

D. COST CONTROL

37. Bill of Quantities

- 37.1 The bill of Quantities shall contain items for the constructions, installation, testing and commissioning work to be done by the Contractor.
- 37.2 The bill of Quantities is used to calculate the Contract price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

38. Change in the Quantities

- 38.1 The Engineer shall have power to make any alterations in or addition to the original specifications , drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instruction in this connection which may be given to him in writing signed by the Engineer and such alteration shall not invalidate the contract and any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respects on which he agreed to do the main work and at the same rate as are specified in the tender for the main work.

Except that when the quantity of any item exceeds the quantity as in the tender by more than 130%, the contractor will be paid for the quantity in excess of 130%, at the rate entered in the SOR of the year during which the excess in quantity is first executed.

39. Variations

- 39.1 All Variations shall be included in updated programmes produced by the Contractor.

40. Payments for Variations

- 40.1 If the additional or altered work includes any class of work for which no rate is specified in this contract, then such class of work shall be carried out as under.
- (i) At the rate derived from the item within the contract which is comparable to the one involving additional or altered class of work; where there are more than one comparable items, the item of the contract which is nearest in comparison with regard to class or classes of the work involved shall be selected and the decision of the Superintending Engineer as to the nearest comparable item shall be final and binding on the contractor.
 - (ii) If the rate cannot be derived in accordance with (i) above, such class of works shall be carried out at the rate entered in the Schedule of Rates of the division

for the year in which the tender was received, increased or decreased by the percentage by which the tender amount is more or less as compared to the amount arrived at the rates in the "Schedule of Rates" of the Division in the year in which the tender was received. If the Schedule of rates of the Division does not contain all the items, the percentage increase or decrease of the tender shall be calculated considering such items which were included in the "Scheduled Rates" of the division for the year and for materials consumed on such item the rate to be charged would be the basic rate taken into account for fixing the rate in S.O.R. referred to above.

- (iii) If it is not possible to arrive at the rate from (i) and (ii) above, such class of work shall be carried out at the rate decided by the competent authorities on the basis of detailed rate analysis after hearing the contractor before a Committee of two Superintending Engineers stationed at the same place or the nearest place.

- 40.2 If the additional or altered work, for which no rate is entered in the "Schedule of Rates" of the Division is ordered to be carried out before the rate is agreed upon, then the contractor shall within seven days of the date of receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate, which it is his intention to charge for such class of work and if the Engineer in charge does not agree to this rates, he shall by notice in writing be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider it advisable, provided always that if the contractor shall commence work or incur any expenditure in regard thereof before the rates shall have been determined as lastly herein before mentioned, then in such cases he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of the dispute, the decision of the Superintending Engineer of the Circle shall be final.

Where, however, the work is to be executed according to the designs, drawings and specifications recommended by the contractor and accepted by the competent authority, the alternation above referred to shall be within the scope of such designs, drawings and specifications appended to the tenders.

The time limit for the completion of the work shall be extended in the proportion that the increase in the cost occasioned by alterations bears to the cost of the original work and the certificate of the Engineer-in-charge as to such proportion shall be final and conclusive.

41. Cash Flow Forecasts

- 41.1 When the programme is updated, the contractor is to provide the engineer with an updated cash flow forecast.

42. Payment certificates.

- 42.1 The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously.
- 42.2 The Engineer shall check the Contractor's monthly statement within 14 days and certify the amount to be paid to the Contractor after taking in to account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 32.3 of the Contract Data (secured Advance).
- 42.3 The value of work executed shall be determined by the Engineer.
- 42.4 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.
- 42.5 The value of work executed shall include the valuation of variations and compensation events.
- 42.6 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information

43. Payments

- 43.1 Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of the contract and taxes at source, as applicable under the law. The Employer shall pay the Contractor the amounts certified by the Engineer within 28 days of the date of each certificate.
- 43.2 Payment of GST (prevailing rates) on the amount payable under the contract to the Contractor will be made by the Employer. Hence, it is the responsibility of the contractor to pay the GST to the concerned Authority.
- 43.3 Items of the works for which no rate or price has been entered in will not be paid by the Employer and shall be deemed covered by other rates and prices in the Contract.

44. Compensation events

- 44.1 The following are compensation Events unless they are caused by the Contractor:
 - (a) The Employer does not give access to a part of the Site by the site Possession date stated in Contract data to the Contractor
- 44.2 In case of compensation event occurs and it prevents the work being completed beyond the Intended Completion Date then Authority will approve EOT with eligible contractual price escalation.

45. Tax

- 45.1 The rates quoted by the Contractor must be inclusive of all taxes prevailing on due date of bid submission except GST. However, any subsequent changes in the tax structure by Government after due date of bid submission will be compensated (+/-) on availability or submission of actual documentation. Contractor will have to intimate Engineer regarding changes occurred in the tax structure after bid submission. If the contractor fails to provide such information and if any financial obligation may arise due to change in tax structure, same will be recovered from the contractor.
- 45.2 GST will be paid separately on the bills. Hence, it is the responsibility of the contractor to pay the GST to the concerned Authority.

46. Currencies.

- 46.1 All payment shall be made in Indian Rupees.

47. Price Adjustment

- 47.1 Contract price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants in accordance with the following principles and procedures and as per formula given in the contract data:
- (a) The price adjustment shall apply for the work done from the start date given in the contract data up to end of the initial intended completion date or extensions granted by the Engineer and shall not apply to the work carried out beyond the stipulated time for reasons attributable to the contractor.
 - (b) The price adjustment shall be determined during each month from the formula given in the contract data.
 - (c) Following expressions and meanings during to the work done during each month
$$R = \text{Total value of work done during the month. It would include the amount of secured advance granted, if any, during the month less the amount of secured advance recovered, if any during the month. It will exclude value for works executed under variations for which price adjustment will be worked separately based on the terms mutually agreed.}$$
- 47.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other clause in the contract, the unit rates and prices included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

48. Retention

- 48.1 The Employer shall retain from each payment due to Contractor the proportion stated in the Contract Data until Completion of the whole of the Works.

- 48.2 On Completion of the whole of the Works half the total amount retained is repaid to the Contractor and half when the Defects Liability Period has passed and the Engineer has certified that all Defects notified by the Engineer to the Contractor before the end of this period have been corrected.
- 48.3 On completion of the whole works, the contractor may substitute retention money with an "on demand" Bank guarantee.

In case, Contractor requests for refund of the Retention Money deducted by the Employer under the provision of this clause, Employer shall consider the said request of the Contractor provided that the refund hereunder shall be made in tranches of not less than 1% (One Percent) of the Contract Price and Contractor furnishes an irrevocable and unconditional Bank guarantee for an equal amount substantially in the format of Bank Guarantee for Performance Guarantee enclosed with SBD and valid up to 60 day beyond the scheduled / extended Defects Liability Period. On completion of the whole works, the contractor has however an option to submit a fresh irrevocable and unconditional Bank Guarantee for an amount equal to 5% of the total value of work executed substantially in the format of Bank Guarantee for Performance Guarantee enclosed with SBD and valid up to 60 days beyond the Defect Liability Period and yet refund the Retention Money Bank Guarantee submitted for refund of Retention Money.

49. Liquidated Damages

- 49.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payment due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.
- 49.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall not be entitled for any interest on the over payment calculated from the date of payment to the date of repayment.
- 49.3 If the contractor fails to comply with the time for completion as stipulated in the tender, then the contractor shall pay to the employer the relevant sum stated in the Contract Data as Liquidated damages for such default and not as penalty for everyday or part of day which shall elapse between relevant time for completion and the date stated in the taking over certificate of the whole of the works on the relevant section, subject to the limit stated in the contract data.

The employer may, without prejudice to any other method of recovery deduct the amount of such damages from any monies due or to become due to the contractor. The payment or deduction of such damages shall not relieve

the contractor from his obligation to complete the works on from any other of his obligations and liabilities under the contract.

- 49.4 If, before the Time for Completion of the whole of the Works or, if applicable any Section, a Taking Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over-Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

50 Bonus

- 50.1 If the contractor achieves completion of the whole of the works prior to the intended Completion Date prescribed in Contract Data the Employer shall pay to the contractor a sum stated in Contract Data as bonus for every completed month **but subjected to maximum amount as stated in Contract Data**; which shall elapse between the date of completion of all items of works as stipulated in the contract, including variations ordered by the Engineer and the time prescribed in Clause 17.
- 50.2 Bonus shall be paid only to works amounting to above INR 5 crore with time limit of the works is equal or more than 6 months. The bonus would be paid as under

% of Time Saved	% of Initial Contract Price entitled for Bonus
50 %	5%
40 %	4%
30 %	3%
20 %	2%
10 %	1%
Less than 10%	0%

51. ~~Advance Payment~~

- 51.1 ~~The Employer shall make advance payment (not to be paid less than two instalments except in special circumstances for which the reason to be Recorded in writing) to the Contractor of the amounts stated in the Contract Date by the date stated in the Contract Date, against provision by the Contactor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to be at least 110% of the advance payment. The guarantee shall remain effective until the~~

~~advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. The Mobilization advance would be deemed as interest bearing advance at an interest rate of 10 % to be compounded, quarterly.~~

~~51.2 The Contractor is to use the advance payment only to pay for Equipment, plant and Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the engineer.~~

~~51.3 The advance payment shall be repaid by deduction proportionate amount from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, variations, price adjustments, Compensation Events, or Liquidated damages.~~

51.4 Deleted

52. Securities

52.1 The performance Security (including additional security for unbalanced bids) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The performance Security shall be valid until a date 60 days from the date of expiry of Defects Liability Period and the additional security for unbalanced bids shall be valid until a date 28 days from the date of issue of the certificate of completion.

53. Deleted

54. Cost of Repairs.

54.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start date and the end of Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damages arises from the Contractor's acts or omissions.


D. A


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E. FINISHING THE CONTRACT

55. Completion

- 55.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the works and the Engineer will do so upon deciding that the work is completed.

56. Taking Over

- 56.1 The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion.

57. Final Account

- 57.1 The Contractor shall supply to the Engineer a detailed final account of the total amount that the Contractor considers payable as full and final settlement of all claims under the Contract for items before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days of receiving the Contractor's revised account.
- 57.2 If reversal in characteristic of tender (L1 becoming L2) on account of excesses and savings in final account is observed, the Engineer/Employer shall be at liberty to restrict the final payment of BOQ items to the lowest amount evaluated of the bids considering the final quantities and the rates quoted including the rebates if any. Payment of variation items shall however be made at the rates approved by the Employer, within 90 days from the physical completion of work.

58. Operating and Maintenance Manuals

- 58.1 If "as built" drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract data.
- 58.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract data, or they do not receive the Engineer's approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

59. Termination

- 59.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

59.2 Fundamental breaches of Contract include, but shall not be limited to the following:

1. The contractor stops work for 28 days when no stoppage of work is shown on the current programme and the stoppage has not been authorized by the Engineer
2. The Engineer instructs the Contractor to delay the progress of the Works and the instructions is not withdrawn within 28 days;
3. The Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstructions or amalgamation
4. A payment certified by the Engineer is not paid by the Employer to the Contractor within 56 days of the date of the Engineer's certificate
5. The Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;
6. The Contractor does not maintain a security which is required;
7. The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and
8. If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

For the purpose of this paragraph: "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.

59.3 When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 59.2 above, the Engineer shall decide whether the breach is fundamental or not.

59.4 Notwithstanding the above, the employer may terminate the Contract for convenience.

60. Payment upon Termination

60.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a Certificate for the value of the work done less advance payments received up to the date of the issue of the certificate, less other recoveries due in terms of the contract, less taxes due to

deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

- 60.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Engineer shall issue a certificate for the value of the work done, the cost of balance material brought by the contractor and available at site, the reasonable cost of removal of equipment, repatriation of the Contractor's personnel employed solely on the works, and the Contractor's cost of protecting and securing the Works and less advance payment received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to deducted at source as per applicable law.

61. Property

- 61.1 All materials on the Site, Plant Equipment's, Temporary Works and Works are deemed to be property of the Employer, if the Contract is terminated because of a contractor's default.

62. Release from Performance

- 62.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

F. SPECIAL CONDITIONS OF CONTRACT

63. LABOUR

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment of housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the site and such other information as the Engineer may require.

64. COMPLIANCE WITH LABOUR REGULATIONS

During continuance of the contract, the Contractor and his sub-contractor shall abide at all times by all existing labour enactments and rules made thereunder, regulations, notification and bye laws of the State or central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notifications that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to the construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer/employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have the right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point to time.

SALIENT FEATURES OF SOME MAJOR LABOUR AND OTHER LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTIONS WORK

- A) **Workmen Compensation Act 1923:** - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- B) **Payment of Gratuity Act. 1972:** - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more on death, the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- C) **Employees P.F. and Miscellaneous Provision Act 1952:** - The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33% The benefits payable under the Act are:
1. Pension or family pension on retirement or death, as the case may be.
 2. Deposit linked insurance on the death in harness of the worker.
 3. Payment of P.F. accumulation on retirement/death etc.
- D) **Maternity Benefit Act 1951 :-** The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- E) **Contract Labour (Regulation & Abolition) Act 1970 :** The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer, if they employ 20 or more contract labour.
- F) **Minimum Wages Act 1948 :-** The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act, if the employment is a scheduled employment. Construction of Building, Roads, Runways are scheduled employment.
- G) **Payments of wages Act 1936:-** It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- H) **Equal remunerations Act 1979 :-** The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against female employees in the matter of transfer, training and promotions etc.
- I) **Payments of Bonus Act 1965 :-** The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20 % of wages to employees drawing Rs. 3500/- per month or less. The bonus to be paid to employees getting Rs. 2500/- per month or above Rs. 3500/- per month shall be worked out by taking wages as Rs. 2500/- per month only. The Act does not

apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.

- J) **Industrial Disputes Act 1947 :-** The Act lays down the machinery and procedure for resolutions of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- K) **Industrial employment (standing Orders) Act 1946 :-** It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the State and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.
- L) **Trade Unions Act 1926:-** The Act lays the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have given certain immunities from civil and criminal liabilities.
- M) **Child Labour (Prohibition & Regulation Act 1986 :-** The Act prohibits employment of children below 14 years of age in certain occupations and process and provides for regulation of employment of children in all other occupations and processes. Employment of Child labour is prohibited in Building and Construction Industry.
- N) **Inter – State Migrant workmen's (Regulation of Employment & Conditions of service) Act 1979:-** The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, is an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home upto the establishment and back, etc.
- O) **The Building and Other Construction workers (Regulation of employment and Conditions of Service) Act 1996 and the Cess Act of 1996:-** All the establishments who carry on any building or other constructions work and employ 10 or more workers are covered under this Act.
All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the government. The Employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, First Aid facilities, Ambulance, Housing accommodations for workers near the workplace etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officers appointed by the Government.

- P) **Factories Act 1948 :-** The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in the manufacturing process.
- Q) **Royalty charges-**The contractor shall pay the royalty to the competent authority as per rule. The **royalty** charges paid shall be borne by the contractor and shall not be reimbursed by the Employer.
- R) **Following Pollution control Acts and amendments made thereof from time to time shall be applicable.**
1. Water (Preservation and control of Pollution) Act, 1974
 2. Air (Prevention and Control of Pollution Act 1981
 3. Environmental (Protection) Act 1986

The contractor must commit to adopting Environmental management plan for best energy use, waste management, the reduction of pollution as in EMS (Environmental Management system) ISO-14001-2015

65. **ARBITRATION (GCC Clause 24)**

The procedure for arbitration will be as follows: -

- 65.1 If the Contractor is of the view that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to **#Superintending Engineer** (Higher Authority) within 14 days of the notification of the Engineer's decision. If the issue is not resolved, any party can refer the matter for conciliation within 15 days from the decision given by the **#Superintending Engineer**.
- 65.2
- (a) For the work up to Rs.100 Cr., if any of the parties is not satisfied with the decision of the **#Superintending Engineer**, both the parties have to refer to the **#Chief Engineer** concerned for the conciliation process.
 - (b) For the work more than Rs.100 Cr., if any of the parties is not satisfied with the decision of the **Superintending Engineer**, both parties have to refer to the **#Secretary, Roads & Building Department, Government of Gujarat** for the conciliation process.
- If the dispute is not resolved through the conciliation process, contractor may refer the dispute to Gujarat Public Works Contract Dispute Arbitration Tribunal. If the Contractor fails to refer a claim / dispute to the Higher Authority within 14 days of the notification of the Engineer's decision, the Contractor shall not be entitled to any additional payment/claim if he doesn't follow the above sequence in stipulated time. However, during such period, he would not stop the work in any case.

SECTION - 4
CONTRACT DATA

#CONTRACT DATA

Clause Reference With
respect to section 3

Item marked "N/A" do not apply to this Contract.

1. The Employers is [CL.1.1]
Name: Executive Engineer, R&B Panchayat Division, Dev-Bhoomi Dwarka
Address: Executive Engineer, R&B Panchayat Division, Dev-Bhoomi Dwarka
Name of authorized Representative (will be intimated later)
2. The Engineer is Executive Engineer, R&B Panchayat Division, Dev-Bhoomi Dwarka
Name of Authorized Representative:
3. The Defects Liability Period is **03 (Three) years** from the date [CL.1.1&33]
of completion which shall include complete ~~five~~ ^{three} Monsoon Period
4. The Start Date shall be **1st** days for the date of issue of the Notice [CL.1.1]
to proceed with the work.
5. The Intended Completion Date for the whole of the works is [CL.1.1,17&2]
11 Months after start of work with the following milestones:
Milestone dates: [CL.2.2& 49.1]
Physical works to be completed Period from the start date

Milestone 1 i.e.	10 % of work	82 days.
Milestone 2 i.e.	40% of work	165 days.
Milestone 3 i.e.	80% of work	247 days.
Milestone 4 i.e.	100% of work	330 days.
6. The Site is located as mentioned below [CL.1.1]
 1. Ran Mevasa Virpur Aasota Road – CH. 2/000 to 2/200, 9/900 to 10/100, 12/500 to 12/700, 20/600 to 20/800 (Box Culvert), 20/000 to 21/000 (Pipe Culvert) Taluka – Kalyanpur
 2. Bhangor Jogara Shedhak Road – CH. 8/300 to 8/500 – Taluka – Bhanvad (Minor Bridge)
7. The name and identification number of the Contract is: [CL.1.1]
RECONSTRUCTION OF MINOR BRIDGES, BOX CULVERTS & PIPE CULVERTS AT VARIOUS LOCATIONS IN DEV-BHOOMI DWARKA DISTRICT (PANCHAYAT) UNDER MMGSY, IN THE STATE OF GUJARAT (PACKAGE - 3).
8. The works consist of Bridge work & Road Diversion work [CL.1.1]
with items as per B.O.Q. The works shall, inter alia, include the following, as Specified or as directed:
(A) Road Works
Site clearance; setting - out and layout; widening of existing carriageway and strengthening including camber corrections; construction of new road/ Parallel service road; bituminous pavements remodelling /construction of junctions, intersections, bus bays, lay-bays; supplying and placing of drainage Channels, flumes, guard posts and guard other related items; construction/extension of cross drainage works, bridge, approaches and other related stones; protective works for roads/bridge; all aspects of quality assurance of various components of the works; rectification of The defects in the completed works during the Defects Liability Period; submission of "As- built" drawings and any other related documents; and other item of work as may be required to be carried out for completing the work in accordance with the drawings and the provisions of the contract and to ensure safety.

(B) Bridge Works

Site clearance; setting out, provision of foundations, piers abutments and bearing; prestressed/reinforced cement concrete superstructure; wearing coat, hand railings, expansion joints, approach slabs, drainages spouts/ down take pipes, arrangements for fixing light posts, water mains, utilities etc; provision of suitably designed protective works; providing wing/return walls; provision of road markings, road signs etc.; all aspects of quality assurance; clearing the site and handing over the works on completion; rectification of the defects during the Defects Liability Period and submission of "As-built" drawings and other related documents; and other items of work as may be required to be carried out for completing the works in accordance with the drawings and the provisions of the contract and to Insure safety

SCOPE OF WORK: -

1. **Construction of Box Culvert at various chainges on Ran Mevasa Virpur Aasota Road (MDR) Ta.Kalyanpur**
2. **Reconstruction of Existing Bridge on Ch 8/300 to 8/500 on Bhangor Jogara Shedhak Road. Taluka- Bhanvad District- Devbhoomi Dwarka**

(Refer Tender GAD for further Detail)

(C) Other Items

Any Other Items as required to fulfil all contractual obligations as per the Bid documents.

10. The following documents also form part of the Contract:
_____As per clause 2-3_____ [CL.1.1]
11. The law which applies to the Contract is the law of Union of India [CL.2.3(9)]
12. The language of the Contract documents is English [CL.3.1]
13. Limit of subcontracting 25% of the Initial Contract Price [CL.3.1]
14. The Schedule of Other Contractors [CL.7.1]
15. The Schedule of Key Personnel As per Annex – II to Section I. [CL.8]
16. The minimum insurance cover for physical property, injury and death is Rs. 5 lakhs per occurrence with the number of occurrences limited to four. After each occurrence, the contractor will pay an additional premium necessary to make insurance valid for four occurrences always. [CL.9]
17. Site Investigation report [CL.13]
18. The Site Possession dates shall be from the issue of letter of work order. [CL.14]
19. The period for submission of programme for approval of the engineer shall be 21 days from the issue of Letter of Acceptance. [CL.21]
20. The period between program updates will be ~~92 days~~ 30 days [CL.27.1]
21. The amount to be withheld for late submission of an updated programme shall be Rs. 01 lakhs. [CL.27.3]
22. The following events shall also be Compensation Events [CL.27.3]
- Substantially adverse ground conditions encountered during the course of execution of work not provided for in the bidding document. [CL. 44]
- (i) Removal of underground utilities detected subsequently
- (ii) Significant changes in classification of soil requiring additional mobilization by the contractor, e.g. ordinary soil to rock excavation,
- (iii) Removal of unsuitable material like marsh, debris dumps, etc. not caused by the contractor.
- (iv) Artesian conditions
- (v) Seepage, erosion landslide

- (vi) River training requiring protection of permanent work
 - (vii) Presence of historical, archeological or religious structures, monuments interfering with the works
 - (viii) Restriction of access to ground imposed by civil, judicial, or military authority
23. The currency of the Contract is Indian Rupees [CL. 46]
24. **The formula (e) for adjustment of prices are as under:** [CL.47]
- If any of the commodities like Cement, Steel or Bitumen are not found applicable in a work, the weight component of that commodities {i.e. 'Cement' (Pc), 'Steel' (Ps) or 'Bitumen' (Pb) as indicated in SBD for the purpose of Price Adjustment} shall be clubbed with the weight component of 'Other Material' (Pm), such that the gross % weight of the components shall remain as 100%.
- R = value of work as defined in Clause 47.1 of Conditions of Contract

Adjustment for labour component

- (i) Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:

$$V_L = 0.85 \times (P_l/100) \times R \times (L_i - L_0)/L_0$$

V_L = Increase or decrease in the cost of work during the month under consideration due to changes in rates for local labour

L_0 = The consumer price index for industrial workers for the State on 28 days preceding the scheduled date of opening of technical Bids as published by Labour Bureau, Ministry of Labour, Government of India

L_i = The consumer price index for industrial workers for the State for the month under consideration as published by the Labour Bureau, Ministry of Labour, Government of India.

