPE B2
152
355 APPROX
63
101
457
SKETCH NO. 6
254
12
12 THK. PLASTER
381 APPROX
228
228
76
152
305
254
305
TYPE C1
864
SKETCH NO 7
254
12 THK. PLASTER
305
228
76
152
305
254
305
864
SKETCH NO 8.
TYPE C2

ANNEXURE - IV



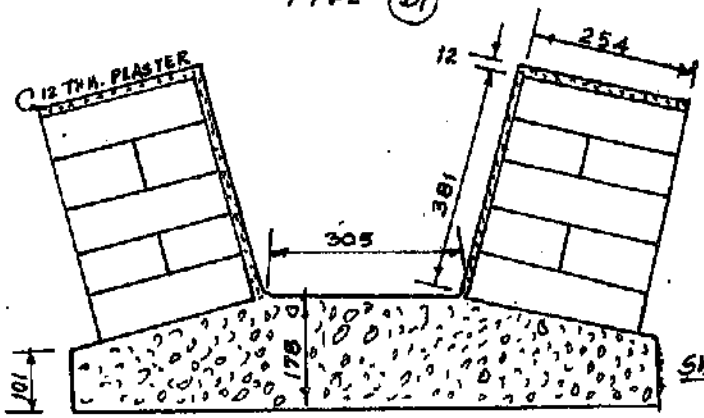
SKETCH NO. 9

TYPE (C3)



SKETCH NO-10

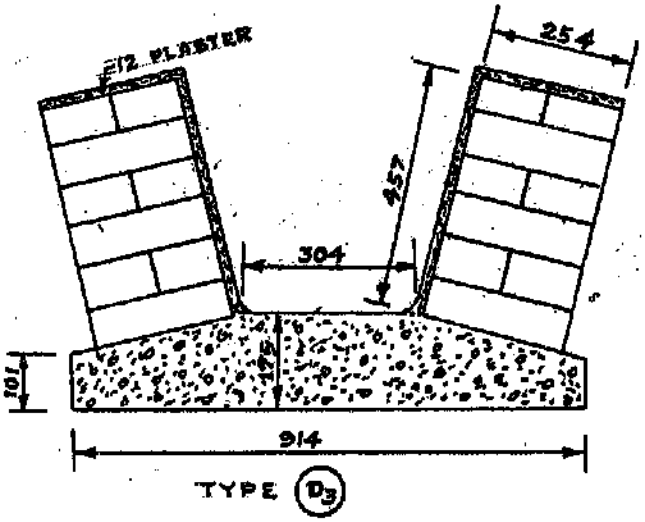
TYPE (D1)



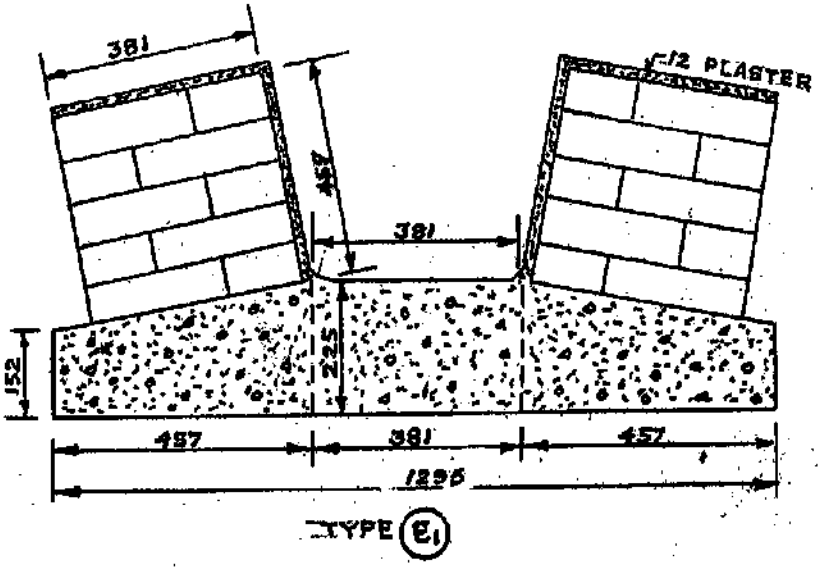
SKETCH NO-11

TYPE (D2)