P_l = Percentage of labour component of the work.

Adjustment for cement component.

- (ii) Prices adjustment for increase or decrease in the cost of cement procured by the contractor

$$V_c = 0.85 \times (P_c/100) \times R \times (C_i - C_0)/C_0$$

V_c = Increase or decrease in the cost of work during the month under consideration due to changes in rates for cement.

C_0 = The all-India wholesale price index for Ordinary Portland Cement on 28 days preceding the scheduled date of opening of technical bid as published by the Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.

C_i = The all-India average wholesale price index for Ordinary Portland Cement for the month under consideration as published by **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_c = Percentage of cement component of the work

Adjustment for steel component

- (iii) Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula

$$V_s = 0.85 \times (P_s/100) \times R \times (S_i - S_o)/S_o$$

V_s = Increase or decrease in the cost of work during the month under consideration due to changes in the rates for steel

S_o = The all-India wholesale price index for steel (**Mild Steel - Long Products Rebars**) on 28 days preceding the date of opening of Bids as published by the **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

S_i = The all-India average wholesale price index for steel (**Mild Steel - Long Products Rebars**) for the month under consideration as published by **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_s = Percentage of steel component of the work

Note : For the application of this clause, the index of **Mild Steel-Long products Rebars** has been chosen to represent the steel group.

Adjustments of bitumen component

- (iv) Price adjustment for increase in the cost of bitumen shall be paid in accordance with the following formula

$$V_b = 0.85 \times (P_b/100) \times R \times (B_i - B_o)/B_o$$

V_b = Increase or decrease in the cost of work during the month under consideration due to changes in rates for bitumen.

B_o = The official retail price of bitumen at the IOC depot at the nearest centre on the day 28 days prior to the scheduled date of opening of technical bid.

B_i = The official retail price of bitumen of IOC depot at the nearest centre for the 15th day of the month under consideration.

P_b = Percentage of bitumen component of the work

Adjustment of POL (fuel and lubricant) component

- (v) Price adjustment for increase or decrease in cost of POL (fuel and lubricant) shall be paid in accordance with the following formula

$$V_f = 0.85 \times (P_f/100) \times R \times (F_i - F_0)/F_0$$

V_f = Increase or decrease in the cost of work during the month under consideration due to changes in rates for fuel and lubricants.

F_0 = The official retail price of High-Speed Diesel (HSD) at the existing consumer pumps of IOC at the nearest centre on the day 28 prior to the date of opening of Bids.

F_i = The official retail price of HSD at the existing consumer pumps of IOC at the nearest centre for the 15th day of the month of the under consideration.

P_f = Percentage of fuel and lubricants component of the work

Note: For the application of this clause, the price of High-Speed diesel Oil has been chosen to represent the fuel and lubricants group.

Adjustment for Construction Machinery

- (vi) Price adjustment for increase or decrease in the cost of plant and Machinery spare procured by the Contractor shall be paid in accordance with the following formula

$$V_p = 0.85 \times (P_p/100) \times R \times (P_i - P_0)/P_0$$

V_p = Increase or decrease in the cost of work during the month under consideration due to changes in rates for plant and machinery spares

P_0 = The all-India wholesale price index for **manufacturer of machinery for mining, quarrying and Construction** for the month under consideration as published **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_i = The all-India average wholesale price index for **manufacturer of machinery for mining, quarrying and Construction** for the month under consideration as published **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_p = Percentage of plant and machinery spares component of the work.

Note: For the application of this clause, index of Heavy Machinery and parts has been chosen to represent the Plant and Machinery Spares group

Adjustment of other materials Component

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

$$V_m = 0.85 \times (P_m/100) \times R \times (M_i - M_0)/M_0$$

V_m = Increase or decrease in the cost of work during the month under consideration due to change in rates for local materials other than cement, steel, bitumen, and POL.

M_0 = The All-Indian wholesale price index (all commodities) on 28 days preceding the scheduled date of opening of technical Bids, as published by the **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

M_i = The All-India wholesale price index (all commodities) for the month under consideration as published by the **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_m = Percentage of local material components (other than cement, steel, bitumen, and POL) of the work.

The following percentage will govern the price adjustment for the entire contract:

1. Labour - P_l	25.90%
2. Cement - P_c	20.56%
3. Steel - P_s	16.63%
4. Bitumen - P_b	00.51%
5. POL - P_f	06.52%
6. Plant & Machinery Spares - P_p	11.10%
7. Other Materials - P_m	18.78%
Total	100.00 %

25. The proportion of payments retained (retention money) shall be 6% {CL. 48} from each bill subject to a maximum of 5% of final contract price.
26. Amount of Liquidated damages for delay in completion of works
- For Whole of work {CL.49}
(1/2000)th of the Initial contract price, rounded off to the nearest Thousand, per day. For sectional Completion (wherever specified In item 6 of Contract data) (1/2000)th of initial contract price for #5 km Section, rounded off to the nearest thousand per day.

27. Maximum limit of liquidated damages For delay in completion work 10 percent of the Initial {CL. 49} Contract Price rounded off to the nearest thousand
28. Amount of Bonus for early completion Amount of bonus for early completion of work shall be given as per CL.50 of Section-3
29. Maximum limit of bonus for early Completion of work **5 percent** of the Contract {CL. 50} Price

30. ~~The amount of the advance payment are: {CL. 51 & 52}~~

#Nature of Advances	Amount (Rs.)	Conditions to Be fulfilled
i Mobilization 10% of the contract Price	10% of the contract Price	On submission of unconditional Bank Guarantee. (to be drawn before the end of 20% of the contract period). The contractor may furnish four bank guarantees of 2.5 % of each valid for the full period.
ii Equipment 90% for new and 50% of depreciated value for old equipment. Total amount will be subject to a maximum of 5% of the Contract Price	90% for new and 50% of depreciated value for old equipment. Total amount will be subject to a maximum of 5% of the Contract Price	After equipment is brought to site (provided the Engineer is satisfied That the equipment is required for performance of the contract) and on submission of unconditional Bank Guarantee for amount of advance
iii Secured Advance for Non-persish-able material Brought to site	Deleted	

~~{The advance payment will be paid to the Contractor no later than 28 days after fulfilment of the above conditions}.~~

31. ~~Repayment of advance payment for mobilization and equipment {CL. 51.3}~~
~~The advance loan shall be repaid with percentage deduction from the interim payments certified by the Engineer under the Contract. Deduction shall commence in the next Interim Payment Certificate following that in which the~~

~~total of all such payments to the Contractor has reached not less than 20 percent of the Contract Price or 6 (six) months from the date of payment of first instalment of advance, whichever period concludes earlier, and shall be made at the rate of 20 percent (collectively for both Mobilization Advance and Equipment Advance) of the amounts of all Interim Payment Certificate until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clause 17 and 28.~~

32. Deleted

33. The securities shall be for the following minimum amounts equivalent {CL. 52}

As a percentage of the Contract Price:

Performance Security for 5 percent of contract price plus Rs. (to be decided after evaluation of the bid) as additional security in terms of ITB Clause 29.5

The standard form of Performance security acceptable to the Employer shall be an unconditional Bank Guarantee of the type as presented in Section 8 of the Bidding Documents.

34. The Schedule of Operating and maintenance Manuals.....N/A. {CL. 58}

35. The date by which "as- built" drawings (in scale as directed) in 2 sets {CL. 58} are required within 28 days of the issue of certificate of completion of the whole or section of the work, as the case may be.

36. The amount to be withheld for failing to supply "as built" drawings {CL. 58} by the Date required is **Rs. 5.0 Lakhs.**

37. The following events shall also be fundamentals breach of contract: {CL.59.2}
"The Contractor has contravened Sub- clause 7.1 and Clause 9 of GCC"

38. The percentage to apply the value of the work not completed representing {Cl 60} the Employer's additional cost for completing the Works shall be 20 percent.


D.A.


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SECTION - 5
TECHNICAL SPECIFICATION

INDEX OF SPECIFICATION

Name of Work: RECONSTRUCTION OF MINOR BRIDGES, BOX CULVERTS & PIPE CULVERTS AT VARIOUS LOCATIONS IN DEV-BHOOMI DWARKA DISTRICT (PANCHAYAT) UNDER MMGSY, IN THE STATE OF GUJARAT (PACKAGE - 3).

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
1	Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (C) By mechanical means in area of light jungle.	As per separate sheet attached here with.	MORT&H Specification
2	Demarcation of road alignment including marking out road line by providing and fixing wooden pegs or steel rod of required size at every 25 M to 50 M. including excavating trenches on both sides of 0.30 m. x 0.30M. including supplying of labours and all materials for every work etc complete.	As per separate sheet attached here with.	--
3	Portable Barricade in Construction Zone (Installation of a steel portable barricade with horizontal rail 300 mm wide, 2.5 m in length fitted on a 'A' frame made with 45 x 45 x 5 mm angle iron section, 1.5 m in height, horizontal rail painted (2 coats) with yellow and white stripes, 150 mm in width at an angle of 45°, 'A' frame painted with 2 coats of yellow paint, complete as per IRC:SP:55-2001)	As per separate sheet attached here with.	MORT&H Specification
4	Diversion of water course, providing cofferdam and bund or island as may be necessary for foundation and maintaining the same for the period as may be necessary.	As per separate sheet attached here with.	--
5	Earthwork for embankment including breaking clods, dressing with all lead and lift (Excluding watering and consolidation) (A) Selected soil should be From borrow area with all lead and lift and should have CBR not less than 6.00%.	As per separate sheet attached here with.	MORT&H Specification
6	Earthwork for embankment including breaking clods, dressing with all lead and lift and including watering rolling and consolidation of subgrade in layers at O.M.C. to required dry density including filling the depression which occur during the process using power roller 8T to 10T.(E) From Borrow area including all lead & lift	As per separate sheet attached here with.	MORT&H Specification
7	WBM Grading-2 Providing, laying, spreading and compacting stone agg. Of 63mm to 45mm size to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with smooth wheel roller 80-100 KN in stage to proper grade and camber, applying and brooming, stone screening/binding material to fill-up the intersties of coarse agg., watering and compacting to the required density grading-2 as per Technical Specification Clause.405 By manual means.	As per separate sheet attached here with.	MORT&H Specification
8	Rolling and Watering of earthwork with vibratory roller including filling in depression which occur during the process and as directed.	As per separate sheet attached here with.	MORT&H Specification
9	Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing of the excavated stuff upto all lead. (B) Dense or hard soil.	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
10	Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing of the excavated stuff upto all lead. (C) Hard Murrum	As per separate sheet attached here with.	MORT&H Specification
11	Excavation of foundation in Sand gravel caly soft soil and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff as directed. Depth upto 3.00mt.	As per separate sheet attached here with.	MORT&H Specification
12	Excavation of foundation in hard murrum and boulders and very stiff or sticky clays and other similar strata including shorting out and strutting and dewatering as necessary and disposing of the excavated stuff as directed.	As per separate sheet attached here with.	MORT&H Specification
13	Excavation in large boulders and soft rock by wedging including shoring, strutting and dewatering as necessary and disposing of the excavated stuff as directed,	As per separate sheet attached here with.	MORT&H Specification
14	Excavation in hard rock by dry-wet blasting and chiseling including dewatering preparing foundation base by proper benching and stepping and disposing of the excavated stuff as directed (B) Blasting prohibited.	As per separate sheet attached here with.	MORT&H Specification
15	Providing and fixing Mild steel dowel bar of minimum 32mm dia. For anchoring by drilling holes in foundation strata including necessary bending, hooking of dowel bars and grouting the holes complete as per detailed drawing and as directed.	As per separate sheet attached here with.	MORT&H Specification
16	Providing and laying rubble for apron (Each stone weighting not less than 40kg) including and packing and filling in the interstices with quarry spall.	As per separate sheet attached here with.	MORT&H Specification
17	Providing and filling in foundation with ordinary cement concrete M-15 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.	As per separate sheet attached here with.	MORT&H Specification
18	Providing and casting in situ ordinary cement concrete M-15 mix and providing necessary pin headers including shuttering, scaffolding, laying vibrating, curing and finishing complete Without V-Grooves For all Hieght.	As per separate sheet attached here with.	MORT&H Specification
19	Providing and filling in foundation with ordinary cement concrete M-10 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.	As per separate sheet attached here with.	MORT&H Specification
20	Providing and filling in foundation with ordinary cement concrete M-15 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.	As per separate sheet attached here with.	MORT&H Specification
21	Providing & laying 22.5 cm thick dry rubble stone pitching on side slope on existing earthwork on murrum bed 7.50 cm thick & filling interstic with murrum & providing Flush pointing in CM 1:3 etc complete including curing & preparing slope in Earth work as directed.	As per separate sheet attached here with.	MORT&H Specification
22	Providing parapet of ordinary cement concrete M-20 as per detailed drawing with necessary reqinforcement including shuttering laying vibrating and finishing to line and level complete (ii) cast in situ.	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
23	Providing and casting in situ Controlled cement concrete M-20 for R.C.C. work in Piers, abutment, returns and riding returns as per drawing including centering, shuttering, scaffolding where necessary laying, vibrating curing and finishing complete (A) For all Height	As per separate sheet attached here with.	MORT&H Specification
24	Providing and casting in situ Controlled cement concrete M-30 for C.C. work in Piers, abutment, returns and riding returns as per drawing including centering, shuttering, scaffolding where necessary laying, vibrating curing and finishing complete (A) For all Height	As per separate sheet attached here with.	MORT&H Specification
25	Providing and casting in situ Ordinary cement concrete M-20 for C.C. Toe Wall and Curtain walls including necessary shuttering laying, vibrating, ramming and curing complete.	As per separate sheet attached here with.	MORT&H Specification
26	Providing and casting in situ Controlled Cement Concrete M-25 for R.C.C. Raft and cut-off walls including necessary shuttering laying, vibrating ramming of curing complete.	As per separate sheet attached here with.	MORT&H Specification
27	Providing and casting in situ Controlled Cement Concrete M-30 for C.C. Raft and cut-off walls including necessary shuttering laying, vibrating ramming of curing complete.	As per separate sheet attached here with.	MORT&H Specification
28	Providing and casting in situ Controlled Cement concrete M 30 mix for R.C.C. works in pier cap, abutment cap, and dirt wall including controlled cement concrete M 35 bed block or pedestals for required size below bearings as per detailed drawings, centering, shuttering, scaffolding wherever necessary laying, vibrating, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification
29	Providing and casting in situ Controlled cement concrete M 25 for R.C.C. Solid slab including centering, scaffolding, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification
30	Providing and casting in situ Controlled cement concrete M 30 for R.C.C. Solid slab including centering, scaffolding, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification
31	Providing and casting in situ Controlled cement concrete- M-20 for average 75/150mm thick wearing coat laid as directed including tamping, vibrating, finishing, curing and filling in joints with bitumen complete.	As per separate sheet attached here with.	MORT&H Specification
32	Providing and casting in situ Controlled cement concrete- M-30 for average 75mm thick wearing coat laid as directed including tamping, vibrating, finishing, curing and filling in joints with bitumen complete.	As per separate sheet attached here with.	MORT&H Specification
33	Providing and casting in situ Controlled cement concrete- M-20 mix for kerbs/Kerb blocks including formwork, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification
34	Providing and casting in situ Controlled cement concrete- M-30 mix for kerbs/Kerb blocks including formwork, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
35	Providing and casting in situ Contolled cement concrete- M-25 mix for Approach slab including formwork, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification
36	Providing and casting in situ Contolled cement concrete- M-30 mix for Approach slab including formwork, curing and finishing complete.	As per separate sheet attached here with.	MORT&H Specification
37	Providing and laying weep hole in Abutment and returns by using A.C pipe of 100mm. Incl. fixing in proper grade and jointing the complete as per detailed specification.	As per separate sheet attached here with.	MORT&H Specification
38	Providing and laying filter media 600mm. thick directed at the back of abutments, returns and wing walls as per detailed specifications.	As per separate sheet attached here with.	MORT&H Specification
39	Providing and filling sand behind abutments and between riding return, square return in layers as directed.	As per separate sheet attached here with.	MORT&H Specification
40	Providing and fixing in position Mild steel dowel bars in pier cap or abutment caps for anchorage in free end as per detailed drawings including cutting bending and welding complete.	As per separate sheet attached here with.	MORT&H Specification
41	Providing and laying in Position FE -500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Piers (B) Abutments (C) Returns (D) Walls etc.	As per separate sheet attached here with.	MORT&H Specification
42	Providing and laying in Position FE -500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Pier cap (B) Abutment cap & Dirt walls.	As per separate sheet attached here with.	MORT&H Specification
43	Providing and laying in Position FE -500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Solid slab	As per separate sheet attached here with.	MORT&H Specification
44	Providing and Fixing in position FE-500/500D TMT bar reinforcement including cutting, bending, hooking, and tying complete as per detailed drawaing (A)RCC kerb (B) RCC Footpath (B) RCC Solid Slab/ App. Slab / Wearing coat.	As per separate sheet attached here with.	MORT&H Specification
45	Providing 12mm. Thick Pre-moulded asphalt filler joints as per drawings	As per separate sheet attached here with.	MORT&H Specification
46	Providing G.I. 100mm. Diameter water spouts including necessary iron gratings as per drawings.	As per separate sheet attached here with.	MORT&H Specification
47	Providing flood gauge marks on sub structure as per design including painting complete	As per separate sheet attached here with.	--

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
48	Painting Two Coats on New Concrete Surfaces (Painting two coats after filling the surface with synthetic enamel paint in all shades on new plastered concrete surfaces) - For inner face of Kerb / Crash Barrier	As per separate sheet attached here with.	--
49	Filling available excavated earth (excluding rock) in trenches plinth sides of foundation etc. in layers not exceeding 20cm in depth consolidating each deposited layer by ramming and watering.	As per separate sheet attached here with.	MORT&H Specification
50	Supplying and fixing reinforced concrete heavy duty non presure pipes with collars for culverts carrying heavy traffic as per IS 458-1991 specification including setting and joining the pipes in C.M. 1:2 watering and laying (to level or slope) of I.S. Class NP-3 of following internal diameter with all lead and lift. (i) 900mm Dia.	As per separate sheet attached here with.	MORT&H Specification
51	Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. Stone/Rubble masonry.	As per separate sheet attached here with.	MORT&H Specification
52	Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. RCC Work.	As per separate sheet attached here with.	MORT&H Specification
53	Dismantling G.I. Pipes G.S.W. Pipes and A.C Rain water pipes with fitting and clamps including stacking the materials with all lead and lift (for any of pipe)	As per separate sheet attached here with.	MORT&H Specification
54	Removing all type of hume pipes and stacking including all lead of earthwork and dismantling of masonry works. (A) Up to 600 mm dia	As per separate sheet attached here with.	MORT&H Specification
55	Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. (A) CC Work	As per separate sheet attached here with.	MORT&H Specification
56	Dismantling of Flexible Pavements (Dismantling of flexible pavements and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately) ii) By Mechanical means. A) Bituminous course	As per separate sheet attached here with.	MORT&H Specification
57	Dismantling of Cement Concrete Pavement (Dismantling of cement concrete pavement by mechanical means using pneumatic tools, breaking to pieces not exceeding 0.02 cum in volume and stock piling at designated locations and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately).	As per separate sheet attached here with.	MORT&H Specification
58	Providing temporary all weather and fair weather diversion suitable for traffic during the construction period of the bridge / Slab drain including providing necessary drains and all safety measures including red lamps / signals at night for traffic etc. complete..	As per separate sheet attached here with.	--
59	Providing and fixing Flood guage post mark of 'C' angle size 100mm x 50mm x 6mm thick (in head wall 0.500mt. And 1.50mt. Out side with painting and lettering with redeum color as directed.	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
60	Regulatory / Mandatory Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60 cms Dia Circle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting	As per separate sheet attached here with.	MORT&H Specification
61	Distance Informatory / Destination Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x120 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting	As per separate sheet attached here with.	MORT&H Specification
62	Diversion Ahead Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x60 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.1 mtr long stand post (2 Nos.) of 50 x 50 x 5mm / 50NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
	engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting		
63	Men at work (2' x 2') sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP(Aluminum composite Panel); size 60cm x 60cm square as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting	As per separate sheet attached here with.	MORT&H Specification
64	Sign board per Squate Meter :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 1meter x1 meter as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 4 mtr long stand post (2 Nos.) of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting	As per separate sheet attached here with.	MORT&H Specification
65	Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
	x 35 x 3mm; painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting		
66	Chevron sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50 cm as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting	As per separate sheet attached here with.	MORT&H Specification
67	Hazard Marker Sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 1.8mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting	As per separate sheet attached here with.	MORT&H Specification
68	Hazard Marker Sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminum composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
	quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 1.8mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (B) Class-B Type-4 Retro Reflective sheeting		
69	Cautionary Warning Sign : Providing and fixing sign boards made out of 2mm Aluminium sheet size 90x90x90 cms. Equilateral triangle as per the design of IRC-67-1977 pre treated with phospheting process and acid etching coated with one coat of apoxy primer and two coats of best quality epoxy paint reflectorised with retro reflective sheeting as per latest MOST specification 3.1 Mt. long stand post and frame fabricated from suitable size iron angle of 35x35x3mm, 75x75x6mm. as required painted with best quality epoxy coating in black and white bends the details of symbole for each board shall be as per the instruction of Engineer in charge the fixing at site shall be in 1:2:4 CC block of size 45x45x60cms. for each leg including excavation curring etc. complete under the supervision of engineer in charge (A) Engineering Grade.	As per separate sheet attached here with.	MORT&H Specification
70	MMGSY Project Information Board: Providing and fixing of typical PMGSY Project informatory sign board with Logo as per 1700 of MORD specifications and drawing. The board will be a composite unit consisting of Three Plates ACM (Aluminum Composite Material), material specifiacaitons as per clause 17001.3. The top most plate will be of 3mm ACM in diamond shape of 600x600mm size, riveted with MS angle iron frame of 25mmx25mmx5mm size on back on edges. The middle 4mm ACM plate of will be 1200x150mm size riveted with MS angle iron frame of 25mmx25mmx5mm size on back on edges. The main 4mm ACM lower most plate will be 1500mmx600mm size, riveted with MS angle iron frame of 25mmx25mmx5mm size. Riveting of all the sheets over angle and flat iron frame will be done neatly to have plain surface on one side. The angle iron frame of lower most plate and flat iron frame of the middle plate will be welded to two nos. 75mm x75mm (12 SWG) sheet tubes posts placed at 1125mm apart centre to centre. the top of the middle plate will be flushed with the top of 75mm dia medium steel tube posts and these posts will be embeded in cement concrete M15 grade block of 450x450x600mm below ground level. The height of the bottom of the lower plate will be 1200mm from normal ground level and the bottom of the middle plate will be 100mm above the top level of the lower most plate.	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
	the diamond shaped plate mounted over flat angle iron frame will be connected to middle plate by square steel section of 47mmx47mm, thickness 12SWG having a spacing of 100mm between the diamond shaped plate and middle plate and this square section will be riveted to the bottom point of the diamond shaped plate. MMGSY logo, letters and numerals on the ACM should be made up of Retro Reflective sheeting of Type-1 AEGP Class-A grade as per the latest MORD section 1700 and IRC 67-2012 specifications. All the section of the frame and posts shall be painted with primer and two coats of epoxy paint. The design, painting and lettering shall be done as per the MMGSY Signage Guide and as directed by Engineer-In-charge. . A warranty for 5 years for the Retro reflective sheeting for Class-A respectively, from original manufacturer shall be submitted by contractor.		
71	Road marking with hot applied thermoplastic paints with reflectorising glass beads on bitumin surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250gms per sqm area, thickness of 2.5mm is excluding of surface applied glass beds as per IRC:35-2015. The finished surface to be level, uniform and free from streaks and holes. zebra patta /bump patta lane/center line/ edge line/cut patta. The white color marking should provide luminance coefficient on cement road shall be min 130 mcd/m ² /lux and Asphalt road shall be min 100 mcd/m ² /lux during the service life during the day time. The marking should meet the performance criteria for night time reflectivity, wet reflectivity and skid resistance as mentioned in the section-15 of IRC 35-2015. Warranty for the Retro reflectivity should be two years.	As per separate sheet attached here with.	MORT&H Specification
72	Cat Eye / Road Stud / RPM: Supplying of Molded Twin Shanks Raised Pavement Markers made of polycarbonate and ABS moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 13635 kgs. tested in accordance to ASTM D 4280 Type H and complying to Specifications of Category A of MORTH Circular No RW/NH/33023/10-97 DO III Dt 11.06. 1997. The height, width and length shall not exceed 20 mm, 130 mm and 130 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 +/- 5 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less than 19 +/- 2 mm and height not less than 30 +/- 2 mm) from the body is to be a minimum value of 500 Kgf. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturers recommendation and The color of the marker should be as per the IRC 35-2015 and as directed by Engineer-in-charge.	As per separate sheet attached here with.	MORT&H Specification
73	Providing and applying anti carbonation, anti fading, mold resistant, heat insulating, and 100% acrylic breathable decorative external waterproof coating of approved shade for Pier/Abutment, Riding return, Square return, Protection wall, Pier / Abutment Cap, Dirt wall, Solid slab etc. having Viscosity @ Room Temperature by Ford cup No. B-4 (dilute 2 parts of	As per separate sheet attached here with.	--