SKETCH NO. 12 ANNEXURE - V



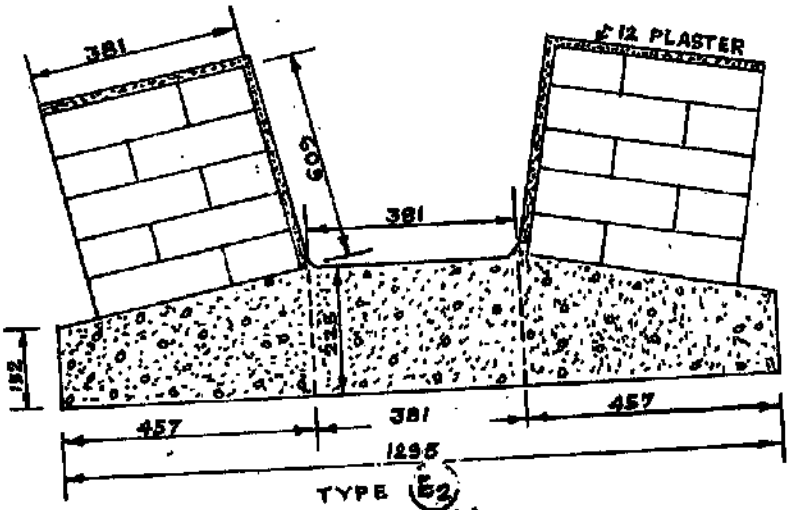
TYPE D_3



TYPE E_1

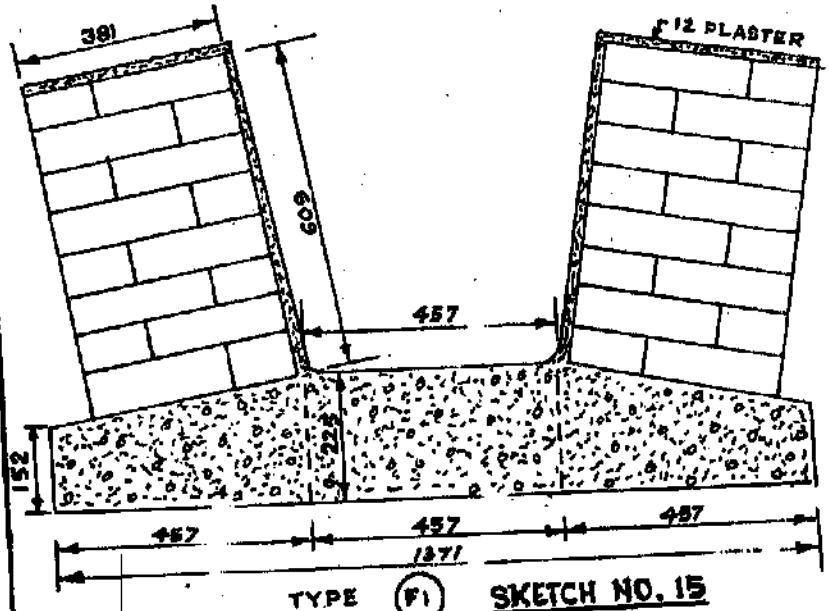
SKETCH NO. 13

ANNEXURE-VI



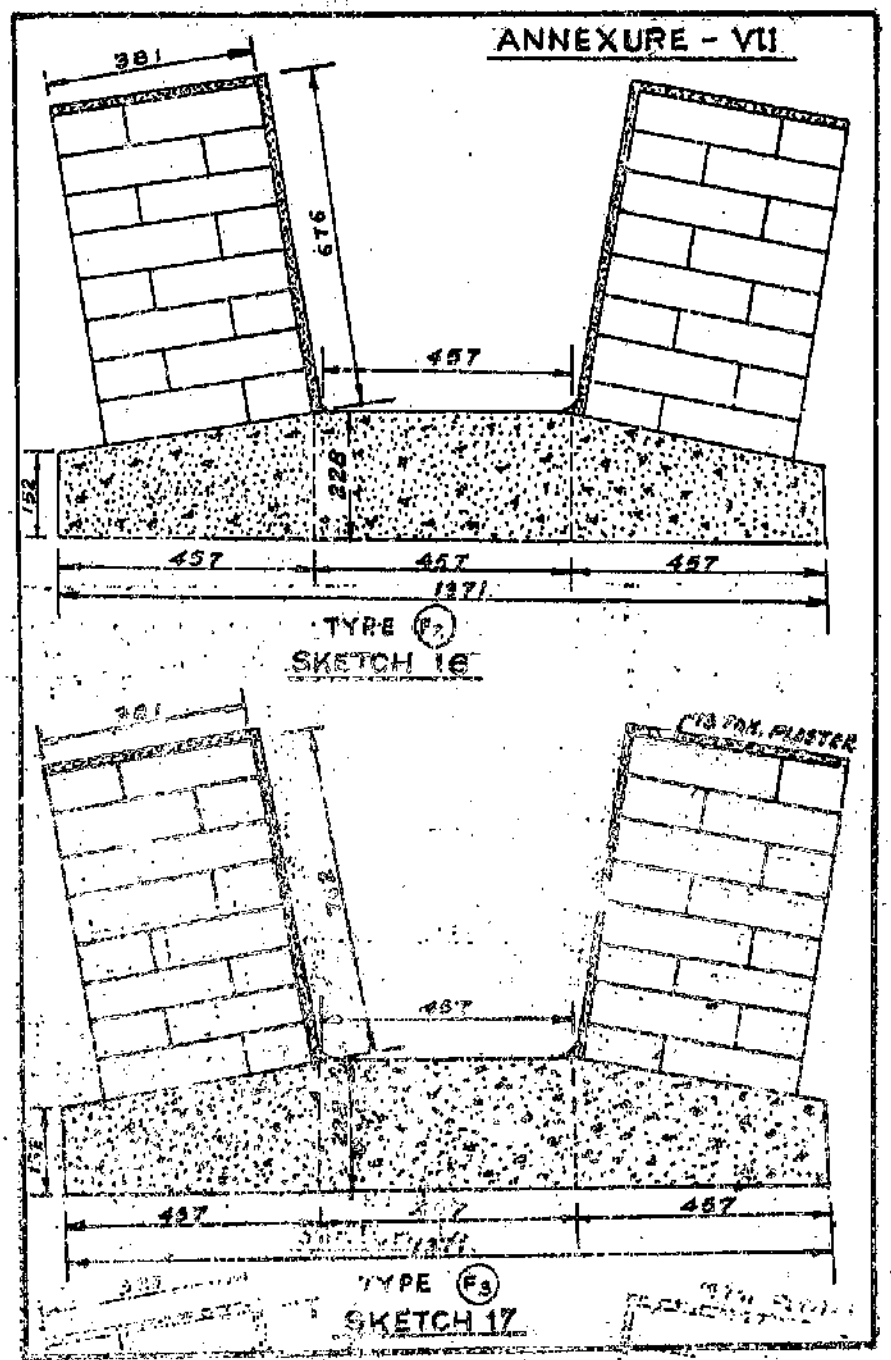
TYPE (E2)

SKETCH NO. 14.



TYPE (F1) SKETCH NO. 15

ANNEXURE - VII



TYPE (F2)

SKETCH 16

TYPE (F3)

SKETCH 17

ANNEXURE

Sl. No.	Type No.	Inner width at bottom	Inner width at top of of water Level	Inclined Ht. of brick work upto top of water Level	Clearance bet. top of brick work & water Level	Depth of Water (vertical/Height) (R)
		Cm.	Cm.	Cm.	Cm.	Cm.
1.	A	10.16	13.97	7.62	5.08	7.62
2.	B_1	15.24	20.32	10.16	5.08	10.16
3.	B_2	15.24	24.13	17.78	5.08	17.68
4.	C_1	22.86	33.02	17.78	5.08	17.272
5.	C_2	22.86	34.29	25.40	5.08	22.096
6.	C_3	22.86	38.10	33.02	5.08	29.18
7.	D_1	30.48	41.91	22.86	7.6	22.096
8.	D_2	30.48	45.72	30.48	7.6	29.08
9.	D_3	30.48	48.26	38.10	7.6	36.8
10.	E_1	38.10	55.88	38.10	7.6	36.8
11.	E_2	38.10	63.50	53.34	7.6	51.81
12.	F_1	45.72	63.50	53.34	7.6	51.81
13.	F_2	45.72	72.20	66.96	7.6	59.18
14.	F_3	45.72	81.28	68.58	7.6	66.548

FORMULA ADOPTED

(1) FOR DETERMINING VELOCITY
MANNING'S FORMULA
$V = \frac{1.486}{N} (S)^{1/2} (R)^{2/3}$ WHERE

V = VELOCITY IN METRE/SEC.
N = ROUGHNESS FACTOR
S = LONGITUDINAL SLOPE
R = HYDRAULIC MEAN DEPTH
$= \frac{A}{P}$ (A = CROSS SECTION OF MAX : FLOW
P = WETTED PERIMETER.)

VIII

Cross Section of minimum flow through drain	Longitudinal slope (S)	Roughness Factor (N)	Velocity(V)	Discharge (Q)
Sq. Cm.			Metre/ Second	Cu.m./sec.
89.032	1 in 150	0.013	0.670	0.0060
176.03	1 in 200	0.013	0.754	0.0135
390.0	"	0.013	0.9895	0.0314
482.58	1 in 300	0.013	0.848	0.041
687.74	"	0.013	0.958	0.066
897.42	"	0.013	0.948	0.085
929.68	"	0.013	1.069	0.101
1122.58	"	0.013	1.107	0.124
1449.68	"	0.013	1.185	0.168
2213.55	"	0.013	1.475	0.826
2632.25	"	0.013	1.4112	0.371
2829.7	"	0.013	1.443	0.408
3269.76	"	0.013	1.694	0.687
4225.8	"	0.013	1.67	0.706

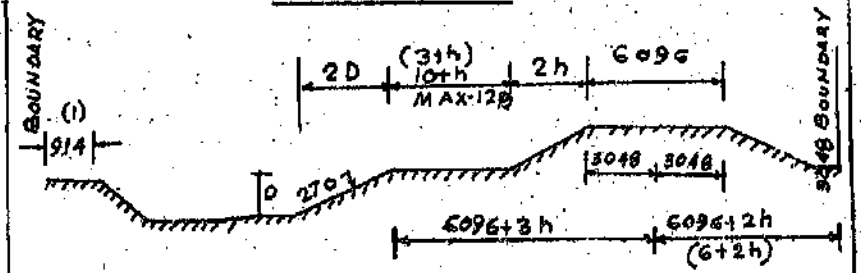
(II) FOR DETERMINING DISCHARGE : A= CROSS SECTION OF MAX. FLOW THROUGH THE DRAINS

Q = A.V. WHERE V = VELOCITY IN METRE PER SECOND

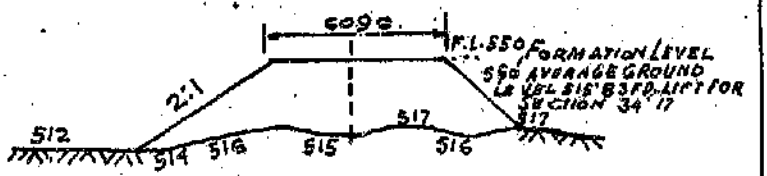
Q = DISCHARGE IN cu.m./SEC.

ANNEXURE IX

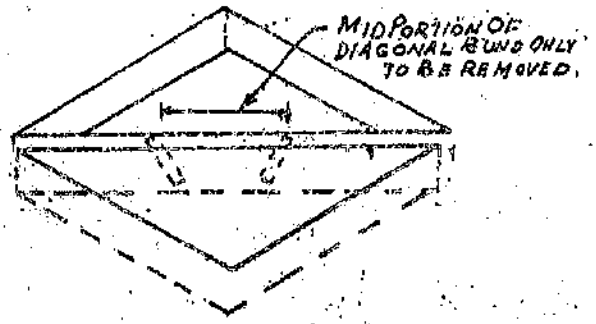
SKETCH - 18



SKETCH - 19



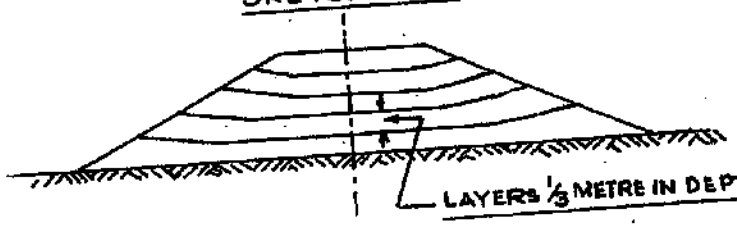
FIGURES IN BRACKET ARE IN METRES.