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
	product with 1 part of water) 18 to 30 sec. pH of 7.00 to 10.00 and Sp. Gravity @ Room Temperature 1.30+0.1, tested for carbon dioxide diffusion resistance properties for coating materials and coating systems for exterior masonry and concrete as per DIN EN 1062-6 (2002-2010) by a NBA Grade "A" accredited institution.		
74	Carrying out load test of super structure as directed including all necessary materials plant equipment, instruments, labour and arrangements for test directed.	As per separate sheet attached here with.	MORT&H Specification
75	Type - B, "THRIE" : Metal Beam Crash Barrier (Providing and erecting a "Thrie" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 85 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 2 m high with 1.15 m below ground level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a space of channel section 150 x 75 x 5 mm, 546 mm long complete as per clause 811)	As per separate sheet attached here with.	MORT&H Specification
76	Providing and fixing guard stone as per I.R.C. type design including white washing etc. complete	As per separate sheet attached here with.	MORT&H Specification
77	Scarifying bitumen macadam surface 6 cm to 10 cm.depth including stacking useful materials on road side and disposing off remaining stuff (A) On Existing Road	As per separate sheet attached here with.	MORT&H Specification
78	Construction of Subgrade with approved material obtained from borrow pits with all lifts and leads, transporting to site spreading, grading to required slope and compacting to meet requirement to MoRTH table 300-2 in layers not more than 200 mm thick as directed by engineer in charge.(Effective CBR Minimum 8 %)	As per separate sheet attached here with.	MORT&H Specification
79	Construction of granular sub-base (Grade - 1) by providing coarse graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per MoRTH clause 401.	As per separate sheet attached here with.	MORT&H Specification
80	Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam (in two layers) specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density, complete as per MoRTH clause 406.	As per separate sheet attached here with.	MORT&H Specification
81	Providing and applying Prime coat with Slow Setting Bitumen Emulsion binder (SS- 1) @ rate of 7.5 Kg./10 sq.m. of road surface using Emulsion pressure sprayer etc.,cleaning the road surface complete including cost of material labour etc complete as directed by engineer in charge.	As per separate sheet attached here with.	MORT&H Specification

Sr. No. of Item	Item Description	Applicable Specification	Specification Booklet
1	2	3	4
82	Providing and applying tack coat with Rapid Setting Bitumen Emulsion binder (RS- 1) @ rate of 2.5 Kg./10 sq.m. of road surface using Emulsion pressure sprayer etc., cleaning the road surface complete including cost of material labour etc complete as directed by engineer in charge.	As per separate sheet attached here with.	MORT&H Specification
83	Providing and laying 25 mm thick (Compacted) Semi -dence Bituminous concrete on exiting bituminous surface and using specified graded black trapped machine crushed aggregate with 5% Bitumen Vg-30 - 60/70 grade bitumen by Wt of total mix as per MORTH specification including heating and mixing of asphalt with B.T. chips in continuous batch mix plant and transporting same at site and speading by sensor paver finisher and consolidation the same with pair of 8 tonnes to 10 tonnes vibratory roller to achive desire density and including flusing the stone dust @0.03 cum/10smt including cost of required tools , plants, all machineries, equipment fire wood , oil, kerosene, charges etc. complete.	As per separate sheet attached here with.	MORT&H Specification
84	Providing and laying compacted Bituminous concrete using BT aggregate as per MORTH gradation ,specification and asphalt Grade VG 30 mixing @54.00 Kg /MT of total Wt. of mix i.e. (5.40% of total weight mix) including heating and mixing aggregate & asphalt by batch mix plant spreading the same by sensor paver finisher including rolling & consolidation with 10-12 tonne vibratory roller,Tandem Roller ,PTR & providing all materials equipment's tools & plants, fire wood, oil , kerosene,labour charges , using contractor 's own machinery etc. Complete as directed by engineer in charge as per MoRTH Specification	As per separate sheet attached here with.	MORT&H Specification
85	Providing and laying 20 mm thick mix seal surfacing using spcified graded crushed Black Trap stone aggregates as per MORTH gradetion using VG-30 bulk bitumen for mixing at the rate of 5.1 % (51.00 Kg./M.T.) by hot mix process and hot laid process using paver finisher to the required camber and grade, including rolling with vibratory roller to achive desier density including cost of fier wood, oil, Kerosene, labour charges and hier charges of machinaries etc. complete.	As per separate sheet attached here with.	MORT&H Specification
86	Providing and erecting a "W" metal crash barrier comprising of 3mm thick currugated sheet metal beam rail, 70cm above Road/Ground level, fixed on ISMC series channel vertical post, 150x75x5mm spaced 2m center to center, 1.8m high, 1.1m below ground/road level, all steel parts and fitments to be galavanized by hot dip process, all fittings to conform to IS:1367 and IS:1364 metal beam rail to be fixed on the vertical post with a spacer of channel section 150x75x5mm, 330mm long complete as per clause 810.	As per separate sheet attached here with.	MORT&H Specification

Handwritten signature/initials

ITEMWISE SPECIFICATION

Item No. 1

Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (C) By mechanical means in area of light jungle.

1. CLEARING AND GRUBBING

1.1. Scope

This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness, rubbish etc., which in the opinion of the Engineer are unsuitable for incorporation in the works, from, the area of road land containing road embankment, drains, cross-drainage structures and such other areas as may-be specified on the drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

1.2. Preservation of Property/Amenities

Roadside trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all highway facilities within or adjacent to the highway which are not to be disturbed shall be protected from injury or damage. The Contractor shall, provide and install at his own expense, suitable safeguards approved by the Engineer for this purpose.

During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional works to that effect vide Clause 306. Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the schedules for carrying out temporary and permanent erosion control works as stipulated in Clause 306.3.

1.3. Methods, Tools and Equipment

Only such methods, tools and equipment as are approved by the Engineer and which will not affect the property to be preserved shall be adopted for the Work. If the area has thick vegetation/roots/trees, a crawler or pneumatic tier dozer of adequate capacity may be used for clearance purposes. The dozer shall have ripper attachments for removal of tree stumps. All trees, stumps, etc., falling within excavation and fill lines shall be cut to such depth below ground level that in no case foil within 500 mm of the subgrade. Also, all vegetation such as roots, under-growth, grass and other deleterious matter unsuitable for incorporation in the embankment/subgrade shall be removed between fill lines to the satisfaction of the Engineer. On areas beyond these limits, trees and stumps required to be removed as directed by the Engineer shall be cut down to 1 m below ground level so that these do not present an unsightly appearance.

All branches of trees extending above the trimmed as directed by the Engineer.

All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface at these points conform to the surrounding area.

Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed and their workings, which may extend to several metres, shall be suitably treated.

1.4. Disposal of Materials

All materials arising from clearing and grubbing operations shall be the property of Government and shall be disposed of by the Contractor as hereinafter provided or directed by the Engineer.

Trunks, branches and stumps of trees shall be cleaned of limbs and roots and stacked. Also boulders, stones and other materials usable in road construction shall be neatly stacked as directed by the Engineer. Stacking of stumps, boulders, stones etc., shall be done at specified spots with all lifts and to any lead.

All products of clearing and grubbing which, in the opinion of the Engineer, cannot be used or auctioned shall be cleared away from the roadside in a manner as directed by the Engineer. Care shall be taken to see that unsuitable waste materials are disposed of in such a manner that there is no likelihood of these getting mixed up with the materials meant for embankment, subgrade and road construction.

1.5. Measurements for Payment

Clearing and grubbing for road embankment, drains and cross-drainage structures shall be measured on area basis in terms of hectares. Clearing and grubbing of borrow areas shall be deemed to be a part of works preparatory to embankment construction and shall be deemed to have been included in the rates quoted for the embankment construction item and no separate payment shall be made for the same. Cutting of trees up to 300 mm in girth including removal of stumps and roots, and trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations. Removal of stumps left over after trees have been cut by any other agency shall also be considered incidental to the clearing and grubbing operations.

Cutting, including removal of stumps and roots of trees of girth above 300 mm and backfilling to required compaction shall be measured in terms of number according to the sizes given below: -

- i) Above 300 mm to 600 mm
- ii) Above 600 mm to 900 mm
- iii) Above 900 mm to 1800 mm
- iv) Above 1800 mm

For this purpose, the girth shall be measured at a height of 1 meter above ground or at the top of the stump if the height of the stump is less than one meter from the ground.

1.6. Rates

- 1.6.1. The Contract unit rates for the various items of clearing and grubbing shall be payment in full for carrying out, the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. These will also include removal of stumps of trees less than 300 mm in girth as well as stumps left over after cutting of trees carried out by another agency, excavation and back-filling to required density, where necessary, and handling, salvaging, piling and disposing of the cleared materials with all lifts to any lead. Unit rate based on Hectare basis.

- 1.6.2 The Contract unit rate for cutting (including removal of stumps and roots) of trees of girth above 300 mm shall include excavation and backfilling to required compaction, handling, salvaging, piling and disposing of the cleared materials with all lifts and any lead.

- 1.6.3. Where a Contract does not include separate items of clearing and grubbing, the same shall be considered incidental to the earthwork items and the Contract unit prices for the same shall be considered as including clearing and grubbing operations.

- 1.6.4 The mode of payment shall be in **hectare** basis.

Item No. 2

Demarcation of road alignment including marking out road line by providing and fixing wooden pegs or steel rod of required size at every 25 M to 50 M. including excavating trenches on both sides of 0.30 m. x 0.30M. including supplying of labours and all materials for every work etc complete.

1. The centre line axis of the dual two-lane bridge is to be done for bridge and also for approaches / retaining walls in both ends shall be surveyed along their lengths. Centre line pegs for each two-lane bridge, ramps including foundation pegs at each location and at suitable distance of 3.0 m c/c along the approach on each side shall be fixed.
2. All deviation angles of the central line axis for both the two-lane bridge including tangent distances shall be demarcated with pegs fixed in to the ground.
3. The rate on Lump sum basis shall include all equipment, survey instruments, necessary survey party, supply and fixing of pegs including, fixing of pillars for intermediate stations established GTS bench mark at every 200 m distance, labour, materials required in completing the job as required, as per direction of Engineer-in-charge.
4. Contractor has to carry out full topographical survey including working of center line with total station instrument.
5. The measurement and payment shall be paid per Km.

Item No. 3

Portable Barricade in Construction Zone (Installation of a steel portable barricade with horizontal rail 300 mm wide, 2.5 m in length fitted on a 'A' frame made with 45 x 45 x 5 mm angle iron section, 1.5 m in height, horizontal rail painted (2 coats) with yellow and white stripes, 150 mm in width at an angle of 450, 'A' frame painted with 2 coats of yellow paint, complete as per IRC:SP:55-2001)

1. Relevant specification for Fabrication and installation of barricades including painting with fluorescent paint, blinkers and fixing panelled plain MS sheets 20 SWG of 1.8 m height and M.S. Posts angle 40 x 40 x 5 mm at 2.5 m c/c and dismantling the same after completion of work as directed by Engineer and as per site requirements. (All materials will be property of contractor after demolishing including blinkers) shall apply to this item.
2. The measurement & payment shall be in Number basis.

Item No. 4

Diversion of water course, providing cofferdam and bund or island as may be necessary for foundation and maintaining the same for the period as may be necessary.

- 1.1 This item provides for the construction of cofferdam/Island which shall be temporary enclosure built to exclude water from the working area and to permit free access to the area during, the execution of work. It shall be vented at suitable locations for allowing river flow during the working season. The cofferdam may be made of earth, filling in suitable stable profile as per site conditions with enough working space all-round.
- 1.2 The contractor shall have to make his own arrangement for the procurement of each for the construction of cofferdam/ Island at his own cost.
- 1.3 The rate of the item includes the cost of construction and maintenance of any cofferdam approach bund or other devices etc. necessary for draining the flow of water or any such item of any sort whatsoever required to prevent water entering the foundation trenches.
- 1.4 The cofferdam/ Island shall have to be maintained till the completion of working period. The rates shall accordingly include the provision of reconstruction or making good the damages as per requirements for subsequent one or more working seasons if necessary. The contractor shall have no claim for any extra payment for such maintenance work due to such contingent requirements. The rate includes all arrangement for operations, excavations and earth work in embankment necessary plants, labour maintenance etc.
- 1.5 The payment for this item shall be Job basis.

Item No. 5

Earthwork for embankment including breaking clods, dressing with all lead and lift (Excluding watering and consolidation) (A) Selected soil should be From borrow area with all lead and lift and should have CBR not less than 6.00%.

- (1) MORT&H specifications as in section 305 & 900 (5th revision) shall be followed in connection with this item. All relevant provisions as have been included in the respective IRC and IS specifications are also applicable.
- (2) The land width on which the earthwork is to be done shall be cleared of all trees having a girth of 30 cm and less, loose stones, vegetation, bushes, stumps, and all other objectionable materials. All the materials cleared will be the property of Government. Useful material shall be arranged in convenient stacks along the road boundary or as directed at places within all lead & Lift. and handed over to the department in convenient section. Unsuitable material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the works property or people in the neighborhood. In all cases the materials shall be disposed off in a neat manner.
- (3) After clearing the site, the alignment of the road shall be properly set out true to line, curves, slopes, grades, and sections as shown on the plan or directed by the engineer in charge. The contractor shall provide all labors and materials such as lime, strings, pegs, nails, bamboos, stone, mortar, concrete, etc. required for setting out, establishing bench marks and giving profiles. The contractor shall be responsible for maintaining the BMs profile alignments and other marks as long as they are required for the work in the opinion of the engineer in charge. If the contractor defaults in this respect they may be restored by the department at the cost of the contractor.
- (4) When an existing embankment is to be widened, continuous, horizontal benches, each at least 0.30 meter wide shall be cut into the existing slope for ensuring adequate bond with the fresh embankment of the embankment. The dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other type of hauling equipment.
- (5) The soil to be used for embankment shall be free from trees, stumps, roots, rubbish or any other objectionable materials. Only material considered suitable by the engineer-in-charge shall be used for the construction and that considered unsuitable other disposed off as directed by him. The selection of the materials to be used in the construction of embankment shall be made after soil surveys and investigations carried out by the department. The embankment shall consist of earth available from road side borrow pits on either side with all lead and all lifts.
- (6) Location, shape and size of borrow pits shall be as indicated by the engineer in charge. Pits shall not be dug continuously. Ridges of not less than 8 metres width should be left at interval not exceeding 300 metres. Small drain shall be cut through the ridges to facilitate drainage. The outer edge of borrow pits shall be so regulated that the bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontals projected from the edge of final section of the bank, the maximum depth in any case being limited to 1.5 metres. Also, no pits shall be dug within 5 metres of the toe of the final section of the road embankment.

1.1.No borrow pits shall be allowed at the following sites along the road.

- i.) Up to 30 metres on either side of CD works.
- ii.) Up to 15 metres on either side of cart track crossing for which approaches are to be constructed.

1.2.If there is top layer of black cotton or other objectionable soils, the same shall be removed and disposed off elsewhere and usable material found at lower level will only be used in the embankment.

- (7) The embankment shall be constructed in uniform layers not exceeding 250 mm in loose thickness. The soil shall be spread uniformly over the entire width of the embankment, unless otherwise directed by the engineer in charge. The consolidation including watering and rolling of earthwork shall be carried out by the department. The operation of laying the successive layer of earth shall have to be suitably. All clods of hard lumps of earth shall be broken to have maximum size of 15 cm when being placed in the embankment and a maximum size of 5 cm when being

placed in the top 45 cms of the embankment. The work of next layer shall be allowed only after the first layer below it has been thoroughly compacted.

- (8) Where an embankment is to be placed on sloping ground, the surface of the ground shall be benched in the steps of trenches or broken up in such a manner that the new material shall have perfect bond with the existing surface. Where the embankment is to be placed over an existing road surface, the surface shall be scarified to minimum depth of a 5 cm so as to provide ample bond between the old and new material. However, when the embankment is to be placed over an old concrete pavement and lies within 1 meter of new sub grade level the pavement shall be broken up in pieces not to exceed 0.1 m and may be left under the new embankment. If the existing road surface is of granulate or bituminous type and lies within 1 mt. of the new sub grade level, the same shall be scarified to a depth of minimum 50 mm, so as to provide ample bond between the old and the new material.
- (9) To avoid interference with the construction of abutment, wing walls or return walls of culverts/bridge structure, the contractor shall at point to be determined by the engineer in charge, suspend work on embankments forming approaches to such structures, until such time as the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of interference or damage to the bridge work. Unless directed otherwise, the filling ground culverts, bridges and other structures up to a distance twice the height of embankment. The fill material shall not be placed against any abutment or wing wall unless permission has been given for 14 days, the embankment shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of work in this regard shall be got approved from the engineer in charge. Where the provision of any filter medium is specified behind the abutment, the same shall be laid in layers simultaneous with the laying of fill material. The material used for the filter shall conform to the requirements for filter medium and will be aid extra in the relevant item.
- (10) The embankment shall be finished in conformity with the alignment, levels, cross sections and dimension shown on the plans or as directed by engineer in charge. Where the alignment of the road is in a curve, the top of the embankment shall be formed with the super elevation and the increased width shown on the drawings or as the engineer in charge may direct. Finishing operations shall include the work of shaping and dressing the shoulders, road bed and the side slopes to conform the cross section.
- (11) The earthwork measurements shall be paid on cross sectional measurements and computing the volumes of earthwork in cubic metres by average area method. The contractor shall sign day-to-day levelling work and also original cross section, longitudinal section, etc. in token of his acceptance. The working sections both longitudinal and cross of the ground shall be taken by the engineer in charge before the actual work is started. The contractor or his authorized representative shall attend day to day levelling work and sign with date the field book daily in token of his acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with specific reference to the sections before starting further work. Once the work is started, no cognizance of any complaint will be taken. Merely not signing of level book shall not be deemed as disagreement. The executive engineer shall also verify levelling work to the extent of 5% before commencement of earthwork and on finalization. The contractor shall maintain the embankment by filling in ruts, rain cuts, depression due to shrinkage, etc. to proper formation and grade till this item is finally measured and accepted by the department. The measurements shall be taken on compacted earthwork. If the compaction as stipulated in Para above is not done by the department in that case shrinkage from such earthwork quantity shall be deducted as per norms i.e. 10% after monsoon and 15% before monsoon. However, the contractor shall have to bear loss of quantity due to all settlements as well as other types of deformations etc., if any, that might have taken place at the time of taking the final measurement of this item.
- (12) The rate of earthwork includes, clearing jungles, dog-belling, fixing profiles, erecting necessary pillars for stones for bench marks for leveling purpose, excavating earth from borrow areas, breaking clods, conveying, and spreading earth in layers with all lead and lift, finishing the entire embankment and incidentals necessary to complete the work to the specifications. The cutting

stuff of cutting in ordinary soil, soft murrum, soft rock, hard murrum and hard rock shall be utilized in embankment construction under this item within the lead specified in the particular item. No payment shall be made under this item for the cutting stuff used in the embankment but labour for cutting will be paid as per specifications in the particular item, and only balance quantity of earthwork brought from borrow areas will be paid in this item.

The measurement will be in **cum** of actual completed volume.

Item No. 6

Earthwork for embankment including breaking clods, dressing with all lead and lift and including watering rolling and consolidation of subgrade in layers at O.M.C. to required dry density including filling the depression which occur during the process using power roller 8T to 10T.(E) From Borrow area including all lead & lift

1. The relevant specification for item no. 5 shall apply to this item.
2. The measurement and payment shall be in **Cum** basis.

Item No. 7

WBM Grading-2, Providing, laying, spreading and compacting stone agg. Of 63mm to 45mm size to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with smooth wheel roller 80-100 KN in stage to proper grade and camber, applying and brooming, stone screening/binding material to fill-up the intersties of coarse agg., watering and compacting to the required density grading-2 as per Technical Specification Clause.405 By manual means.

404 WATER BOUND MACADAM SUB-BASE/BASE

404.1 Scope

This work shall consist of clean crushed aggregates mechanically interlocked by rolling and bonding together with screening, binding material where necessary. and water laid on a properly prepared subgrade/sub-base/base or existing pavement, as the case may be and finished in accordance with the requirements of these Specifications and in close conformity with the lines, grades, cross-sections and thickness as per approved plans or as directed by the Engineer.

404.2 Materials

404.2.1 Coarse Aggregates

Coarse aggregates shall be either crushed or broken stone, crushed slag, over burnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed *gravel/shingle is used, not less than 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:2386 (Part 5).

**Table 400-8 : Physical Requirements of Coarse Aggregates for Water Bound
Macadam for Sub-base/Base Courses**

S.No.	Test	Test Method	Requirements
1) ***	Los Angeles Abrasion value or Aggregate Impact value	IS: 2386(Part4)	40 percent (Max)
		IS: 2386 (Part-4) or 15:5640*	30 percent (Max)
2)	Combined Flakiness and Elongation Indices (Total) **	IS:2386 (Part-1)	35 percent (Max)

* Aggregates which get softened in presence of water shall be tested for Impact value under wet conditions in accordance with 18:5640.

** The requirement of flakiness index and elongation index shall be enforced only in the case of crushed broken stone and crushed slag.

*** In case water bound macadam is used for sub-base, the requirements in respect of Los Angeles Value and Aggregate Impact Value shall be relaxed to 50 percent and 40 percent maximum respectively.

404.2.2 Crushed or Broken Stone

The crushed or broken stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles, dirt and other deleterious material.

404.2.3 Crushed Slag

Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed slag shall not be less than 11:2 kN per m³ and the percentage of glossy material shall not be more than 20. It should also comply with the following requirements:

- | | | |
|------|--------------------|--|
| i) | Chemical stability | To comply with requirements of appendix of BS:1047 |
| ii) | Sulphur content | Maximum 2 percent |
| iii) | Water absorption | Maximum 10 percent |

404.2.4 Overburnt (Jhama) Brick Aggregates .

Jhama brick aggregates shall be made from overburnt bricks or brick bats and be free from dust and other objectionable and deleterious materials. This shall be used only for road stretch when traffic is low.

404.2.5 Grading Requirement of Coarse Aggregates

The coarse aggregates shall conform to one of the Gradings given in Table 400-9 as specified.

404.2.6 Screenings

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

Table 400-9 : Grading Requirements of Coarse Aggregates

Grading No.	Size Range	IS Sieve Designation	Percent by weight Passing
1)	63 mm to 45 mm	75mm	100
		63mm	90-100
		53mm	25-75
		45mm	0-1.5
		22.4 mm	0-5
2)	53 mm to 22.4 mm	63mm	100
		53mm	95-100
		45mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer shall be 75 mm.

Screenings shall conform to the grading set forth in Table 400-10. The quantity of screenings required for various grades of stone aggregates are given in Table 400-11. The Table also gives the quantities of materials (loose) required for 10 m² for sub-base/base compacted thickness of 75 mm.

The use of screenings shall be omitted in the case of soft aggregates such as brick metal, kankar, laterites, etc. as they are likely to get crushed to a certain extent under rollers.

404.2.7 Binding Material

Binding material to be used for water bound macadam as a filler material meant for preventing ravelling shall comprise of a suitable material approved by the Engineer having a Plasticity Index (PI) value of less than 6 as determined in accordance with IS:2720 (Part-5).

The quantity of binding material where it is to be used will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be 0.06-0.09 m³ per 10m².

Table 400-10: Grading For Screenings

Grading Classification	Size of Screenings	IS Sieve Designation	Percent by Weight Passing the sieve
A	13.2 mm	13.2 mm	100

B	11.2 mm	11.2 mm	95-100
		5.6mm	15-35
		180 micron	0-10
		11.2 mm	100
		9.5mm	80-100
		5.6mm	50-70
		180 micron	5-25

Table 400-11 :Approximate Quantities of Coarse Aggregates and Screenings Required for 75 mm Compacted Thickness of Water Bound Macadam (WBM) Sub-Base/Base Course for 10 m² Area

Classification	Size Range	Compacted Thickness	Loose Qty.	Screenings			
				Stone Screening		Crushable Type Such as Moorum or Gravel	
				Grading Classification &Size	For WBM Sub-base/ Base Course (Loose Quantity)	Grading Classification &Size	Loose Qty.
Grading 1	63mm to 45 mm	75mm	0.91 to 1.07 m ³	Type A 13.2 mm	0.12 to 0.15 m ³	Not uniform	0.22 to 0.24 m ³
-do-	-do-	-do-	-do-	Type B 11.2 mm	0.20 to 0.22 m ³	-do-	-do-
Grading 2	53mm to 22.4 mm	75mm	-do-	-do-	0.18 to 0.21 m ³	-do-	-do-

The above mentioned quantities should be taken as a guide only, for estimation of quantities for construction etc.

Application of binding materials may not be necessary when the screenings used are of crushable type such as moorum or gravel.

404.3 Construction Operations

404.3.1 Preparation of Base

The surface of the sub-grade/sub-base/base to receive the water bound macadam course shall be prepared to the specified grade and camber and cleaned of dust, dirt and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained.

Where the WBM is to be laid on an existing metalled road, damaged area including depressions and potholes shall be repaired and made good with the suitable material. The existing surface shall be scarified and re-shaped to the required grade and camber before spreading the coarse aggregate for WBM.

As far as possible, laying water bound macadam course over existing bituminous layer may be avoided since it will cause problems of internal drainage of the pavement at the interface of two courses. It is desirable to completely pick out the existing thin bituminous wearing course where water bound macadam is proposed to be laid over it.

404.3.2 Inverted Choke/Sub-surface Drainage Layer

If water bound macadam is to be laid directly over the sub-grade without any other intervening pavement course, a 25 mm course of screenings (Grading B) or coarse sand shall be spread on the prepared sub-grade before application of the aggregates is taken up. In case of a fine sand or silty or clayey sub-grade, it is advisable to lay 100 mm insulating layer of screening or coarse sand on top of fine grained soil, the gradation of which will depend upon whether it is intended to act as a drainage layer as well. As a preferred alternative to inverted choke, appropriate geosynthetics performing functions of separation and drainage may be used over the prepared sub-grade as directed by the Engineer. Section 700 shall be applicable for use of geosynthetics.

404.3.3 lateral Confinement of Aggregates

For construction of WBM, arrangement shall be made for the lateral confinement of aggregates. This shall be done by building adjoining shoulders along with WBM layers. The practice of constructing WBM in a trench section excavated in the finished formation must be completely avoided.

Where the WBM course is to be constructed in narrow widths for widening of an existing pavement, the existing shoulders should be excavated to their full depth and width up to the sub-grade level except where widening specifications envisages laying of a stabilised sub-base using in-situ operations in which case the same should be removed only up to the sub-base level.

404.3.4 Spreading Coarse Aggregates

The coarse aggregates shall be spread uniformly and evenly upon the prepared sub-grade/ sub-base in the required quantities from the stockpiles to proper profile by using templates placed across the road about 6 m apart, in such quantities that the thickness of each compacted layer is not more than 75 mm. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed base be permitted. Wherever possible, approved mechanical devices such as aggregate spreader shall be used to spread the aggregates uniformly so as to minimize the need for manual rectification afterwards.

No segregation of coarse aggregates shall be allowed and the coarse aggregates as spread shall be of uniform gradation with no pockets of fine material.

The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregates as may be required. The surface shall be checked frequently with a straight edge while spreading and rolling so as to ensure a finished surface as per approved drawings.

The coarse aggregates shall not normally be spread more than 3 days in advance of the subsequent construction operations.

404.3.5

Rolling

Immediately following the spreading of the coarse aggregates, rolling shall be started with three wheeled power rollers of 80 to 100 kN capacity or tandem or vibratory rollers of 80 to 100 kN static weight. The type of roller to be used shall be approved by the Engineer based on trial run.

Except on superelevated portions and carriageway with unidirectional cross-fall, where the rolling shall proceed from inner edge to the outer, rolling shall begin from the edges gradually progressing towards the center. First the edge/edges shall be compacted with roller running forward and backward. The roller shall then move inward parallel to the center line of the road, in successive passes uniformly overlapping preceding tracks by at least one-half width.

Rolling shall be carried out on courses where coarse aggregates of crushed/ broken stone are used, till the road metal is partially compacted. This will be followed by application of screenings and binding material where required in Clauses 404.3.6 and 404.3.7.

However, where screenings are not to be applied as in the case of aggregates like brick metal, laterite and Kankar for sub-base construction, the compaction shall be continued until the aggregates are thoroughly keyed. Rolling shall be continued and light sprinkling of water shall be done till the surface is well compacted. Rolling shall not be done when the sub-grade is soft or yielding or when it causes a wave-like motion in the sub-grade or sub-base course.

The rolled surface shall be checked transversely with templates and longitudinally with 3 m straight edge. Any irregularities, exceeding 12 mm, shall be corrected by loosening the surface, adding or removing necessary amount of aggregates and re-rolling until the entire surface conforms to the desired camber and grade. In no case shall the use of screenings be permitted to make up depressions.

Material, which gets crushed excessively during compaction or becomes segregated, shall be removed and replaced with suitable aggregates.

404.3.6

Application of Screenings

After the coarse aggregates have been rolled to Clause 404.3.5, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregates. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit spreading arrangement. Tipper operating for spreading the screenings shall be equipped with pneumatic tyres and operated so as not to disturb the coarse aggregates.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand brooms or both. In no case shall the screenings

be applied so fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse aggregates. These operations shall continue until no more screenings can be forced into voids of the coarse aggregates. The spreading, rolling, and brooming of screenings shall be carried out in only such lengths of the road which could be completed within one day's operation.

404.3.7 Sprinkling of Water and Grouting

After application of screenings, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into voids and to distribute them evenly. The sprinkling, sweeping and rolling operation shall be continued, with additional screenings applied as necessary until the coarse aggregates have been thoroughly keyed, well-bonded and firmly set in its full depth and a grout has been formed of screenings. Care shall be taken to see that the sub-base or sub grade does not get damaged due to the addition of excessive quantities of water during construction.

In case of lime treated soil sub-base, construction of water bound macadam on top of it shall be taken up after curing as per Clause 402.3.9 and as directed by the Engineer.

Application of binding material : After the application of screenings in accordance with Clauses 404.3.6 and 404.3.7, the binding material where it is required to be used (Clause 404.2.7) shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or- mechanical brooms to fill the voids properly, and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them; These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

404 3.8 Setting and Drying

After the final compaction of water bound macadam course, the pavement shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set. The Engineer shall have the discretion to stop hauling traffic from using the completed water bound macadam course, if in his opinion it would cause excessive damage to the surface.

The compacted water bound macadam course shall be allowed to completely dry and set before the next pavement course is laid over it.

404.4 Surface Finish and Quality Control of Work

404.4.1 The surface finish of construction shall conform to the requirements of Clause 902.

404.4.2 Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

404.4.3 The water bound macadam work shall not be carried out when the atmospheric temperature is less than 10°C in the shade.

404.4.4 Reconstruction of Defective Macadam

The finished surface of water bound macadam shall conform to the tolerances of surface/regularity as prescribed in Clause 902. However, where the surface irregularity of the course exceeds the tolerances or where the course is otherwise defective due to sub-grade soil mixing with the aggregates, the course to its full thickness shall be scarified over

the affected area, reshaped with added material, or removed and replaced with fresh material as applicable and re-compacted. The area treated shall not be less than 10 sqm. In no case shall depressions be filled up with screenings or binding material.

404.5 Arrangements for Traffic

During the period of construction, the arrangements for traffic shall be done as per Clause 112.

404.6 Measurements for Payment

Water bound macadam shall be measured as finished work in position in cubic metres.

404.7 Rate

The Contract unit rate for water bound macadam sub-base/base course shall be payable in full for carrying out the required operations including full compensation for all components listed in Clause 401.7 (i) to (v), including arrangement of water used in the work as approved by the Engineer.

Item No. 8

Rolling and Watering of earthwork with vibratory roller including filling in depression which occur during the process and as directed.

1. The relevant specification of MoRT&H (5th revision) as per Item description given in section 400 shall apply to this item.
2. The Mode of Measurement & payment shall be done in **cum** basis.

Item No. 9

Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing of the excavated stuff upto all lead. (B) Dense or hard soil.

Relevant Specifications of MORT&H fifth revision Section – 304 shall apply to this item.

304 EXCAVATIONS FOR STRUCTURES

304.1 Scope

Excavation for structures shall consist of the removal of material for the construction of foundations for bridges, culverts, retaining walls, headwalls, cutoff walls, pipe culverts and other similar structures, in accordance with the requirements of these Specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer. The work shall include construction of the necessary cofferdams and cribs and their subsequent removal; all necessary sheeting, shoring, bracing, draining and pumping; the removal of all logs, stumps, grubs and other deleterious matter and obstruction, necessary for placing the foundations; trimming bottoms of excavations; backfilling and clearing up the site and the disposal of all surplus material.

304.2 Classification of Excavation

All materials involved in excavation shall be classified in accordance with Clause 301.2.

304.3 Construction Operations

304.3.1 Setting Out

After the site has been cleared according to Clause 201, the limits of excavation shall be set out true to lines, curves and slopes to Clause 301.3.1.

304.3.2

Excavation

Excavation shall be taken to the width of the lowest step of the footing including additional width as required for construction operation. The sides shall be left plumb where the nature of soil allows it. Where the nature of soil or the depth of the trench and season of the year do not permit vertical sides, the Contractor at his own cost shall put up necessary shoring, strutting and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and works and to the satisfaction of the Engineer.

The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of material encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer. Propping shall be undertaken when any foundation or stressed zone from an adjoining structure is within a line of 1 vertical to 2 horizontals from the bottom of the excavation.

Where blasting is to be resorted-to, the same shall be carried out in accordance with Clause 302 and all precautions indicated therein observed. Where blasting is likely to endanger adjoining foundations or other structures, necessary precautions such as controlled blasting, providing rubber mat cover to prevent flying of debris etc. shall be taken to prevent any damage.

304.3.3 Dewatering and Protection

Normally, open foundations shall be laid dry. Where water is met with in excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, depression of water level by well-point system, cofferdams and other necessary works to keep the foundation trenches dry when so required and to protect the green concrete/ masonry against damage by erosion or sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to the approval of the Engineer. Approval of the Engineer shall, however, not relieve the Contractor of the responsibility for the adequacy of dewatering and protection arrangements for the quality and safety of the works.

Where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed and be made as watertight as is necessary for facilitating construction to be carried out inside them, the interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction and inspection and to permit installation of pumping equipments, etc., inside the enclosed area.

If it is determined beforehand that the foundations cannot be laid dry or the situation is found that the percolation is too heavy for keeping the foundation dry, the foundation concrete shall be laid under water by tremie pipe only. In case of flowing water or artesian springs, the flow shall be stopped or reduced as far as possible at the time of placing the concrete.

. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete and for a period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.

At the discretion of the Contractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area.

The Contractor shall take all precautions in diverting channels and in discharging the drained water as not to cause damage to the works, crops or any other property.

304.3.4

Preparation of Foundation

The bottom of the foundation shall be levelled both longitudinally and transversely or stepped as directed by the Engineer. Before footing is laid, the surface shall be slightly watered and rammed in the event of excavation having been made deeper than that shown on the drawings or as otherwise ordered by the Engineer, the extra depth shall be made up with concrete as per Clause 2104.1 at the cost of the Contractor. Ordinary filling shall not be permitted to bring the foundation to the design level as shown in the drawing.

When rock or other hard strata is encountered, it shall be freed of all soft and loose material, cleaned and cut to a firm surface either level or stepped as directed by the Engineer. All seams shall be cleaned out and filled with cement mortar or grout to the satisfaction of the Engineer. In the case of excavation in rock, annular space around footing shall be filled with lean concrete M 15 upto the top level of rock.

If the depth of fill required is more than 1.5 m in soft rock or 0.6 m in hard rock above the foundation level, the filling upto this level shall be done with M-15 concrete and portion above shall be filled by concrete or by boulders grouted with cement.

When foundation piles are used, the excavation for pile cap shall be done after driving/casting of all piles forming the group. After pile driving operations in a given pit are completed, all loose and displaced materials therein shall be removed to the level of the bottom of the pile cap.

304.3.5 Slips and Slip-Outs

If there are any slips or slip-outs in the excavation, these shall be removed by the Contractor at his own cost.

304.3.6 Public Safety

Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red lights at night to avoid accidents. The Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures. For safety precautions, guidance may be taken from IS:3764.

304.3.7 Backfilling

Backfilling shall be done with approved material after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface in layers not exceeding 150 mm compacted thickness. The compaction shall be done with the help of suitable equipment such as trench compactor, mechanical tamper, rammer, plate vibrator etc., after necessary watering, so as to achieve the maximum dry density.

304.3.8 Disposal of Surplus Excavated Materials

Clause 301.3.11 shall apply.

304.4 Measurements for Payment

Excavation for structures shall be measured in cu.m for each class of material encountered, limited to the dimensions shown on the drawings or as directed by the Engineer. Excavation over increased width, cutting of slopes, production/support to the existing structures shoring, shuttering and planking shall be deemed as incidental to the main work and shall not be measured and paid separately.

Preparation of rock foundation shall be measured in square metres.

304.5 Rates

304.5.1 The Contract unit rate for the items of excavation for structures shall be payment in full for carrying out the, required operations including full compensation for:

- i) Setting out;
- ii) Transporting the excavated materials for use or disposal with all leads and lifts;
- iii) Construction of necessary cofferdams, cribs/sheeting, shoring and bracing and their subsequent removal;
- iv) Removal of all logs, stumps, grubs and other deleterious matter and obstructions, for placing the foundations including trimming of bottoms of excavations;
- v) Foundation sealing, dewatering including pumping when no separate provision for it is made in the Contract;
- vi) Backfilling, clearing up the site and disposal of all surplus material with all leads and lifts or as otherwise specified; and
- vii) All labour, materials, tools, equipment, safety measures, diversion of traffic and incidentals necessary to complete the work to Specifications.

304.5.2 The Contract unit rate for preparation of rock foundation shall be full compensation for cutting, trimming and cleaning the foundation surface and filling/sealing of all seams with cement grout or mortar including all materials, labour and incidentals required for completing the work.

Item No. 10

Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing of the excavated stuff upto all lead. (C) Hard Murrum

1. The relevant specification for item no. 9 shall apply to this item.
2. The measurement and payment shall be in **Cum** basis.

Item No. 11

Excavation of foundation in Sand gravel caly soft soil and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff as directed. Depth upto 3.00mt.

1. The relevant specification for item no. 9 shall apply to this item.
2. The measurement and payment shall be in **Cum** basis.

Item No. 12

Excavation of foundation in hard murrum and boulders and very stiff or sticky clays and other similar strata including shorting out and strutting and dewatering as necessary and disposing of the excavated stuff as directed.

1. The relevant specification for item no. 9 shall apply to this item.
2. The measurement and payment shall be in **Cum** basis.

Item No. 13

Excavation in large boulders and soft rock by wedging including shoring, strutting and dewatering as necessary and disposing of the excavated stuff as directed,

301.1 Scope

This work shall consist of excavation, removal and disposal of materials necessary for the construction of roadway, side drains and waterways in accordance with requirements of these Specifications and the lines, grades and cross-sections shown in the drawings or as indicated by the Engineer. It shall include the hauling and stacking of or hauling to sites of embankment and subgrade construction suitable cut materials as required, as also

the disposal of unsuitable cut materials in specified manner, with all leads and lifts, reuse of cut materials as may be deemed fit, trimming and finishing of the road to specified dimensions or as directed by the Engineer.

301.2 Classification of Excavated Material

301.2.1 Classification: All materials involved in excavation shall be classified by the Engineer in the following manner:

a) Soil:

This shall comprise topsoil, turf, sand, silt, loam, clay, mud, peat, black- cotton soil, soft shale or loose murrum, a mixture of these and similar material which yields to the ordinary application of pick, spade and/or shovel, rake or other ordinary digging equipment. Removal of gravel or any other modular material having dimension in any one direction not exceeding 75 mm shall be deemed to be covered under this category.

b) Ordinary Rock (not requiring blasting) This shall include:

- i) rock types such as laterites, shales and conglomerates, varieties of limestone and sandstone etc., which may be quarried or split with crow bars, also including any rock which in dry state may be hard, requiring blasting but which, when wet, becomes soft and manageable by means other than blasting;
- ii) macadam surfaces such as water bound and bitumen bound; soling of roads, cement concrete pavement, cobble stone, etc. compacted murrum or stabilized soil requiring use of pick axe or shovel or both.
- iii) lime concrete, stone masonry and brick work in lime/cement mortar below ground level, reinforced cement concrete which may be broken up with crow bars or picks and stone masonry in cement mortar below ground level; and
- iv) boulders which do 'not require blasting found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin.

c) Hard Rock (requiring blasting) This shall comprise:

- i) any rock or cement concrete for the excavation of which the use of mechanical plant and/or blasting is required,
- ii) reinforced cement concrete below ground level and in bridge/ ROB/RUB/flyover piers and abutments,
- iii) boulders requiring blasting.

d) Hard Rock (using controlled blasting):

Hard rock requiring blasting as described under (c) but where controlled blasting is to be carried out in locations where built-up area, huts, and are situated at within 200m of the blast site. -

e) Hard Rock (blasting prohibited)

Hard rock requiring blasting as described under (d) but where blasting is prohibited for any reason like people living within 20 m of blast sites etc. and excavation has to be carried out by chiselling, wedging or any other agreed method.

f) Marshy soil

This shall include soils like soft clays and peats excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

301.2.2 Authority for Classification

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

301.3 Construction Operations

301.3.1 Setting Out

After the site has been cleared as per Clause 201, the limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer. Clause 109 shall be applicable for the setting out operations.

301.3.2 Stripping and Storing Top soil

When so directed by the Engineer, the topsoil existing over the sites of excavation shall be stripped to specified depths and stock piled at designated locations for re-use in covering embankment slopes, cut slopes, berms, and other disturbed areas where re-vegetation is desired in accordance with Clause 305.3.3. Prior to stripping the topsoil, all trees, shrubs etc. shall be removed along with their roots, with approval of the Engineer.

301.3.3 Excavation-General

All excavations shall be carried out in conformity with the directions laid here-in-under and in a manner approved by the Engineer. The work shall be so done that the suitable materials available from excavation are satisfactorily utilized as deemed fit or as approved by the Engineer.

While planning or executing excavations, the Contractor shall take all adequate precautions against soil erosion, water pollution etc. as per Clause 306, and take appropriate drainage measures to keep the site free of water in accordance with Clause 311.

The excavations shall conform to the lines, grades side slopes and levels shown on the drawings or as directed by the Engineer. The Contractor shall not excavate outside the limits of excavation. Subject to the permitted tolerances, any excess depth/width excavated beyond the specified levels/dimensions on the drawings shall be made good at the cost of the Contractor with suitable material of characteristics similar to that removed and compacted to the requirements of Clause 305.

All debris and loose material on the slopes of cuttings shall be removed. No backfilling shall be allowed to obtain required slopes excepting that when boulders or soft materials are encountered in cut slopes, these shall be excavated to approved depth on instructions of the Engineer and the resulting cavities filled with suitable material and thoroughly compacted in an appropriate manner.

After excavation, the sides of excavated area shall be trimmed and the area contoured to minimize erosion and ponding, allowing for natural drainage to take place.

301.3.4 Methods, Tools, and Equipment

Only such methods tools and equipment as approved by the Engineer shall be adopted/ used in the work. If so desired by the Engineer, the Contractor shall demonstrate the efficacy of the type of equipment to be used before the commencement of work.

301.3.5 Rock Excavation

Rock, when encountered in road excavation, shall be removed upto the formation level or as otherwise indicated in the drawings. Where, however, unstable shales or other unsuitable materials are encountered at the formation level, these shall be excavated to the extent of 500 mm below the formation level or as otherwise specified. In all cases, the excavation operations shall be so carried out that at no point on cut formations the rock protrudes above the specified levels. Rocks and boulders which are likely to cause differential settlement and also local drainage problems shall be removed to the extent of 500 mm below the formation level in the formation width including side drains.