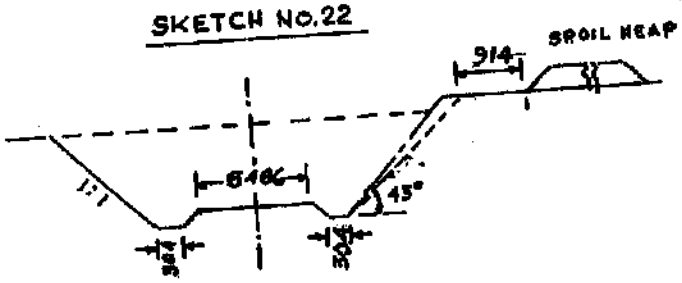
SKETCH - 20

ANNEXURE - X

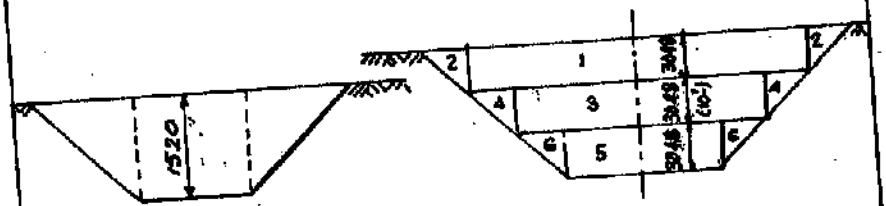
SKETCH NO. 21



SKETCH NO. 22



SKETCH NO. 23



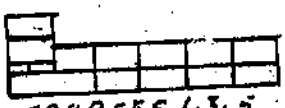
SKETCH NO. 24



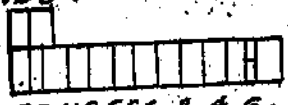
FIGURES ARE IN mm.

SKETCH No. 25 ANNEXURE XI.

ENGLISH BONDS.

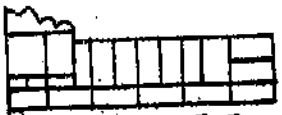


COURSES 1.3.5



COURSES 2.4.6.

2 HALF BRICK WALL.



COURSES 1.3.5

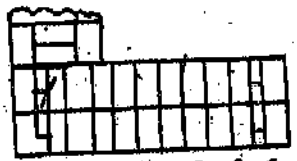


COURSES 2.4.6.

3 HALF BRICK WALL.

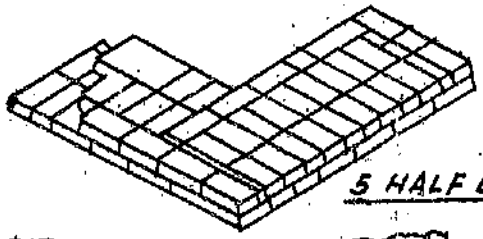


COURSES 1.3.5

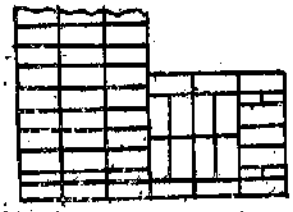


COURSES 2.4.6

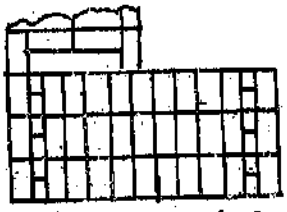
4 HALF BRICK WALL.



5 HALF BRICK WALL



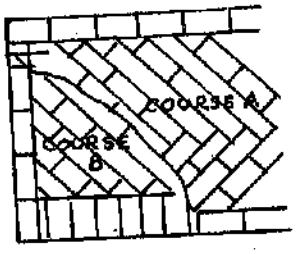
COURSES 1.3.5



COURSES 2.4.6

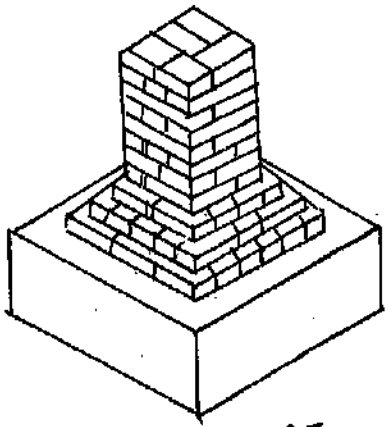
6 HALF BRICK WALL.