Where excavation is done to levels lower than those specified, the excess excavation shall be made good as per Clauses 301.3.3 and 301.6 to the satisfaction of the Engineer. Slopes in rock cutting shall be finished to uniform lines corresponding to slope lines shown on the drawings or as directed by the Engineer. Notwithstanding the foregoing all loose pieces of rock on excavated slope surface which move when pierced by a crowbar shall be removed.

Where blasting is to be resorted to, the same shall be carried out as per Clause 302 and all precautions indicated therein observed,

Where presplitting is prescribed to be done for the establishment of a specified slope in rock excavation, the same shall be carried out as per Clause 303.

301.3.6 Marsh Excavation

The excavation of soil from marshes/swamps shall be carried out as per the programme approved by the Engineer.

Excavation of marshes shall begin at one end and proceed in one direction across the entire marsh immediately ahead of backfilling with materials like boulders sand murrum bricks bats, dismantled concrete as approved by the Engineer. The method and sequence of excavating and backfilling shall be such as to ensure, to the extent practicable, the complete removal or displacement of all muck from within the lateral limits indicated on the drawings or as staked by the Engineer.

301.3.7 Excavation of Road Shoulders / Verge / Median for Widening of Pavement or Providing Treated Shoulders

In the works involving widening of existing pavements or providing paved shoulders the existing shoulders/verge/median shall be removed to its full width and upto top of the subgrade. The subgrade material within 500 mm from the bottom of the pavement for the widened portion or paved shoulders shall be loosened and recompacted as per Clause 305. Any unsuitable material found in this portion shall be removed and replaced with the suitable material while doing so, care shall be taken to see that no portion of the existing pavement designated for retention is loosened or disturbed. If the existing pavement gets disturbed or loosened, it shall be dismantled and cut to a regular shape with sides vertical and the disturbed/loosened portion removed completely and re-laid as directed by the Engineer, at the cost of the Contractor.

301.3.8 Excavation for Surface/Sub-Surface Drains

Where the Contract provides for construction of surface/sub-surface drains, the same shall be done as per Clause 309. Excavation for these drains shall be carried out in proper sequence with other works as approved by the Engineer.

301.3.9 Slides

If slips, slides, over-breaks or subsidence occur in cuttings during the process of construction, they shall be removed at the cost of the Contractor as ordered by the Engineer. Adequate precautions shall be taken to ensure that during construction, the slopes are not rendered unstable or give rise to recurrent slides after construction. If finished slopes slide into the roadway subsequently, such slides shall be removed and paid for at the Contract rate for the class of excavation involved, provided the slides are not due to any negligence on the part of the Contractor. The classification of the debris material from the slips, slides etc. shall conform to its condition at the time of removal and payment made accordingly regardless of its condition earlier.

301.3.10

Dewatering

If water is met with in the excavations due to springs, seepage, rain or other causes, it shall be removed by suitable diversions, pumping or bailing out and the excavation kept dry whenever so required or directed by the Engineer. Care shall be taken to discharge the drained water into suitable outlets as not to cause damage to the works, crops or any other property. Due to any negligence on the part of the Contractor, if any such damage is caused, it shall be the sole responsibility of the Contractor to repair/restore to the original condition at his own cost or compensate for the damage.

301.3.11

Use and Disposal of Excavated Materials

All the excavated materials shall either be reused with the approval of the Engineer or disposed of with all loads and lifts as directed by the Engineer.

301.3.12

Backfilling

Backfilling of masonry/concrete hume pipe or drain excavation shall be done with approved material with all loads and lifts after concrete/masonry/hume pipe is fully set and carried out in such a way as not to cause undue thrust on any part of the structure and/or not to cause differential settlement. All space between the drain walls and the side of the excavation shall be backfilled to the original surface making due allowance for settlement, in layers not exceeding 150 mm compacted thickness to the required density, using suitable compaction equipment such as trench compactor, mechanical tamper, rammer or plate compactor as directed by the Engineer.

301.4

Plying of Construction Traffic

Construction traffic shall not use the cut formation and finished subgrade without the prior permission of the Engineer. Any damage arising out of such use shall be made good by the Contractor at his own cost.

301.5

Preservation of Property

The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roadside trees, drains, sewers, sub-surface drains, pipes, conduits and any other structures under or above ground, which may be affected by construction operations and which, in the opinion of the Engineer, shall be continued in use without any change. Safety measures taken by the Contractor in this respect, shall be got approved from the Engineer. However, if any, of these objects is damaged by reason of the Contractor's negligence, it shall be replaced or restored to the original condition at his cost. If the Contractor fails to do so, within the required time as directed by the Engineer or if, in the opinion of the Engineer, the actions initiated by the Contractor to replace/restore the damaged objects are not satisfactory, the Engineer shall

arrange the replacement/restoration directly through any other agency at the risk and cost of the Contractor after issuing prior notice to the effect.

301.6 Preparation of Cut Formation

The cut formation, which serves as a sub-grade, shall be prepared to receive the sub-base/ base course as directed by the Engineer.

Where the material in the subgrade has a density less than specified in Table 300-1, the same shall be loosened to a depth of 500 mm and compacted in layers in accordance with the requirements of Clause 305 adding fresh material, if any required, to maintain the formation level as shown on the drawings. Any unsuitable material encountered in the subgrade level shall be removed as directed by the Engineer, replaced with suitable material and compacted in accordance with Clause 305.

In rocky formations the surface irregularities shall be corrected and the levels brought up to the specified elevation with granular base material as directed by the Engineer, laid and compacted in accordance with the respective Specifications for these materials. The unsuitable material shall be disposed of in accordance with Clause 301.3.11. After satisfying the density requirements, the cut formation shall be prepared to receive the sub-base/base course in accordance with Clauses 310 and 311.

301.7 Finishing Operations

Finishing operations shall include the work of properly shaping and dressing all excavated surfaces.

When completed, no point on the slopes shall vary from the designated slopes by more than 150 mm measured at right angles to the slope, except where excavation is in rock (ordinary or hard) where no point shall vary more than 300 mm from the designated slope. In no case shall any portion of the slope encroach on the roadway.

The finished cut formation shall satisfy the surface tolerances described in Clause 902.

Where directed, the topsoil removed and conserved (Clauses 301.3.2 and 305.3.3) shall be spread over cut slopes, shoulders and other disturbed areas. Slopes may be roughened and moistened slightly, prior to the application of topsoil, in order to provide satisfactory bond. The depth of topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 100 mm.

301.8 Measurements for Payment

Excavation for roadway shall be measured by taking cross-sections at suitable intervals before the excavation starts (after clearing and grubbing/stripping etc. as the case may be) and after its completion and computing the volumes in cu.m by the method of average end areas for each class of material encountered. Where it is not feasible to compute volumes by this method because of erratic location of isolated deposits, the volumes shall be computed by other accepted methods.

At the option of the Engineer, the Contractor shall leave depth indicators during excavations of such shape and size and in such positions as directed so as to indicate the original ground level as accurately as possible. The Contractor shall see that these remain intact till the final measurements are taken.

For rock excavation, the overburden shall be removed first so that necessary cross-sections could be taken for measurement. Where cross-sectional measurements could not be taken due to irregular configuration or where the rock is admixed with other classes of materials, the volumes shall be computed on the basis of measurement of stacks of excavated rubble allowing a deduction of 35% therefrom. When volume is calculated on

the basis of measurement of stacks of the excavated material other than rock, a deduction of 16% of stacked volume shall be allowed.

Works involved in the preparation of cut formation shall be measured in units indicated below:

i)	Loosening and recompacting the loosened material at subgrade	Cum.
ii)	Loosening and removal of unsuitable material and replacing with suitable material and compacting to required density	Cum.
iii)	Preparing rocky subgrade	Sqm.
iv)	Stripping including storing and reapplication of topsoil	Cum.

301.9 Rates

301.9.1 The Contract unit rates for the items of roadway and drain excavation shall be payment in full for carrying out the operations required for the individual items including full compensation for:

- i) setting out;
- ii) transporting the excavated materials for use or disposal with all leads and lifts by giving suitable credit towards the cost of re-usable material and salvage value of unusable material;
- iii) trimming bottoms and slopes of excavation;
- iv) dewatering;
- v) keeping the work free of water as per Clause 311;
- vi) arranging disposal sites; and
- vii) all labour, materials, tools, equipment., safety measures, testing and incidentals necessary to complete the work to Specifications.

Where presplitting of rock is prescribed it shall be governed by Clause 303.5.

301.9.2 The Contract unit rate for loosening and recompacting the loosened materials at subgrade shall include full compensation for loosening to the specified depth, including breaking clods, spreading in layers, watering where necessary and compacting to the requirements.

301.9.3 Clauses 301.9.1 and 305.8 shall apply as regards Contract unit rate for item of removal of unsuitable material and replacement with suitable material respectively.

301.9.4 The Contract unit rate for item of preparing rocky sub-grade as per Clause 301.6 shall be full compensation for providing, laying and compacting granular base material for correcting surface irregularities including all materials, labour and incidentals necessary to complete the work and all leads and lifts.

301.9.5 The Contract unit rate for the items of stripping and storing topsoil and of reapplication of topsoil shall include full compensation for all the necessary operations including all lifts and leads.

302 BLASTING OPERATIONS

302.1 General

Blasting shall be carried out in manner that completes the excavation to the lines indicated in drawings, with the least disturbance to adjacent material. It shall be done only with the written permission of the Engineer. All the statutory laws, regulations, rules, etc., pertaining to the acquisition, transportation, storage, handling and use of explosives shall be strictly followed by the contractor.

The Contractor may adopt any method or methods of blasting consistent with the safety and job requirements. Prior to starting any phase of the operation, the Contractor shall provide information describing pertinent blasting procedures, dimensions and notes.

The magazine for the storage of explosives shall be built to the designs and specifications of the Explosives Department concerned and located at the approved site. The storage places shall be clearly marked "DANGER-EXPLOSIVES". The Contractor shall be liable for property damage, injury or death resulting from the use of explosives. All permits shall be obtained by the Contractor. No unauthorized person shall be admitted into the magazine which, when not in use, shall be kept securely locked. No matches or inflammable material shall be allowed in the magazine. The magazine shall have an effective lightning conductor. The following shall be hung in the lobby of the magazine:

- a) A copy of the relevant rules regarding safe storage both in English and in the language with which the workers concerned are familiar,
- b) A statement of up-to-date stock in the magazine,
- c) A certificate showing the last date of testing of the lightning conductor, and
- d) A notice that smoking is strictly prohibited.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be marked. Where no local laws or ordinances apply, storage shall be provided to the satisfaction of the Engineer and in general not closer than

300 m from the road or from any building or camping area or place of human occupancy. In addition to these, the Contractor shall also observe the following instructions and any further additional instructions which may be given by the Engineer and shall be responsible for damage to property and any accident which may occur to workmen or public on account of any operations connected with the storage, handling or use of explosives and blasting. The Engineer shall frequently check the Contractor's compliance with these precautions.

302.2 Materials, Tools and Equipment

All the materials, tools and equipment used for blasting operations shall be of approved type. The Engineer may specify the type of explosives to be allowed in special cases. The fuse to be used in wet locations shall be sufficiently water-resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and definitely known to permit such a length being cut as will permit sufficient time to the firer to reach safely before explosion takes place. Detonators shall be capable of giving effective blasting of the explosives. The blasting powder, explosives, detonators, fuses, etc., shall be fresh and not damaged due to dampness, moisture or any other cause. They shall be inspected before use and damaged articles shall be discarded totally and removed from the site immediately.

302.3 Personnel

The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the details of handling explosives and blasting operations.

302.4 Blasting Operations

The blasting shall be carried out during the pre-determined hours of the day preferably during the mid-day luncheon hour or at the close of the work as ordered in writing by the Engineer. The hours shall be made known to the people in the vicinity.

The Contractor shall notify each public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury. In advance of any blasting work within 50 m of any railway track or structures, the Contractor shall notify the concerned Railway Authority of the location, date, time and approximate duration of such blasting operation.

Red danger flags shall be displayed prominently in all directions during the blasting operations. The flags shall be planted 200 m from the blasting site in all directions. People, except those who actually light the fuse, shall be prohibited from entering this area and all persons including workmen shall be kept away from the flagged area; and all persons; including workmen shall be removed from the flagged area at least 10 minutes before the firing. A warning siren shall be sounded for the above purpose.

Only controlled blasting shall be resorted to along with the safeguard above at locations where built-up area, huts and structures in use lie within 200 m. Similarly, excavation of hard rock without blasting is mandatory where people live within 20 m of blast site.

The charge holes shall be drilled to required depths and at suitable places. Blasting should be as light as possible consistent with thorough breakage of the material necessary for economic loading and hauling. Any method of blasting which leads to overshooting shall be discontinued.

When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and the powder dropped shall be gently tamped with copper rods with rounded ends. The explosive powder shall then be covered with tamping material which shall be tamped lightly but firmly.

When blasting is done with dynamite and other high explosives, dynamite cartridges shall be prepared by inserting the square cut end of a fuse into the detonator and finishing it with nippers at the open end, the detonator gently pushed into the primer leaving 1/3rd of the copper tube exposed outside. The paper of the cartridge shall then be closed up and securely bound with wire or twine. The primer shall be housed into the explosive. Boreholes shall be cleared of all debris and explosives inserted. The space of about 200 mm above the charge shall then be gently filled with dry clay, pressed home and the rest of the tamping formed of any convenient material gently packed with a wooden rammer.

At a time not more than 10 such charges will be prepared and fired. The man in charge shall blow a siren in a recognized manner for cautioning the people. All the people shall then be required to move to safe distances. The charges shall be lighted by the man-in-charge only. The man-in-charge shall count the number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back to the work site.

After blasting operation, the Contractor shall compact the loose residual material below subgrade and replace the material removed below subgrade with suitable material.

302.5

Misfire

In case of misfire, the following procedure shall be observed:

- i) Sufficient time shall be allowed to account for the delayed blast. The man-in-charge shall inspect all the charges and determine the missed charge.
- ii) If it is the blasting powder charge, it shall be completely flooded with water. A new hole shall be drilled at about 450 mm from the old hole and fired. This should blast the old charge. In case, it does not blast the old charge, the procedure shall be repeated till the old charge is blasted.

- iii) In case of charges of gelignite, dynamite, etc., the man in-charge shall gently remove the tamping and the primer with the detonator. A fresh detonator and primer shall then be used to blast the charge. Alternatively, the hole may be cleared of 300 mm of tamping and the direction then ascertained by placing a stick in the hole. Another hole may then be drilled 150 mm away and parallel to it. This hole shall then be charged and fired when the misfired hole should explode at the same time. The man-in-charge shall at once report to the Contractor's office and the Engineer all cases of misfire, the cause of the same and what steps were taken in connection therewith.

If a misfire has been found to be due to defective detonator or dynamite, the whole quantity in the box from which defective article was taken must be sent to the authority directed by the Engineer for inspection to ascertain whether all the remaining materials in the box are also defective.

302.6

Account

A careful and day to day account of the explosive shall be maintained by the Contractor in an approved register and manner which shall be open to inspection by the Engineer at all times.

304

EXCAVATIONS FOR STRUCTURES

304.1

Scope

Excavation for structures shall consist of the removal of material for the construction of foundations for bridges, culverts, retaining walls, headwalls, cutoff walls, pipe culverts and other similar structures, in accordance with the requirements of these Specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer. The work shall include construction of the necessary cofferdams and cribs and their subsequent removal; all necessary sheeting, shoring, bracing, draining and pumping; the removal of all logs, stumps, grubs and other deleterious matter and obstruction, necessary for placing the foundations; trimming bottoms of excavations; backfilling and clearing up the site and the disposal of all surplus material.

304.2

Classification of Excavation

All materials involved in excavation shall be classified in accordance with Clause 301.2.

304.3

Construction Operations

304.3.1

Setting Out

After the site has been cleared according to Clause 201, the limits of excavation shall be set out true to lines, curves and slopes to Clause 301.3.1.

304.3.2

Excavation

Excavation shall be taken to the width of the lowest step of the footing including additional width as required for construction operation. The sides shall be left plumb where the nature of soil allows it. Where the nature of soil or the depth of the trench and season of the year do not permit vertical sides, the Contractor at his own cost shall put up necessary shoring, strutting and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and works and to the satisfaction of the Engineer.

The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of material encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer. Propping shall be undertaken when any

foundation or stressed zone from an adjoining structure is within a line of 1 vertical to 2 horizontals from the bottom of the excavation.

Where blasting is to be resorted-to, the same shall be carried out in accordance with Clause 302 and all precautions indicated therein observed. Where blasting is likely to endanger adjoining foundations or other structures, necessary precautions such as controlled blasting, providing rubber mat cover to prevent flying of debris etc. shall be taken to prevent any damage.

304.3.3 Dewatering and Protection

Normally, open foundations shall be laid dry. Where water is met with in excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, depression of water level by well-point system, cofferdams and other necessary works to keep the foundation trenches dry when so required and to protect the green concrete/ masonry against damage by erosion or sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to the approval of the Engineer. Approval of the Engineer shall, however, not relieve the Contractor of the responsibility for the adequacy of dewatering and protection arrangements for the quality and safety of the works.

Where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed and be made as watertight as is necessary for facilitating construction to be carried out inside them, the interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction and inspection and to permit installation of pumping equipments, etc., inside the enclosed area.

If it is determined beforehand that the foundations cannot be laid dry or the situation is found that the percolation is too heavy for keeping the foundation dry, the foundation concrete shall be laid under water by tremie pipe only. In case of flowing water or artesian springs, the flow shall be stopped or reduced as far as possible at the time of placing the concrete.

. Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete and for a period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.

At the discretion of the Contractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area.

The Contractor shall take all precautions in diverting channels and in discharging the drained water as not to cause damage to the works, crops or any other property.

304.3.4 Preparation of Foundation

The bottom of the foundation shall be levelled both longitudinally and transversely or stepped as directed by the Engineer. Before footing is laid, the surface shall be slightly watered and rammed in the event of excavation having been made deeper than that shown on the drawings or as otherwise ordered by the Engineer, the extra depth shall be made up with concrete as per Clause 2104.1 at the cost of the Contractor. Ordinary filling shall not be permitted to bring the foundation to the design level as shown in the drawing.

When rock or other hard strata is encountered, it shall be freed of all soft and loose material, cleaned and cut to a firm surface either level or stepped as directed by the

Engineer. All seams shall be cleaned out and filled with cement mortar or grout to the satisfaction of the Engineer. In the case of excavation in rock, annular space around footing shall be filled with lean concrete M 15 upto the top level of rock.

If the depth of fill required is more than 1.5 m in soft rock or 0.6 m in hard rock above the foundation level, the filling upto this level shall be done with M-15 concrete-and portion above shall be filled by concrete or by boulders grouted with cement.

When foundation piles are used, the excavation for pile cap shall be done after driving/casting of all piles forming the group. After pile driving operations in a given pit are completed, all loose and displaced materials therein shall be removed to the level of the bottom of the- pile cap.

304.3.5 Slips and Slip-Outs

If there are any slips or slip-outs in the excavation, these shall be removed by the Contractor at his own cost.

304.3.6 Public Safety

Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red lights at night to avoid accidents. The Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures. For safety precautions, guidance may be taken from IS:3764.

304.3.7 Backfilling

Backfilling shall be done with approved material after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface in layers not exceeding 150 mm compacted thickness. The compaction shall be done with the help of suitable equipment such as trench compactor, mechanical tamper, rammer, plate vibrator etc., after necessary watering, so as to achieve the maximum dry density.

304.3.8 Disposal of Surplus Excavated Materials

Clause 301.3.11 shall apply.

304.4 Measurements for Payment

Excavation for structures shall be measured in cum for each class of material encountered, limited to the dimensions shown on the drawings or as directed by the Engineer. Excavation over increased width, cutting of slopes, production/support to the existing structures shoring, shuttering and planking shall be deemed as incidental to the main work and shall not be measured and paid separately.

Preparation of rock foundation shall be measured in square metres.

304.5 Rates

304:5.1 The Contract unit rate for the items of excavation for structures shall be payment in full for carrying out the, required operations including full compensation for:

- i) Setting out;

- ii) Transporting the excavated materials for use or disposal with all leads and lifts;
- iii) Construction of necessary cofferdams, cribs/sheeting, shoring and bracing and their subsequent removal;
- iv) Removal of all logs, stumps, grubs and other deleterious matter and obstructions, for placing the foundations including trimming of bottoms of excavations;
- v) Foundation sealing, dewatering including pumping when no separate provision for it is made in the Contract;
- vi) Backfilling, clearing up the site and disposal of all surplus material with all leads and lifts or as otherwise specified; and
- vii) All labour, materials, tools, equipment, safety measures, diversion of traffic and incidentals necessary to complete the work to Specifications.

304.5.2 The Contract unit rate for preparation of rock foundation shall be full compensation for cutting, trimming, and cleaning the foundation surface and filling/sealing of all seams with cement grout or mortar including all materials, labour and incidentals required for completing the work.

Item No. 14

Excavation in hard rock by dry-wet blasting and chiseling including dewatering preparing foundation base by proper benching and stepping and disposing of the excavated stuff as directed (B) Blasting prohibited.

1. The relevant specification as per Item No. 13 Shall apply to this item.
2. Mode of Measurement & payment for this item shall be done in **Cum** basis.

Item No. 15

Providing and fixing Mild steel dowel bar of minimum 32mm dia. For anchoring by drilling holes in foundation strata including necessary bending, hooking of dowel bars and grouting the holes complete as per detailed drawing and as directed.

1. The relevant specifications of MoRT&H (5th revision) section 2100, 1600 & 1700 as per item description shall apply to this item.
2. 32 mm Dia. MS dowel bar must be confirming to IS:432 (Part-I)
3. The measurement & payment shall be in **Rmt** basis.

Item No. 16

Providing and laying rubble for apron (Each stone weighting not less than 40kg) including and packing and filling in the interstices with quarry spall.

1. The relevant specifications as per MORTH specification as given in section 2500 shall apply to this item.
2. The measurement and payment shall be in **Cum** basis.

Item No. 17

Providing and filling in foundation with ordinary cement concrete M-15 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section -1500, 1700 & 2100 of MORT&H fifth revision specification.
2. The measurement & payment shall be per **cum** basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.

Item No. 18

Providing and casting in situ ordinary cement concrete M-15 mix and providing necessary pin headers including shuttering, scaffolding, laying vibrating, curing and finishing complete Without V-Grooves For all Hieght.

1. The relevant specification as per Item No. 17 Shall apply to this item.
2. The measurement and payment shall be done in **Cum** basis.

Item No. 19

Providing and filling in foundation with ordinary cement concrete M-10 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.

1. The relevant specifications for item no 17 shall apply to this item.
2. The measurement & payment shall be in **Cum** basis.

Item No. 20

Providing and filling in foundation with ordinary cement concrete M-15 mix and providing necessary vertical pin headers incl. Formwork, vibrating, ramming and curing complete.

1. The relevant specifications for item no 17 shall apply to this item.
2. The measurement & payment shall be in **Cum** basis.

Item No. 21

Providing & laying 22.5 cm thick dry rubble stone pitching on side slope on existing earthwork on murrum bed 7.50 cm thick & filling interstic with murrum & providing Flush pointing in CM 1:3 etc complete including curing & preparing slope in Earth work as directed.

1. The relevant specifications of MoRT&H (5th revision) as given in Section no. 2504 & 2506 shall apply to this item.
2. The measurement and payment shall be in **Sqm** basis.

Item No. 22

Providing parapet of ordinary cement concrete M-20 as per detailed drawing with necessary reinforcement including shuttering laying vibrating and finishing to line and level complete (ii) cast in situ.

1

Cast In-Situ Concrete Railing / Crash Barrier

The portion of the railing/crash barrier or parapet which is to be cast in-situ shall be constructed in accordance with the requirements for Structural Concrete Section and reinforcement conforming to Sections 1600 and 1700 of these Specifications.

Forms shall be fabricated conforming to the shape of railing/crash barrier shown on the drawings. It shall be ensured that no form joint appears on plane surfaces. For bridges/viaducts of length more than 500 m horizontal slip forms shall be used for casting of crash barriers.

All mouldings panel work and bevel strips shall be constructed according to the details shown on the drawings. All comers in the finished work shall be true, sharp and clean-cut and shall be free from cracks, spalls, or other defects. Castings of posts shall be done in single pour.

2

TESTS AND STANDARDS OF ACCEPTANCE

The material shall be tested in accordance with these Specifications and shall meet the prescribed criteria and requirements.

The work shall conform to these Specifications and shall meet the prescribed standards of acceptance.

- 3 **The Mode of Measurement** for cast in-situ railing/parapet wall shall measure in **running metres** basis.
- 4 The contract unit rate of railing shall include the cost of all labour, material, formwork, tools, and plant required for completing the work as per these Specifications.

Item No. 23

Providing and casting in situ Controlled cement concrete M-20 for R.C.C. work in Piers, abutment, returns and riding returns as per drawing including centering, shuttering, scaffolding where necessary laying, vibrating curing and finishing complete (A) For all Height

1. The relevant specifications given for machine mixed plain cement concrete M20 grade as per Section -1000, 1500, 1700 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per **cum.** basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum.** Basis.

Item No. 24

Providing and casting in situ Controlled cement concrete M-30 for C.C. work in Piers, abutment, returns and riding returns as per drawing including centering, shuttering, scaffolding where necessary laying, vibrating curing and finishing complete (A) For all Height

1. The relevant specifications given for machine mixed plain cement concrete M30 grade as per Section – 1000, 1500, 1700 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per **cum.** basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum.** Basis.

Item No. 25

Providing and casting in situ Ordinary cement concrete M-20 for C.C. Toe Wall and Curtain walls including necessary shuttering laying, vibrating, ramming and curing complete.

1. The relevant specifications given for machine mixed plain cement concrete M20 grade as per Section – 1000, 1500, 1700 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per **cum.** basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum.** Basis.

Item No. 26

Providing and casting in situ Controlled Cement Concrete M-25 for R.C.C. Raft and cut-off walls including necessary shuttering laying, vibrating ramming of curing complete.

1. The relevant specifications given for machine mixed plain cement concrete M25 grade as per Section – 1000, 1500, 1700 & 2100 of MORT&H fifth revision specification.
2. The measurement shall be per **cum.** basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.

4. The mode of payment shall be in per cum. Basis.

Item No. 27

Providing and casting in situ Controlled Cement Concrete M-30 for C.C. Raft and cut-off walls including necessary shuttering laying, vibrating ramming of curing complete.

1. The Relevant Specification of Item No. 26 shall apply to this item.
2. The measurement and payment shall be in Cum basis.

Item No. 28

Providing and casting in situ Contolled Cement concrete M 30 mix for R.C.C. works in pier cap, abutment cap, and dirt wall including controlled cement concrete M 35 bed block or pedestals for required size below bearings as per detailed drawings, centering, shuttering, scaffolding wherever necessary laying, vibrating, curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M30 & M35 grade as per Section -1000, 1500, 1700 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per cum. Basis.

Item No. 29

Providing and casting in situ Controlled cement concrete M 25 for R.C.C. Solid slab including centering, scaffolding, curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M25 grade as per Section – 1000, 1500, 1700 & 2300 of MORT&H fifth revision specification.
2. The measurement shall be per cum. basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per cum. Basis.

Item No. 30

Providing and casting in situ Controlled cement concrete M 30 for R.C.C. Solid slab including centering, scaffolding, curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M30 grade as per Section – 1000, 1500, 1700 & 2300 of MORT&H fifth revision specification.
2. The measurement shall be per cum. basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per cum. Basis.

Item No. 31

Providing and casting in situ Contolled cement concrete- M-20 for average 75/150mm thick wearing coat laid as directed incuding. tamping, vibrating, finishing, curring and filling in joints with bitumen complete.

1. The relevant specifications given for machine mixed plain cement concrete M20 grade as per Section – 1000, 1500, 1700 & 2700 of MORT&H fifth revision specification.
2. The measurement shall be per cum. basis.

3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum**. Basis.

Item No. 32

Providing and casting in situ Contolled cement concrete- M-30 for average 75mm thick wearing coat laid as directed incuding. tamping, vibrating, finishing, curring and filling in joints with bitumen complete.

1. The relevant specifications given for machine mixed plain cement concrete M30 grade as per Section – 1000, 1500, 1700 & 2700 of MORT&H fifth revision specification.
2. The measurement shall be per **cum**. basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum**. Basis.

Item No. 33

Providing and casting in situ Controlled cement concrete- M-20 mix for kerbs/Kerb blocks including formwork,curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M20 grade as per Section – 409, 1000, 1500 & 1700 of MORT&H fifth revision specification.
2. The measurement shall be per **cum**. basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum**. Basis.

Item No. 34

Providing and casting in situ Controlled cement concrete- M-30 mix for kerbs/Kerb blocks including formwork,curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M30 grade as per Section – 409, 1000, 1500 & 1700 of MORT&H fifth revision specification.
2. The measurement shall be per **cum**. basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum**. Basis.
5. The measurement and payment shall be in Cmt basis.

Item No. 35

Providing and casting in situ Contolled cement concrete- M-25 mix for Approach slab including formwork, curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M25 grade as per Section – 1000, 1500, 1700 & 2700 of MORT&H fifth revision specification.
2. The measurement shall be per **cum**. basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum**. Basis.

Item No. 36

Providing and casting in situ Contolled cement concrete- M-30 mix for Approach slab including formwork, curing and finishing complete.

1. The relevant specifications given for machine mixed plain cement concrete M30 grade as per Section – 1000, 1500, 1700 & 2700 of MORT&H fifth revision specification.
2. The measurement shall be per **cum.** basis.
3. The unit rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per **cum.** Basis.

Item No. 37

Providing and laying weep hole in Abutment and returns by using A.C pipe of 100mm. Incl. fixing in proper grade and jointing the complete as per detailed specification.

1. WEEP HOLE

Weep holes shall be provided in solid plain concrete/reinforced concrete, brick/stone masonry, abutment, wing wall and return walls as shown on the drawing or directed by the Engineer to drive moisture from the back filling. Weep holes shall be provided with 100 mm dia. using PVC / Polysil pipes structures in plain/reinforced concrete or brick masonry. In case of stone masonry, weep holes shall be 80 mm wide, 150 mm high or circular with 150 mm diameter. Weep holes shall extend through the full width of concrete/masonry with slope of about 1 vertical: 20 horizontals towards the draining face. The spacing of weep holes shall generally be 1 m in either direction or as shown in the drawing with the lowest at about 150 mm above the low water level or ground level which is higher or as directed by the Engineer. Approved makes for PVC weep holes is Supreme and Finolex.

2. The Measurements & payment shall be given on **number** of weep holes provided.
3. The rate includes all materials, labors, equipments and plants etc. required for executing this item.

Item No. 38

Providing and laying filter media 600mm. thick directed at the back of abutments, returns and wing walls as per detailed specifications.

1. Well graded pebbles or metal of 40 mm to 63 mm size shall be used. The grading and tolerance of metal of pebbles should be as under.

Sr. No.	No. of Size range	Sieve designation	Percentage by weight passing through the sieve
1.	63 mm to 40 mm	90 mm	100-50
		63 mm	85-100
		50 mm	35-70
		40 mm	00-15
		20 mm	00-05

The size shall be 40 mm to 63 mm wherein, tolerance limit for oversize shall be upto 15% and that for lower size should be upto 15% below 20 mm. It shall be tightly placed to a thickness not less than 600 mm and provided over the entire surface behind abutments wings or return walls to the full height.

2. Materials shall be first stacked in boxes of 2 m x 1.5 m x 0.5 m size on fairly level ground and measured.
3. The measurement & payment shall be made on **square meter basis.**
4. The unit rate includes the cost of materials, scaffolding, labour and tools to complete the work.

Item No. 39

Providing and filling sand behind abutments and between riding return, square return in layers as directed.

1. The sand to be used for filling shall be coarse, granular, clean, free from dust and deleterious matters obtained from a source as approved by the Engineer-in-charge. Sand between returns shall conform to I.S.: 383.
2. Sand between returns and below raft foundations shall be filled in suitable layers not exceeding 20 cms. at a time and each layer shall be well compacted.
3. Mode of measurement shall be the total cubical content (in cumt.) of the area covered by sand filling.

Item No. 40

Providing and fixing in position Mild steel dowel bars in pier cap or abutment caps for anchorage in free end as per detailed drawings including cutting bending and welding complete.

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision section 1600 shall apply to this item.
2. The measurement & payment shall be in Nos. basis.

Item No. 41

Providing and laying in Position FE -500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Piers (B) Abutments (C) Returns (D) Walls etc.

1 DESCRIPTION

This work shall consist of furnishing and placing coated or uncoated mild steel or high strength deformed reinforcement bars of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer.

2 GENERAL

Steel for reinforcement shall meet the requirements of Section 1000 of these Specifications.

Reinforcements may be either mild steel or high strength deformed bars. They may be uncoated or coated with epoxy.

3 PROTECTIONS OF REINFORCEMENT

Uncoated reinforcing steel shall be protected from rusting or chloride contamination. Reinforcements shall be free from rust, mortar, loose mill scale, grease, oil or paints. This may be ensured either by using reinforcement fresh from the factory or by thoroughly cleaning it using any suitable method such as sand blasting, mechanical wire brushing etc., as directed by the Engineer. Reinforcements shall be stored above the ground in a clean and dry condition, on blocks, racks or platforms and shall be suitably marked to facilitate inspection and identification.

Portions of uncoated reinforcing steel and dowels projecting from concrete shall be protected within one week after initial placing of concrete, with a brush coat of neat cement mixed with water to a consistency of thick paint. This coating shall be removed by lightly tapping with a hammer or other tool not more than one week before placing of the adjacent pour of concrete. Coated reinforcing steel shall be protected against damage to the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

In case of fusion bonded epoxy coated reinforcement or hot dipped galvanized bars used, reference shall be made Clause 1010.3.2 of Section 1000 of these specifications.

4**BENDING OF REINFORCEMENT**

Bar bending schedule shall be furnished by the Contractor and got approved by the Engineer before start of work.

Reinforcing steel shall conform to the dimensions and shapes given in the approved Bar Bending Schedules.

Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer using a proper bar bender, operated by hand or power to obtain the correct shape and radii of bends.

Bars shall not be bent or straightened in a manner that will damage the parent material or the coating.

Bars bent during transport or handling shall be straightened before being used on work. They shall not be heated to facilitate straightening.

5**PLACING OF REINFORCEMENT**

- a) The reinforcement cage should generally be fabricated in the yard at ground level and then shifted and placed in position. The reinforcement shall be placed strictly in accordance with the drawings and shall be assembled in position only when the structure is otherwise ready for placing of concrete. Prolonged time gap between assembling of reinforcement and casting of concrete, which may result in rust formation on the surface of the bars, shall not be permitted.
- b) Reinforcement bars shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed), conforming to IS:280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1 mm.
- c) Bars shall be kept in position usually by the following methods:
 - i) In case of beam and slab construction, industrially produced polymer cover blocks of thickness equal to the specified cover, shall be placed between the bars and formwork, subject to satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer, provided they have the same strength and specification as those of the member.
 - ii) In case of dowels for columns and walls, the vertical reinforcement shall be kept in position by means of timber templates with slots cut in them accurately, or with cover blocks tied to the reinforcement. Timber templates shall be removed after the concreting has progressed upto a level just below their location.
 - iii) Layers of reinforcements shall be separated by spacer bars at approximately one metre intervals. The minimum diameter of spacer bars shall be 12 mm or equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater. Horizontal reinforcement shall not be allowed to sag between supports.
 - iv) Necessary stays, blocks, metal chairs, spacers, metal hangers, supporting wires etc. or other subsidiary reinforcement shall be provided to fix the reinforcement firmly in its correct position.
 - v) Use of pebbles, broken stone, metal pipe, brick, mortar or wooden blocks etc., as devices for positioning reinforcement shall not be permitted.
- d) Bars coated with epoxy shall be placed on supports that do not damage the coating. Supports shall be installed in a manner such that planes of weakness are not created in hardened concrete. The coated reinforcing steel shall be held in place by use of plastic or

plastic coated binding wires especially manufactured for the purpose. Refer Section 1000 of these Specifications for other requirements.

- e) Placing and fixing of reinforcement shall be inspected and approved by the Engineer before concreting is commenced.

6 BAR SPLICES

6.1 Lapping

All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, except where shown on the drawing, shall be permitted without approval of the Engineer. The lengths of the splice shall be as indicated on drawing or as approved by the Engineer. Where practicable, overlapping bars shall not touch each other, and shall be kept apart by 25 mm or 1.25 times the maximum size of coarse aggregate, whichever is greater. If this is not feasible, overlapping bars shall be bound with annealed steel binding wire not less than 1 mm diameter and twisted tight in such a manner as to maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points along the span where stresses are low.

6.2 Welding

- 6.2.1 Splicing by welding of reinforcement will be permitted only if detailed on the drawing or approved by the Engineer. Weld shall develop an ultimate strength equal to or greater than that of the bars connected.

- 6.2.2 While welding may be permitted for mild steel reinforcing bars conforming to IS:432, welding of deformed bars conforming to IS:1786 shall in general be prohibited. Welding may be permitted in case of bars of other than Fe 240 grade including special welding grade of Fe 415 grade bars conforming to IS:1786, for which necessary chemical analysis has been secured and the carbon equivalent (CE) calculated from the chemical composition using the formula:

$$CE = C + \frac{Mn}{6} + \frac{Cr+Mg+V}{5} + \frac{Ni+Cu}{15}$$

is 0.4 or less.

- 6.2.3 The method of welding shall conform to IS:2751 and IS:9417, any supplemental specifications and Clause 1904.8 of these Specifications to the satisfaction of the Engineer.

Welding may be carried out by metal arc welding process. Oxy-acetylene welding shall not be permissible. Any other process may be used subject to the approval of the Engineer and necessary additional requirements to ensure satisfactory joint performance. Precautions on overheating, choice of electrode, selection of correct current in arc welding etc., should be strictly observed.

All bars shall be butt welded except for smaller diameter bars (diameter of less than 20 mm) which may be lap welded. Single-V or Double-V butt joints may generally be used. For vertical bars single bevel or double bevel joints may be used.

Welded joints shall be located well away from bends and shall be not less than twice the bar diameter away from a bend.

Generally, shop welding in controlled conditions is to be preferred, where feasible, Site welding where necessary shall, however, be permitted when the facilities, equipment, process, consumables, operators and welding procedure, are adequate to produce and maintain uniform quality at par with that attainable in shop welding, to the satisfaction of the Engineer.

Joint welding procedures which are to be employed shall invariably be established by a procedure specification. All welders and welding operators to be employed shall be qualified by tests prescribed in IS:2751. Inspection of welds shall conform to IS:822 and destructive or non-destructive testing may be undertaken when deemed necessary. Joints with weld defects detected by visual inspection or dimensional check inspection shall not be accepted.

Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding. When welding is done in two or three stages, the surface shall be cleaned properly after each stage. Bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before carrying out welding. Only competent and experienced welders shall be employed on the work with the approval of the Engineer. No welding shall be done on coated bars.

M.S. electrodes used for welding shall conform to IS:814.

6.2.4 Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section, not more than 20 percent of the bars are welded.

6.2.5 Specimens of welded pieces of reinforcement taken from the site shall be tested. The number and frequency of tests shall be as directed by the Engineer.

6.3 Mechanical at Couplers and Anchorages

6.3.1 Mechanical Couplers

Bars may be joined with approved patented mechanical devices as indicated on the drawing or as approved by the Engineer e.g. by special grade steel sleeves swaged on to bars in end-to-end contact or by screwed couplers. In case such devices are permitted by the Engineer, they shall develop at least 125 percent of the characteristic strength of the reinforcement bar.

6.3.2 Anchorages

Bars may be anchored with approved patented mechanical anchorages as indicated on the drawing or as approved by the Engineer. The anchorages shall be connected to the reinforcing bar by the use of taper thread system. The anchorage shall be capable of developing the characteristic strength of reinforcement without damage to concrete and shall have sufficient diameter and width to develop adequate shear cone strength. The connection shall develop 125% of the characteristic strength of reinforcement bar.

7 TESTING AND ACCEPTANCE

The material shall be tested in accordance with relevant IS specifications and necessary test certificates shall be furnished. Additional tests, if required, will be got carried out by the Contractor at his own cost.

The supply fabrication and placing of reinforcement shall be in accordance with these Specifications and shall be as checked and accepted by the Engineer.

Manufacturer's test certificate regarding compliance with Indian Standards for each lot of steel, shall be obtained and submitted to the Engineer. If required by the Engineer, the Contractor shall carry out confirmatory tests in the presence of a person authorized by the Engineer.

Cost of these tests shall be borne by the Contractor. The sampling and testing procedure shall be as laid down in IS:1786. If any test piece selected from a lot fails, no re-testing shall be done and the lot shall be rejected.

8 MEASUREMENT FOR PAYMENT

Reinforcement shall be measured in length including hooks if any, separately for different diameters as actually used in work, excluding overlaps. From the length so measured, the weight of reinforcement shall be calculated in tonnes on the basis of IS:1732. Wastage, overlaps, couplings, welded joints, spacer bars, chairs, stays, hangers and annealed steel wire or other methods for binding and placing, shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

9 RATE

The contract unit rate for coated/uncoated reinforcement shall cover the cost of material, royalty, fabricating, transporting, storing, bending, placing, binding, and fixing in position as shown on the drawings and as per these Specifications and as directed by the Engineer, including all labour, equipment, supplies, incidentals, sampling, testing and supervision.

The unit rate for coated reinforcement shall be deemed to also include cost of all material, labour, tools and plant, royalty, transportation, and expertise required to carry out the coating work as well as sampling, testing and supervision required for the work.

Item No. 42

Providing and laying in Position FE-500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Pier cap (B) Abutment cap & Dirt walls.

1. Relevant specification for item no. 41 shall apply to this item.
2. The measurement and payment shall be in MT basis

Item No. 43

Providing and laying in Position FE-500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following (A) Solid slab

1. Relevant specification for item no. 41 shall apply to this item.
2. The measurement and payment shall be in MT basis

Item No. 44

Providing and Fixing in position FE-500/500D TMT bar reinforcement including cutting, bending, hooking, and tying complete as per detailed drawaing (A)RCC kerb (B) RCC Footpath (B) RCC Solid Slab/ App. Slab / Wearing coat.

1. Relevant specification for item no. 41 shall apply to this item.
2. The measurement and payment shall be in MT basis

Item No. 45**Providing 12mm. Thick Pre-moulded asphalt filler joints as per drawings**

1. The relevant specifications given in Section – 2604 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Sqm. basis

Item No. 46**Providing G.I. 100mm. Diameter water spouts including necessary iron gratings as per drawings.**

1. Material for the drainage spout shall be as mentioned in the item and shall be got approved from the Engineer-in-charge.
2. Water spout shall be 100 mm internal dia. G.I. rating shall be provided at the entry and shall be fixed in the recess so as to be flush with the road surface. The quality and size of the grating shall be got approved for the Engineer-in-charge. The water spouts shall project at-least 10 cm. outside the concrete and shall be rigidly fixed in it. The grating and C.I. pipes shall be painted with two coats of anticorrosive black bitumen paint.
3. Measurement & payment shall be per number of drainage spout fixed.
4. Unit rate includes necessary iron gratings as per drawings.

Item No. 47**Providing flood gauge marks on sub structure as per design including painting complete**

1. The width of the flood gauge be 60 cm. and will have caneri yellow background colour. The flood gauge marking will be in 10 thick strips of alternative black and white colour. the width of the strip shall be as under:

(a) At every 10 cm.	15 cm width
(b) At every 1/2 m.	25 cm width in black
(c) At every meter	35 cm width in white

The lettering shall be in black colour and of 10 cm. height. The lettering shall show every meter and ½ m level. The lettering shall show level based on either GST B.M. or arbitrary B.M as furnished by Engineer in charge.

2. All the painting work shall be done in 3 coats. The paints shall be of approved make.
3. The measurements for payment shall be on Rmt. Basis.
4. The unit rate includes the cost of materials, labour painting, equipment if any to complete the work.

Item No. 48**Painting Two Coats on New Concrete Surfaces (Painting two coats after filling the surface with synthetic enamel paint in all shades on new plastered concrete surfaces) - For inner face of Kerb / Crash Barrier****INTRODUCTION:**

The objective of this work is to supply and application of a finish coat of Synthetic Enamel Paint on new concrete surface.

SCOPE OF WORK:

The contractor's scope of work shall comprise but not limited to the following:-

1. Preparation of all types of surfaces to be painted by removing all loose material / paint, dust, stain etc.
2. Supply & application of primer / putty wherever required.
3. Supply & application of one finish coat of Synthetic Enamel Paint of approved brand on concrete surface
4. Supply & application of Synthetic Enamel Paint of approved brand / make as per Annexure -1 on PPS fence & other as per specification and relevant item.

MATERIAL AND WORKMANSHIP:

1. All the materials, to be used in the work for the purpose of contract shall be as per standards / specifications and relevant test certificates showing requisite properties. The test certificates shall be submitted to the Engineer for his verification. Paints without test certificates or expired paints shall not be accepted.
2. All paints and paint constituents to be used for the work shall be delivered to the work area in original sealed containers, bearing manufacturer's labels, batch No., date of manufacture etc.
3. Constituent adhesives such as thinner, driers etc. shall be those recommended by the paint manufacturer.
4. The workmanship shall be one of the best class achievable in the industry and acceptable to the Engineer. Rectification on account of poor workmanship shall be done by the contractor to the satisfaction of Engineer.

Materials Required For Painting First Coat Primer and Two Subsequent Coats

Application of primer on walls / Concrete surfaces:-

- Cement primer
- Turpentine
- Putty
- Polish paper
- Wood primer
- Emery polish paper
- Water

DESCRIPTION OF ACTIVITIES TO BE CARRIED OUT AT SITE:

Preparation and cleaning of surface before painting:

- a. The existing painted surface should be cleaned thoroughly by using scrapers, wire brushes, emery paper, buffing wheels etc., thus making it free from all oil & grease, loose particles, rust, dust etc. to receive the finish coat.
- b. Surfaces shall be thoroughly cleaned to remove any dust, oil & grease with suitable cleaning agent followed by rinsing with clean water. Damaged painted areas shall be scrubbed thoroughly to achieve a clean surface. Pits / abrupt undulations shall be filled with compatible putty wherever required.
Walls, floors & ceiling and adjacent equipments and piping shall be satisfactorily protected by drop clothes.
Other precautionary measures should be taken during spray / brush painting to ensure that surrounding area /equipment is not affected.