ANNEXURE XII



HERRING BONE BOND

SKETCH No. 26



SKETCH No. 27



COURSES 1,3,5 COURSES 2,4,6

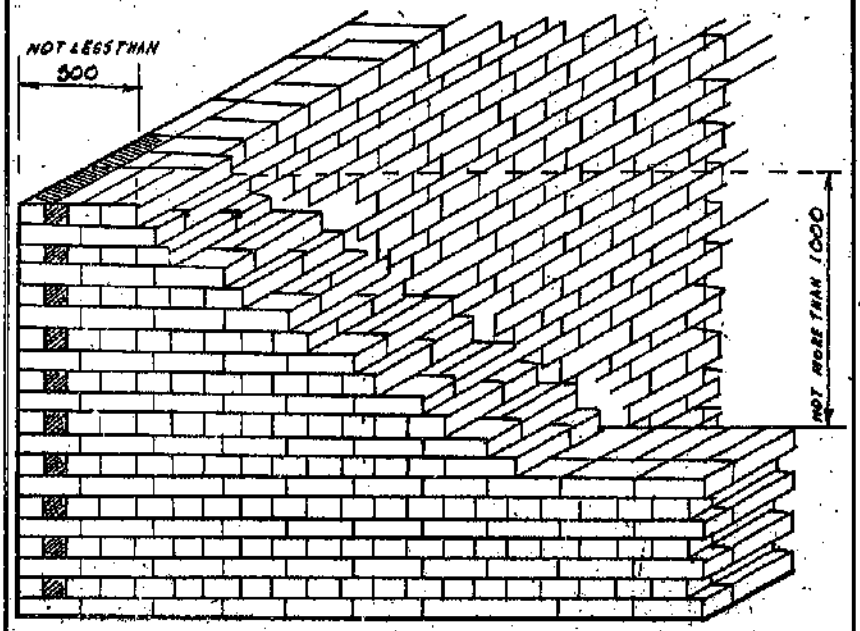
2 HALF BRICK PILLAR.



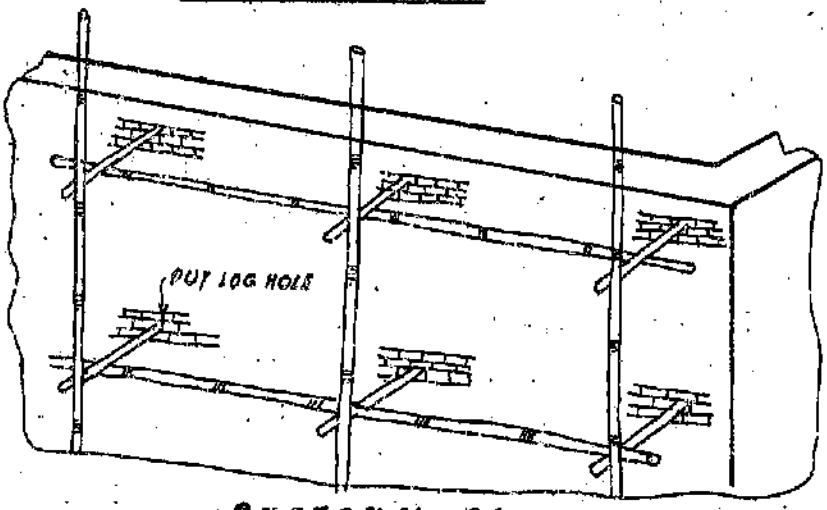
3 HALF BRICK PILLAR.