Application of paint:

The application should be as per manufacturer's instructions / specifications. Before opening the packed drum, it should be rolled on the floor and after opening the drum paints shall be stirred well so that no material/ pigments remains settled at the bottom. Suitably the paint shall be checked as per requirement before opening.

The choice of method of application i.e. by brush or by spray gun will be decided by the Engineer. However, adjacent equipment / structures shall be suitably protected and care shall be taken to prevent intoxication of the surrounding area. The method of paint application depending upon the area shall be jointly discussed and decided with Engineer. Paint thickness (DFT) shall be as per the item scheduled. In case the dry film thickness of finish paint is observed less than the specified values, additional coat shall have to be applied free of charge.

Inspection & check:

All the work is subject to the inspection of the Engineer or his authorized representative which shall be carried out in a manner, satisfactory to the Engineer. The contractor shall rectify any short comings pointed out by the said representative. The general inspection requirements are as follows:-

- a) No paint shall be applied until the authorized inspection has ascertained that all prepared surfaces are satisfactorily cleaned and are in a condition to ensure the proper receipt of and adhesion of the coating.
- b) The contractor shall furnish all gauges, instruments and the necessary measuring equipments required for inspecting the work, test pieces, samples etc. at site and in the shop. The Engineer's authorized representative is intended to ensure that the material and workmanship are in

accordance with this specification, but it will not relieve the contractor for any of his responsibilities for the ultimate workmanship and performances.

EQUIPMENT TO BE USED IN PAINTING WORK:

- i) Drop cloth / polythene sheets:
Drop cloth and polythene sheets of suitable size & quality shall be used to protect other materials and surfaces.
- ii) Masking:
The masking material where-ever necessary shall be used in sufficient quantities to avoid falling of paint on unwanted surfaces.
- iii) Grinding / buffing wheels, wire brush & emery paper.
- iv) Electrical distribution panels switch boards & hand lamps.
- v) Kerosene, thinners, acetone etc. to remove oil / grease etc.
- vi) Painting brush:
Good quality brushes with long and flexible bristles free from any paint residue shall be used.
- vii) Neat, clean & painted scaffoldings of good quality.
- viii) Good quality ladders, platforms etc.
- ix) Safety gears to be used by personnel like respirator, face mask, hand gloves, protective clothing etc.

MAN POWER:

Experienced man power including Engineers, supervisors, inspectors and painters shall be deployed on the work. The painters shall have to be qualified by EIC before start of work. All other personnel shall be duly authorized by Site in-Charge before deploying them into work. A safety supervisor shall also be deployed for monitoring & instructing the safety aspects during the work.

INSPECTION REPORTS:

Inspection Reports in mutually agreed format shall be submitted along with completion of the work. Each RA Bill shall be submitted with inspection reports of the quantities billed for.

PROGRESS MONITORING:

The contractor shall submit a weekly report and a monthly report in mutually agreed format for monitoring the progress of work.

LIST OF APPROVED SYNTHETIC ENAMEL PAINTS

Approved Synthetic Enamel Paints Manufacturer

- i) Apcolite M/s Asian Paints
- ii) Luxol M/s Berger Paints
- iii) Neromin Synthetic Enamel M/s Kansai Nerolac Paints Ltd.
- iv) Tuffkote Chemical Resisting Enamel M/s Shalimar Paints

Application of paint:

Brushing operations are to be adjusted to the spreading capacity advised by the manufacture of particular paint. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the - laying off is finished. The full process of crossing and laying off will constitute one coat.

Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand-paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from Engineer-in-charge before next coat is started.

Each coat the last shall be lightly rubbed down with sand paper of fine pumice stone and cleaned of dust before the next coat is applied. No hair marks from the brush or logging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

Special care shall be taken while painting over bolts, nuts, rivets, overlap etc. Approved best quality brushes shall be used.

Scaffolding:

Where scaffolding is required, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be painted. A properly secured strong and well tied suspended platform (joola) may be used for painting. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

MODE OF MEASUREMENT & PAYMENT:

The unit rate Painting two coats (including priming coat) on new R.C.C. shall include the cost of all materials, tools and plant required for mixing paint, placing & painting in position, all required specials and jointing adhesive compound, finishing as per direction of the Engineer-in-charge, and all other incidental expenses as shown on the drawings and according to these specifications. They shall also include the cost of making, fixing and removing of all scaffolding and forms required for the work.

The rate of Painting two coats (including priming coat) on new R.C.C. shall include the cost of all labour, materials tools and plant scaffolding and all incidental expenses as described herein above.

The Painting two coats (including priming coat) on new R.C.C. work shall be measured for its length and width or Height limiting dimensions to those specified on plan or as directed.

The measurement and payment Sqm basis.

Item No. 49

Filling available excavated earth (excluding rock) in trenches plinth sides of foundation etc. in layers not exceeding 20cm in depth consolidating each deposited layer by ramming and watering.

1. The relevant specification of MoRT&H (5th revision) as per item description shall apply to this item.
2. The measurement & payment shall be in **Cum** basis.

Item No. 50

Supplying and fixing reinforced concrete heavy duty non pressure pipes with collars for culverts carrying heavy traffic as per IS 458-1991 specification including setting and joining the pipes in C.M. 1:2 watering and laying (to level or slope) of I.S. Class NP-3 of following internal diameter with all lead and lift. (i) 900mm Dia.

1013. REINFORCED CONCRETE PIPES

1. Reinforced concrete pipes for highway structures shall be of NP3 type conforming to the requirements of IS:458.
2. The measurement and mode of payment shall be in **Running meter** basis.

Item No. 51

Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. Stone/Rubble masonry.

1. Relevant Specifications of MORT&H fifth revision Section – 202 shall apply to this item.

1 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS

1.1 Scope

This work shall consist of dismantling and removing existing culverts, bridges, pavements, kerbs and other structures like guard-rails, fences, utility services, manholes, catch basins, inlets, etc., from the right of way which in the opinion of the Engineer interfere with the construction of road or are not suitable to remain in place, disposing of the surplus/unsuitable materials and backfilling to after the required compaction as directed by the Engineer.

Existing culverts, bridges, pavements and other structures which are within the highway and which are designated for removal, shall be removed upto the limit and extent specified in the drawings or as indicated by the Engineer.

Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and any other work to be left in place.

All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.

1.2 Dismantling Culverts and Bridges

The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the part of the structure to be retained and any other properties or structures nearby:

Unless otherwise specified, the superstructure portion of culverts/bridges shall be entirely removed and other parts removed up to at least 600 mm below the sub-grade, slope face or original ground level whichever is the lowest or as necessary depending upon the interference they cause to the new construction. Removal of overlying or adjacent material, if required in connection with the dismantling of the structures, shall be incidental to this item.

Where existing culverts/bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as are necessary and directed by the Engineer to provide a proper connection with the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Due care should be taken to ensure that reinforcing bars which are to be left in place so as to project into the new work as dowels or ties are not injured during removal of concrete.

Pipe culverts shall be carefully removed in such a manner as to avoid damage to the pipes. Steel structures shall, unless otherwise provided, be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the drawings or directed by the Engineer that the structure is to be removed in a condition suitable for re-erection, all members shall be match-marked by the Contractor with white lead paint before dismantling; end pins, nuts, loose plates, etc. shall be similarly marked to indicate their proper location; all pins, pin holes machined surfaces shall be painted with a mixture of white lead and tallow and all loose s shall be securely wired to adjacent members or packed in boxes.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber having salvage value as is designated by the Engineer.

1.3 Dismantling Pavements and Other Structures

In removing pavements, kerbs, gutters, and other structures like guard-rails, fences, holes, catch basins, inlets, etc., where portions of the existing construction are to be left e finished work, the same shall be removed to an existing joint or cut and chipped to a line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer.

All concrete pavements, base courses in carriageway and shoulders etc., designated for oval shall be broken to pieces whose volume shall not exceed 0.02 cu.m and used with approval of the Engineer or disposed of.

1.4 Back-filing

Holes and depressions caused by dismantling operations shall be backfilled with excavated her approved materials and compacted to required density as directed by the Engineer.

1.5 Disposal of Materials

All Surplus materials shall be taken over by the Contractor which may either be re-used with approval of the Engineer or disposed of with all leads and lifts.

Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

2. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads.

Item No. 52

Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. RCC Work.

1. The Relevant Specification of Item No. 51 shall apply to this item.

2. Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

3. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads.

Item No. 53

Dismantling G.I. Pipes G.S.W. Pipes and A.C Rain water pipes with fitting and clamps including stacking the materials with all lead and lift (for any of pipe)

1. The Relevant Specification of Item No. 51 shall apply to this item.

2. Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

3. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads

Item No. 54

Removing all type of hume pipes and stacking including all lead of earthwork and dismantling of masonry works.

(A) Up to 600 mm dia

1. The Relevant Specification of Item No. 51 shall apply to this item.

2. Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

3. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads

Item No. 55

Dismantling the existing structure including removing and stacking the dismantled materials as and where directed. (A) CC Work

1. The Relevant Specification of Item No. 51 shall apply to this item.

2. Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

3. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads

Item No. 56

Dismantling of Flexible Pavements (Dismantling of flexible pavements and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately)

ii) By Mechanical means. A) Bituminous course

1. The Relevant Specification of Item No. 51 shall apply to this item.

2. Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

3. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads

Item No. 57

Dismantling of Cement Concrete Pavement (Dismantling of cement concrete pavement by mechanical means using pneumatic tools, breaking to pieces not exceeding 0.02 cum in volume and stock piling at designated locations and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately).

1. The Relevant Specification of Item No. 51 shall apply to this item.

2. Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/ concrete (plain and reinforced)	cu.m
ii)	Dismantling flexible and cement concrete pavement	cu.m
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	linearm
vi)	Tiled Paver Block	Sqm

3. Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards, and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads

Item No. 58

Providing temporary all weather and fair weather diversion suitable for traffic during the construction period of the bridge / Slab drain including providing necessary drains and all safety measures including red lamps / signals at night for traffic etc. complete.

1. The relevant specification of MoRT&H (5th revision) as per Item description shall apply to this item.
2. The mode of measurement & payment shall be done in Rmt. basis.

Item No. 59

Providing and fixing Flood guage post mark of 'C' angle size 100mm x 50mm x 6mm thick (in head wall 0.500mt. And 1.50mt. Out side with painting and lettering with redeum color as directed.

1. The relevant specification of MoRT&H (5th revision) as per Item description shall apply to this item.
2. The mode of measurement & payment shall be done in Nos. basis.

Item No. 60

Regulatory / Mandatory Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60 cms Dia Circle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 61

Distance Informatory / Destination Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x120 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 62

Diversion Ahead Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x60 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.1 mtr long stand post (2 Nos.) of 50 x 50 x 5mm / 50NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test

report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

1. The relevant specifications given in Section -- 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 63

Men at work (2' x 2') sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP(Aluminum composite Panel); size 60cm x 60cm square as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 64

Sign board per Squate Meter :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 1meter x1 meter as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 4 mtr long stand post (2 Nos.) of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 65

Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by

contractor. (A) Class-C Type-11 Retro Reflective sheeting "

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 66

"Chevron sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50 cm as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg,including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from originaa manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting "

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 67

Hazard Marker Sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 1.8mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg,including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 68

"Hazard Marker Sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminum composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with High Intensity Prismatic Grade retro reflectivesheeting of Type-4 as per ASTM D-4956 and latest M.O.S.T.Specifications; 1.8mtr long stand post of Iron Angle 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 7 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (B) Class-B Type-4 Retro Reflective sheeting

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 69

Cautionary Warning Sign : Providing and fixing sign boards made out of 2mm Aluminium sheet size 90x90x90 cms. Equilateral triangle as per the design of IRC-67-1977 pre treated with phosphating process and acid etching coated with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with retro reflective sheeting as per latest MOST specification 3.1 Mt. long stand post and frame fabricated from suitable size iron angle of 35x35x3mm, 75x75x6mm. as required painted with best quality epoxy coating in black and white bends the details of symbole for each board shall be as per the instruction of Engineer in charge the fixing at site shall be in 1:2:4 CC block of size 45x45x60cms. for each leg including excavation curring etc. complete under the supervision of engineer in charge (A) Engineering Grade.

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 70

MMGSY Project Information Board: Providing and fixing of typical PMGSY Project informatory sign board with Logo as per 1700 of MORD specifications and drawing. The board will be a composite unit consisting of Three Plates ACM (Aluminium Composite Material), material specificaitons as per clause 17001.3. The top most plate will be of 3mm ACM in diamond shape of 600x600mm size, riveted with MS angle iron frame of 25mmx25mmx5mm size on back on edges. The middle 4mm ACM plate of will be 1200x150mm size riveted with MS angle iron frame of 25mmx25mmx5mm size on back on edges. The main 4mm ACM lower most plate will be 1500mmx600mm size, riveted with MS angle iron frame of 25mmx25mmx5mm size. Riveting of all the sheets over angle and flat iron frame will be done neatly to have plain surface on one side. The angle iron frame of lower most plate and flat iron frame of the middle plate will be welded to two nos. 75mm x75mm (12 SWG) sheet tubes posts placed at 1125mm apart centre to centre. the top of the middle plate will be flushed with the top of 75mm dia medium steel tube posts and these posts will be embeded in cement concrete M15 grade block of 450x450x600mm below ground level. The height of the bottom of the lower plate will be 1200mm from normal ground level and the bottom of the middle plate will be 100mm above the top level of the lower most plate. the diamond shaped plate mounted over flat angle iron frame will be connected to middle plate by square steel section of 47mmx47mm, thickness 12SWG having a spacing of 100mm between the diamond shaped plate and middle plate and this square section will be riveted to the bottom point of the diamond shaped plate. MMGSY logo, letters and numerals on the ACM should be made up of Retro Reflective sheeting of Type-1 AEGP Class-A grade as per the latest MORD section 1700 and IRC 67-2012 specifications. Al the section of the frame and posts shall be painted with primer and two coats of epoxy paint. The design, painting and lettering shall be done as per the MMGSY Signage Guide and as directed by Engineer-In-charge. . A warranty for 5 years for the Retro reflective sheeting for Class-A respectively, from original manufacturer shall be submitted by contractor.

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 71

Road marking with hot applied thermoplastic paints with reflectorising glass beads on bitumin surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250gms per sqm area, thickness of 2.5mm is excluding of surface applied glass beds as per IRC:35-2015. The finished surface to be level, uniform and free from streaks and holes. zebra patta /bump patta lane/center line/ edge line/cut patta. The white color marking should provide liminance coefficinet on cemend road shalll be min 130 mcd/m2/lux and Asphalt road shall be min 100 mcd/m2/lux during the service life during the day time. The marking

should meet the performance criteria for night time reflectivity, wet reflectivity and skid resistance as mentioned in the section-15 of IRC 35-2015. Warranty for the Retro reflectivity should be two years.

1. The relevant specifications given in Section – 800 of MORT&H fifth revision and latest GR of R&B Department as per SOR/ 1018/715/ C-1 part file specification shall apply to this item.
2. The measurement shall be in Sq.mt basis.
3. The rate includes of reflect rising glass beads at 250 gm/smt area. Thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC 35. The finished surface to be level uniform free from streaks and holes and as per direction of engineer in charge.
4. The mode of payment shall be in per Sq.mt basis.

Item No. 72

Cat Eye / Road Stud / RPM: Supplying of Molded Twin Shanks Raised Pavement Markers made of polycarbonate and ABS moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 13635 kgs. tested in accordance to ASTM D 4280 Type H and complying to Specifications of Category A of MORTH Circular No RW/NH/33023/10-97 DO III Dt 11.06. 1997. The height, width and length shall not exceed 20 mm, 130 mm and 130 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 +/- 5 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less than 19 +/- 2 mm and height not less than 30 +/- 2 mm) from the body is to be a minimum value of 500 Kgf. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturers recommendation and The color of the marker should be as per the IRC 35-2015 and as directed by Engineer-in-charge.

1. The relevant specifications given in Section – 800 of MORT&H fifth revision specification shall apply to this item.
2. The measurement & payment shall be in Nos. basis

Item No. 73

Providing and applying anti carbonation, anti fading, mold resistant, heat insulating, and 100% acrylic breathable decorative external waterproof coating of approved shade for Pier/Abutment, Riding return, Square return, Protection wall, Pier / Abutment Cap, Dirt wall, Solid slab etc. having Viscosity @ Room Temperature by Ford cup No. B-4 (dilute 2 parts of product with 1 part of water) 18 to 30 sec. pH of 7.00 to 10.00 and Sp. Gravity @ Room Temperature 1.30+0.1, tested for carbon dioxide diffusion resistance properties for coating materials and coating systems for exterior masonry and concrete as per DIN EN 1062-6 (2002-2010) by a NBA Grade "A" accredited institution.

1. Relevant specifications shall apply as per item description and as directed by engineer in charge.
2. The measurement shall be on the basis of Sqm.
3. The mode of payment shall be in per Sqm. basis.
4. The rate include labour, material, equipment required for complete this item.

Item No. 74

Carrying out load test of super structure as directed including all necessary materials plant equipment, instruments, labour and arrangements for test directed.

1. The Engineer –in-charge shall instruct that a load test be made on any part of the super structure if in his opinion such a test is deemed necessary for one or more of reasons specified below:-
 - (a) The work test cubes failing to attain the specified strength.
 - (b) The shuttering being prematurely removed.
 - (c) Over loading during construction of the structure or part thereof.
 - (d) Concrete improperly cured.
 - (e) Any other circumstances attributable to negligence on the part of the contractor which, in the opinion of the Engineer-in-charge, results in the reduction of required strength of the structure or part thereof.

- (f) Any reason other than the foregoing.
2. If the load test be ordered to be made solely or in part for the reasons (a) to (e) the test shall be carried out for contractor's own cost. If the test is required to be carried out for the reasons specified at (f) here in before, the contractor shall make the test and shall be paid for the same.
 3. The test load shall not be applied earlier than 28 days of the completion of placing of the concrete in the part of the structure to be tested and the latter shall not be supported during the test by the shuttering or other non-permanent support. Necessary care shall, however, be taken to ensure that in the event of failure under the test temporary support of the loaded member shall be immediately available.
 4. If the result of the load test for the reasons mentioned at (a) to (e) is not satisfactory in the opinion of the Engineer-in-charge he shall instruct that the part of the structure concerned shall be taken down or cut out and reconstructed to his satisfaction or that other remedial measures shall be taken to make the structure secure and strong as per requirement at the contractor's own risk and cost or the work may be accepted as sub-standard work and paid at reduced rate as may be decided by the Engineer-in-charge and his decision in the matter shall be binding, on the contractor. The contractor shall provide necessary materials, instruments, equipments observations platforms, plant and labour needed for carrying out the test as required. The load in general shall be in the form of sand bags. However, the contractor may apply the test load in any other suitable manner as may be approved by the Engineer-in-charge. The contractor shall make all necessary arrangements for observation platforms, centering, taking deflection by deflectometers etc. to the entire satisfaction of the Engineer-in-charge. The test load shall be kept at least 24 hours or as directed before removal.
Test load of superstructure shall be 1.5 times the equivalent load including maximum stresses at sections of maximum stresses at sections of maximum bending moment and or shear force for which the superstructure is designed.
 5. The item for the purpose of payment shall be measured per M.T of load placed on the superstructure and the payment of the same made on completion of the test.
 6. Unit rate shall include all materials, labour, measuring instruments, tools and plant necessary to carry out the load test.

Item No. 75

Type - B, "THRIE" : Metal Beam Crash Barrier (Providing and erecting a "Thrie" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 85 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 2 m high with 1.15 m below ground level, all steel parts and fittings to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a space of channel section 150 x 75 x 5 mm, 546 mm long complete as per clause 811)

811.3 Metal Beam Crash Barrier

811.3.1 Materials

- 811.3.1.1 Metal beam rail shall be corrugated sheet steel beams of the class, type, section and thickness indicated on the drawings. Railing posts shall be made of steel of the section, weight and length as shown on the drawings. All complete steel rail elements terminal sections, posts, bolts, nuts, hardware and other steel fittings shall be galvanized. All elements of the railing shall be free from abrasions, rough or sharp edges and shall not be kinked, twisted or bent.
- 811.3.1.2 The "W" beam type safety barrier shall consist of a steel post and a 3 mm thick "W" beam rail element. The steel post and the blocking out spacer shall both be channel section of 75 mm x 150 mm & size 5 mm thick. The rail shall be 70 cm above the ground level and posts shall be spaced 2 m center-to-center. Double "W" beam barrier shall be as indicated in IRC:5-1998.

The thrie beam safety barrier shall have posts and spacers similar to the ones mentioned above for "W" beam type. The rail shall be placed at 85 cm above the ground level.

The "W" beam, the thrie beam, the posts, spacers and fasteners for steel barriers shall be galvanized by hot dip process (zinc coated, 0.55 kg per square metre; minimum single spot) unless otherwise specified. The galvanizing on all other steel parts shall conform to the relevant IS Specifications. All fittings (bolts, nuts, washers) shall conform to the IS:1367 and IS:1364. All galvanizing shall be done after fabrication.

- 811.3.1.3 Concrete for bedding and anchor assembly shall conform to Section 1700 of these Specifications..

811.3.2 Construction Operations

- 811.3.2.1 The line and grade of railing shall be true to that shown on the plans. The railing shall be carefully adjusted prior to fixing in place, to ensure proper matching at abutting joints and correct alignment and camber throughout their length. Holes for field connections shall be drilled with the railing in place in the structure at proper grade and alignment.

- 811.3.2.2 Unless otherwise specified on the drawing, railing steel posts shall be given one shop coat of paint (primer) and three coats of paint on structural steel after erection, if the sections are not galvanized. Any part of assembly below ground shall be painted with three coats of red lead paint.

- 811.3.2.3 Splices and end connections shall be of the type and designs specified or shown on the plans and shall be of such strength as to develop full design strength of the rail elements.

811.3.3 Installation of Posts

- 811.3.3.1 Holes shall be dug or drilled to the depth indicated on the plans or posts may be driven by approved methods and equipment, provided these are erected in proper position and are free from distortion and burring or any other damage.

- 811.3.3.2 All post holes that are dug or drilled shall be of such size as will permit proper setting of the posts and allow sufficient room for backfilling and tapping.

- 811.3.3.3 Holes shall be back filled with selected earth or stable materials in layers not exceeding 100 mm thickness and each layer shall be thoroughly tamped and rammed. When backfilling and tamping are completed, the posts or anchors shall be held securely in place.

- 811.3.3.4 Post holes that are drilled in rock and holes for anchor posts shall be backfilled with concrete.

- 811.3.3.5 Posts for metal beam guardrail on bridges shall be bolted to the structure as detailed on the plans. The anchor bolts shall be set to proper location and elevation with templates and carefully checked.

811.3.4 Erection

- 811.3.4.1 All guard rail anchors shall be set and attachments made and placed as indicated on the plans or as directed by the Engineer.