SKETCH No. 28

ANNEXURE - XIII



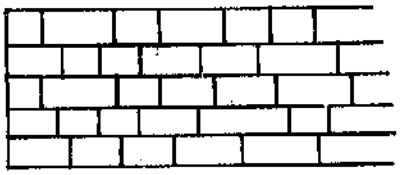
SKETCH No. 29



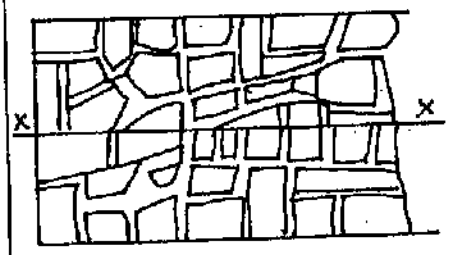
SKETCH No. 30

ANNEXURE XIV.

COURSED RUBBLE MASONRY.

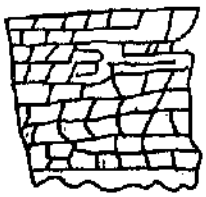


ELEVATION.



PLAN.

UNCOURSED RUBBLE MASONRY.

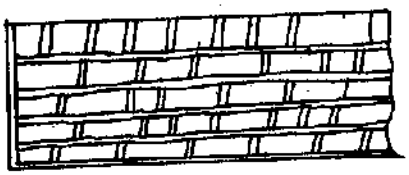


ELEVATION.



SECTION.

SKETCH NO. 32

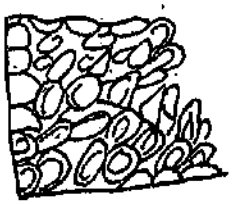


SECTION- X-X.

SKETCH NO. 31.

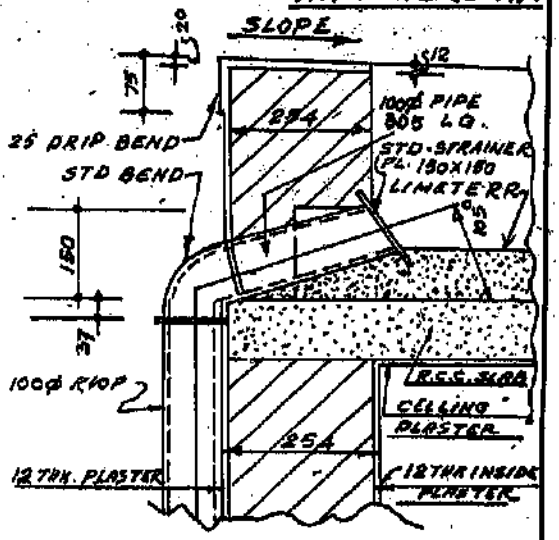
ANNEXURE-XV.

RANDOM RUBBLE MASONRY



PLAN ELEVATION OR SECTION.

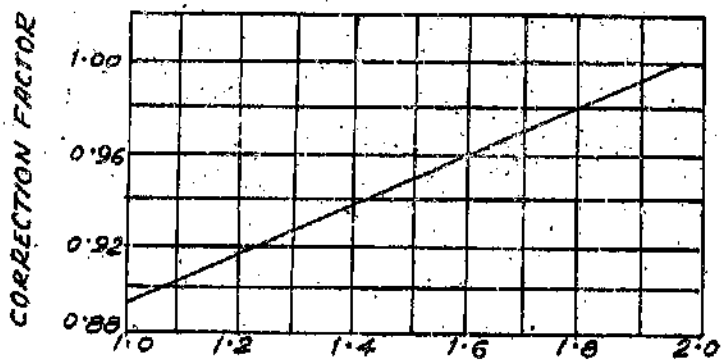
SKETCH NO. 33



SKETCH NO. 34

DETAILS OF DOWN WATER PIPE CONNECTION AT ROOF LEV.

SKETCH NO. 35



$$\text{RATIO} = \frac{\text{HEIGHT}}{\text{DIAMETER}}$$

FIG. 1 CORRECTION FACTOR FOR HEIGHT/DIAMETER RATIO OF A CORE

ERRATA TO

PARTS II, III & IV

Serial No.	Page No.	Reference	For	Read as

ADDENDA & CORRIGENDA

FOR PARTS II, III & IV

Serial No.	Page No.	Reference	

REGISTER OF CORRECTION SLIPS

Correction Slip		Reference		Description	Date of receipt	Initial of person Incharge of book
No.	Date	Page	Item No.			