- 811.3.4.2 All bolts or clips used for fastening the guardrail or fittings to the posts shall be drawn up tightly. Each bolt shall have sufficient length to extend at least 6 mm through and beyond the full nut, except where such extensions might interfere with or endanger traffic in which case the bolts shall be cut off flush with the nut.

- 811.3.4.3 All railings shall be erected, drawn and adjusted so that the longitudinal tension will be uniform throughout the entire length of the rail.

811.3.5 End Treatment for Steel Barrier

811.3.5.1 End treatments shall form an integral part of safety barriers which should not spear, vault or roll a vehicle for head-on or angled impacts. The two end treatments recommended for steel barriers are "Turned-down-guardrail" and "Anchored in back slope", as shown on the drawings or as directed by the Engineer.

811.3.6 Tolerance

The posts shall be vertical with a tolerance not exceeding 6 mm in a length of 3 m. The railing barrier shall be erected true to line and grade.

811.3.7 Measurements for Payment

811.3.7.1 Metal beam railing barriers will be measured by **linear metre** of completed length as per plans and accepted in place. Terminals/anchors of various types shall be paid for by numbers.

811.3.7.2 Furnishing and placing anchor bolts and/or devices for guard rail posts on bridges shall be considered incidental to the construction and the costs thereof shall be included in the price for other items of construction.

811.3.7.3 No measurement for payment will be made for excavation or backfilling performed in connection with this construction.

811.3.8 Rate

The Contract unit rate shall include full compensation for furnishing of labour, materials, tools, equipments and incidental costs necessary for doing all the work involved in constructing the metal beam railing barrier complete in place in all respects as per these Specifications.

Item No. 76

Providing and fixing guard stone as per I.R.C. type design including white washing etc. complete

1 BOUNDARY STONES

1.1 Scope

The work shall cover supply and fixing boundary stones as per designs and Specifications given in IRC:25 Type Designs for Boundary Stones" and at locations indicated in the drawings or as directed by the Engineer. The material to be used shall conform to IRC:25.

1.2 Measurements for Payment

The measurement shall be made in numbers of boundary stones supplied and fixed at site.

1.3 Rate

The Contract unit rate for boundary stones shall be full compensation for furnishing all labour, materials, tools, equipment for preparing, supplying and fixing and all other incidental costs necessary to complete the work to these Specifications.

Item No. 77

Scarifying bitumen macadam surface 6 cm to 10 cm depth including stacking useful materials on road side and disposing off remaining stuff (A) On Existing Road

1. The relevant specification of MoRT&H (5th revision) as given in section 300 shall apply to this item.
2. The mode of measurement & payment shall be done in **Sqm** basis.

Item No. 78

Construction of Subgrade with approved material obtained from borrow pits with all lifts and leads, transporting to site spreading, grading to required slope and compacting to meet requirement to MoRTH table 300-2 in layers not more than 200 mm thick as directed by engineer in charge.(Effective CBR Minimum 8 %)

305 EMABANKMENT CONSTRUCTION

305.1 General

305.1.1 Description

These Specifications shall apply to the construction of embankments including sub-grades, earthen shoulders; and miscellaneous backfills with approved material obtained from approved source; including material from roadway and drain excavation, borrow pits or other sources. All embankments sub-grades, earthen shoulders and miscellaneous backfills shall be constructed in accordance with the requirements of these Specifications and in conformity with the lines, grades, and cross-sections shown on the drawings or as directed by the Engineer.

305.2 Materials and General Requirements

305.2.1 Physical Requirements

305.2.1.1 The materials used in embankments, subgrades, earthen shoulders and miscellaneous backfills shall be soil, moorum, gravel, reclaimed material from pavement, fly ash, pond ash, a mixture of these or any other material as approved by the Engineer. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment.

The following types of material shall be considered unsuitable for embankment:

- a) Materials from swamps, marshes and bogs;
- b) Peat, log, stump and perishable material; any soil that classifies as OL, OI, OH or Pt in accordance with 18:1498;
- c) Materials susceptible to spontaneous combustion;
- d) Materials in a frozen condition;
- e) Clay having liquid limit exceeding 50 and plasticity index exceeding 25; and
- f) Materials with salts resulting in leaching in the embankment.

305.2.1.2 Expansive clay exhibiting marked swell and shrinkage properties ("free swelling index" exceeding 50 percent when tested as per IS:2720- Part 40) shall not be used as a fill material. Where an expansive clay having "free swelling index" value less than 50 percent is used as a fill material, subgrade and top 500 mm portion of the embankment just below sub-grade shall be non-expansive in nature.

305.2.1.3 Any fill material with a soluble sulphate content exceeding 1.9 grams of sulphate (expressed as SO_3) per litre when tested in accordance with BS:1377, Part 3, but using a 2:1 water-soil ratio shall not be deposited within 500 mm distance (or any other distance described in the Contract), of permanent works constructed out of concrete, cement bound materials or other cementitious material.

Materials with a total sulphate content (expressed SO₃ exceeding 0.5 percent by mass, when tested in accordance with BS:1377, Part 3 shall not be deposited within 500 mm, or other distances described in the Contract, of metallic items forming part of the Permanent Works.

305.2.1.4 The size of the coarse material in the mixture of earth shall ordinarily not exceed 75 mm when placed in the embankment and 50 mm when placed in the sub-grade. However, the Engineer may at his discretion permit the use of material coarser than this also if he is satisfied that the same will not present any difficulty as regards the placement of fill material and its compaction to the requirements of these Specifications. The maximum particle size in such cases, however, shall not be more than two-thirds of the compacted layer thickness.

305.2.1.5 Ordinarily, only the materials satisfying the density requirements given in Table 300-1 shall be employed for the construction of the embankment and the sub-grade.

Table 300-1 : Density Requirements of Embankment and Sub-grade Materials

S. No.	Type of Work	Maximum laboratory dry unit weight when tested as per 15:2720 (Part 8)
1)	Embankments up to 3 m height, not subjected to extensive flooding	Not less than 15.2 kN/cu.m
2)	Embankments exceeding 3 m height or embankments of any height subject to long periods of inundation	Not less than 16 kN/ cu.m
3)	Subgrade and earthen shoulders/verges/backfill	Not less than 17.5 kN/cu.m

- Notes: 1) This Table is not applicable for lightweight fill material, e.g., cinder, fly ash, etc.
 2) The material to be used in subgrade shall be non-expansive and shall satisfy design CBR at the specified dry density and moisture content. In case the available materials fail to meet the requirement of CBR, use of stabilization methods in accordance with Clauses 403 and 404 or by any stabilization method approved by the Engineer shall be followed.

305.2.1.6 The material to be used in subgrade shall conform to the design CBR value at the specified dry density and moisture content of the test specimen. In case the available materials fails to meet the requirement of CBR, use of stabilization methods in accordance with Clauses 403 and 404 or by any stabilization method approved by the Engineer or by the RC Accreditation Committee shall be followed.

305.2.1.7 The material to be used in high embankment construction shall satisfy the specified requirements of strength parameters.

305.2.2 General Requirements

305.2.2.1 The materials for embankment shall be obtained from approved sources with preference given to acceptable materials becoming available from nearby roadway excavation under the same Contract.

The work shall be so planned and executed that the best available materials are saved for the subgrade and the embankment portion just below the subgrade.

305.2.2.2 Borrow Materials

The arrangement for the source of supply of the material for embankment and sub-grade and compliance with the guidelines, and environmental requirements, in respect of excavation and borrow areas as stipulated, from time to time by the Ministry of Environment and Forests, Government of India and the local bodies, as applicable shall be the sole responsibility of the Contractor.

Borrow pits along the road shall be discouraged. If permitted by the Engineer, these shall not be dug continuously. Ridges of not less than 8 m width should be left at intervals not exceeding 300 m. Small drains shall be cut through the ridges to facilitate drainage. The depth of the pits shall be so regulated that their bottom does not cut an imaginary line having slope of 1 vertical to 4 horizontal projected from the edge of the final section of the bank, the maximum depth in any case being limited to 1.5 m. Also, no pit shall be dug within the offset width of a minimum of 10 m.

Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plant is operating at the place of deposition.

Where the excavation reveals a combination of acceptable and unacceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. The acceptable materials shall be stockpiled separately.

The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

305.2.2.3 'Fly-Ash'

Use of fly-ash shall conform to the Ministry of Environment and Forest guidelines. Where fly-ash is used the embankment construction shall conform to the physical and chemical properties and requirements of JRC:SP:38-2001, "Guidelines for Use of Flyash in Road Construction". The term fly-ash shall cover all types of coal ash such as pond ash, bottom ash or mound ash.

Embankment constructed out of fly ash shall be properly designed to ensure stability and protection against erosion in accordance with IRC guidelines. A suitable thick cover may preferably be provided at intervening layers of pond ash for this purpose. A thick soil cover shall bind the edge of the embankment to protect it against erosion. Minimum thickness of such soil cover shall be 500 mm.

305.2.2.4 Compaction Requirements

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme approved by the Engineer. It shall be ensured that the subgrade material when compacted to the density requirements as in Table 300-2 shall yield the specified design CBR value of the subgrade.

Table 3002 : Compaction Requirements for Embankment and Sub-grade

Sr. No.	Type of work/material	Relative compaction as percentage of max. laboratory dry density as per IS:2720 (Part 8)
1)	Subgrade and earthen shoulders	Not less than 97%
2)	Embankment.	Not less than 95%
3)	Expansive Clays	
	a) Subgrade and 500 mm portion just below the subgrade	Not allowed
	b) Remaining portion of embankment	90-95%

The Contractor shall at least 7 working days before commencement compaction submit the following to the Engineer for approval:

- i) The values of maximum dry density and optimum moisture content obtained in accordance with IS:2720 (Part 8), appropriate for each of the fill materials he intends to use.
- ii) A graph of dry density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.

The maximum dry density and optimum moisture content approved by the Engineer shall form the basis for compaction.

305.3 Construction Operations

305.3.1 Setting Out

After the site has been cleared to Clause 201, the work shall be set out to Clause 301.3.1. The limits of embankment/sub-grade shall be marked by fixing batter pegs on both sides at regular intervals as guides before commencing the earthwork. The embankment/sub-grade shall be built sufficiently wider than the design dimension so that surplus material may be trimmed, ensuring that the remaining material is to the desired density and in position specified and conforms to the specified side slopes.

305.3.2 Dewatering

If the foundation of the embankment is in an area with stagnant water, and in the opinion of the Engineer it is feasible to remove it, the same shall be removed by bailing out or pumping, as directed by the Engineer and the area of the embankment foundation shall be kept dry. Care shall be taken to discharge the drained water so as not to cause damage to the works, crops or any other property. Due to any negligence on the part of the Contractor, if any such damage is caused, it shall be the sole responsibility of the Contractor to repair/restore it to original condition or compensate for the damage at his own cost.

If the embankment is to be constructed under water, Clause 305.4.6 shall apply.

305.3.3 Stripping and Storing Topsoil

When so directed by the Engineer, the topsoil from all areas of cutting and from all areas to be covered by embankment foundation shall be stripped to specified depths not exceeding 150 mm and stored in stockpiles of height not exceeding 2 m for covering embankment slopes, cut slopes and other disturbed areas where re-vegetation is desired. Topsoil shall not be unnecessarily subjected to traffic either before stripping or when in a stockpile. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

305.3.4

Compacting Ground Supporting Embankment/Sub-Grade

Where necessary, the original ground shall be levelled to facilitate placement of first layer of embankment, scarified, mixed with water and then compacted by rolling in accordance with Clauses 305.3.5 and 305.3.6 so as to achieve minimum dry density as given in Table 300-2.

In case where the difference between the sub-grade level (top of the sub-grade on which pavement rests) and ground level is less than 0.5 m and the ground does not have 97 percent relative compaction with respect to the dry density (as given in Table 300-2), the ground shall be loosened upto a level 0.5 m below the sub-grade level, watered and compacted in layers in accordance with Clauses 305.3.5 and 305.3.6 to achieve dry density not less than 97 percent relative compaction as given in Table 300-2.

Where so directed by the Engineer, any unsuitable material occurring in the embankment foundation (500 mm portion just below the sub-grade) shall be removed, suitably disposed and replaced by approved materials laid in layers to the required degree of compaction.

Any foundation treatment specified for embankments especially high embankments, resting on suspect foundations as revealed by borehole logs shall be carried out in a manner and to the depth as desired by the Engineer. Where the ground on which an embankment is to be built has any of such material types (a) to (f) in Clause 305.2.1.1 at least 500 mm of such material must be removed and replaced by acceptable fill material before embankment construction commences.

305.3.5

Spreading Material in Layers and Bringing to Appropriate Moisture Content

305.3.5.1

The embankment and sub-grade material shall be spread in layers of uniform thickness in the entire width with a motor grader. The compacted thickness of each layer shall not be more than 250 mm when vibratory roller/vibratory soil compactor is used and not more than 200 mm when 80-100 kN static roller is used. The motor grader blade shall have hydraulic control suitable for initial adjustment and maintain the same so as to achieve the specific slope and grade. Successive layers shall not be placed until the layer under construction has been thoroughly compacted to the specified requirements as in Table 300-2 and got approved by the Engineer. Each compacted layer shall be finished parallel to the final cross-section of the embankment.

305.3.5.2

Moisture content of the material shall be checked at the site of placement prior to commencement of compaction; if found to be out of agreed limits, the same shall be made good. Where water is required to be added in such constructions, water shall be sprinkled from a water tanker fitted with sprinkler capable of applying water uniformly with a controllable rate of flow to variable widths of surface but without any flooding. The water shall be added uniformly and thoroughly mixed in soil by blading, using disc harrow until uniform moisture content is obtained throughout the depth of the layer.

If the material delivered to the roadbed is too wet, it shall be dried, by aeration and exposure to the sun, till the moisture content is acceptable for compaction. Should circumstances arise, where owing to wet weather, the moisture content can not be reduced to the required amount by the above procedure, compaction work shall be suspended.

Moisture content of each layer of soil shall be checked in accordance with IS:2720 (Part 2), and unless otherwise mentioned, shall be so adjusted, making due allowance for evaporation losses, that at the time of compaction it is in the range of 1 percent above to 2 percent below the optimum moisture content determined in accordance with IS:2720 (Part 8) as the case may be. Expansive clays shall, however, be compacted at moisture content corresponding to the specified dry density, but on the wet side of the optimum moisture content obtained from the laboratory compaction curve.

After adding the required amount of water, the soil shall be processed by means of graders, harrows, rotary mixers or as otherwise approved by, the Engineer until the layer is uniformly wet.

Clods or hard lumps of earth shall be broken to have a maximum size of 75mm when being placed in the embankment and a maximum size of 50 mm when being placed in the sub grade.

305.3.5.3 Embankment and other areas of fill shall, unless otherwise required in the Contract or permitted by the Engineer, be constructed evenly over their full width and their fullest possible extent and the Contractor shall control and direct construction plant and other construction vehicles. Damage by construction plant and other vehicular traffic shall be made good by the Contractor with material having the same characteristics and strength of the material before it was damaged.

Embankments and unsupported fills shall not be constructed with steeper side slopes or to greater widths than those shown in the drawings, except to permit adequate compaction at the edges before trimming back, or to obtain the final profile following any settlement of the fill and the underlying material,

Whenever fill is to be deposited against the face of a natural slope, or sloping earthworks face including embankments, cuttings, other fills and excavations steeper than 1 vertical to 4 horizontal, such faces shall be benched as per Clause 305.4.1 immediately before placing the subsequent fill.

All permanent faces of side slopes of embankments and other areas of fill shall, subsequent to any trimming operations, be reworked and sealed to the satisfaction of the Engineer by tracking a tracked vehicle, considered suitable by the Engineer, on the slope or any other method approved by the Engineer.

305.3.6 **Compaction**

Only the compaction equipment approved by the Engineer shall be employed to compact the different material types encountered during construction. Static three-wheeled roller, self propelled single drum vibratory roller, tandem vibratory roller, pneumatic tyre roller, pad foot roller, etc., of suitable size and capacity as approved by the Engineer shall be used for the different. Types and grades of materials required to be compacted either individually or in suitable combinations.

The compaction shall be done with the help of self-propelled single drum vibratory roller or pad foot vibratory roller of 80 to 100 kN static weight or heavy pneumatic tyre roller of adequate capacity capable of achieving the required compaction. The Contractor shall demonstrate the efficacy of the equipment he intends to use by carrying out compaction trials. The procedure to be adopted for the site trials shall be submitted to the Engineer for approval.

Earthmoving plant shall not be accepted as compaction equipment nor shall the use of a lighter category of plant to provide any preliminary compaction to assist the use of heavier plant be taken into account.

Each layer of the material shall be thoroughly compacted to the densities specified in Table 300-2. Subsequent layers shall be placed only after the finished layer has been tested according to Clause 903.2.2 and accepted by the Engineer. The Engineer may permit measurement of field dry density by a nuclear moisture/density gauge used in accordance with agreed procedure and provided the gauge is calibrated to give results identical to that obtained from tests in accordance with IS:2720 (Part 28). A record of the same shall be maintained by the Contractor.

When density measurements reveal any soft areas in the embankment/sub-grade/earthen shoulders, further compaction shall be carried out as directed by the Engineer. If inspite of that the specified compaction is not achieved, the material in the soft areas shall be removed and replaced by approved material, compacted using appropriate mechanical means such as light weight vibratory roller, double drum walk behind roller, vibratory plate compactor, trench compactor or vibratory tamper to the density requirements and satisfaction of the Engineer.

305.3.7. Drainage

The surface of the embankment/sub-grade at all times during construction shall be maintained at such a crossfall (not flatter than that required for effective drainage of an earthen surface) as will shed water and prevent ponding.

305.3.8 Repairing of Damages Caused by Rain/Spillage of Water

The soil in the affected portion shall be removed in such areas as directed by the Engineer before next layer is laid and refilled in layers and compacted using appropriate mechanical means such as small vibratory roller, plate compactor or power rammer to achieve the required density in accordance with Clause 305.3.6. If the cut is not sufficiently wide for use of required mechanical means for compaction the same shall be widened suitably to permit their use for proper compaction. Tests shall be carried out as directed by the Engineer to ascertain the density requirements of the repaired area. The work of repairing the damages including widening of the cut, if any, shall be carried out by the Contractor at his own cost, including the arranging of machinery/equipment for the purpose.

305.3.9 Finishing Operations

Finishing operations shall include the work of shaping and dressing the shoulders/verge/roadbed and side slopes to conform to the alignment, levels, cross-sections and dimensions shown on the drawings or as directed by the Engineer subject to the surface tolerance described in Clause 902. Both the upper and lower ends of the side slopes shall be rounded off to improve appearance and to merge the embankment with the adjacent terrain.

The topsoil, removed and conserved earlier (Clauses 301.3.2 and 305.3.3) shall be spread over the fill slopes as per directions of the Engineer to facilitate the growth of vegetation. Slopes shall be roughened and moistened slightly prior to the application of the topsoil in order to provide satisfactory bond. The depth of the topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 150 mm.

Where directed, the slopes shall be turfed with sods in accordance with Clause 307. If seeding and mulching of slopes is prescribed, this shall be done to the requirements of Clause 308.

When earthwork operations have been substantially completed, the road area shall be cleared of all debris, and ugly scars in the construction area responsible for objectionable appearance eliminated.

305.4 Construction of Embankment and Sub-grade under Special Conditions

305.4.1 Earthwork for Widening Existing Road Embankment

When an existing embankment and/or sub-grade is to be widened and its slopes are steeper than 1 vertical on 4 horizontal, continuous horizontal benches, each at least 300 mm wide, shall be cut into the old slope for ensuring adequate bond with the fresh

embankment/sub-grade material to be added. The material obtained from cutting of benches could be utilized in the widening of the embankment subgrade. However, when the existing slope against which the fresh material is to be placed is flatter than 1 vertical on 4 horizontals, the slope surface may only be ploughed or scarified instead of resorting to benching .

Where the width of the widened portions is insufficient to permit the use of conventional rollers, compaction shall be carried out with the help of light weight vibratory roller, double drum walk behind roller, vibratory plate compactor or vibratory tamper or any other appropriate equipment approved by the Engineer. End dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other types of hauling equipment.

305.4.2 Earthwork for Embankment and Sub-Grade to be placed against Sloping Ground

Where an embankment subgrade is to be placed against sloping ground, the latter shall be appropriately benched or ploughed/scarified as required in Clause 305.4.1 before placing the embankment/sub-grade material. Extra earthwork involved in benching or due to ploughing / scarifying etc. shall be considered incidental to the work.

For wet conditions, benches with slightly inward fall and subsoil drains at the lowest point shall be provided as per the drawings, before the fill is placed against sloping ground.

Where the Contract requires construction of transverse subsurface drain at the cut-fill interface, work on the same shall be carried out to CJ use 309 in proper sequence with the embankment and sub-grade work as approved by the Engineer.

305.4.3 Earthwork over Existing Road Surface

Where the embankment is to be placed over an existing road surface, the work shall be carried out as indicated below:

- i) If the existing road surface is of granular type and lies within 1 m of the new formation levels, it shall be scarified to a depth of 50 mm or as directed so as to provide ample bond between the old and new material ensuring that at least 500 mm portion below the top of new sub-grade level is compacted to the desired density;
- ii) If the existing road surface is of bituminous type, or cement concrete and lies within 1 m of the new formation level, the bituminous or cement concrete layer shall be removed completely;
- ii) If the level difference between the existing road surface and the new formation level is more than 1 m, the existing surface shall be roughened after ensuring that the minimum thickness of 500 mm of subgrade is available.

305.4.4 Embankment and Sub-Grade Around Structures

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

Unless directed otherwise, the filling around culverts, bridges and other structures upto a distance of twice the height of the road from the back of the abutment shall be carried out

Independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing wall, unless permission has been given by the Engineer but in any case, not until the concrete or masonry has been in position for 14 days. The embankment and sub-grade shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of work in this regard shall be got approved from the Engineer.

The material used for backfill shall not be an organic soil or highly plastic clay having plasticity index and liquid limit more than 20 and 40 respectively when tested according to 18:2720 (Part 5). Filling behind abutments and wing walls for all structures shall conform to the general guidelines given in IRC:78. The fill material shall be deposited in horizontal layers in loose thickness and compacted thoroughly to the requirements of Table 300-2.

Where the provision of any filter medium is specified behind the abutment, the same shall be laid in layers simultaneously with the laying of fill material. The material used for filter shall conform to the requirements for filter medium spelt out in Clause 2504 unless otherwise specified in the Contract.

Where it may be impracticable to use conventional rollers, the compaction shall be carried out by appropriate mechanical means such as small vibratory roller, plate compactor or power rammer. Care shall be taken to see that the compaction equipment does not hit or come too close to any structural member so as to cause any damage to them or excessive pressure against the structure.

305.4.5 Construction of Embankment over Ground Incapable of Supporting Construction Equipment

Where embankment is to be constructed across ground which will not support the weight of repeated heavy loads of construction equipment, the first layer of the fill may be constructed by placing successive loads of material in a uniformly distributed layer of a minimum thickness required to support the construction equipment as permitted by the Engineer. The Contractor, if so desired by him, may also use suitable geosynthetic material to increase the bearing capacity of the foundation. This exception to normal procedure will not be permitted where, in the opinion of the Engineer, the embankments could be constructed in the approved manner over such ground by the use of lighter or modified equipment after proper ditching and drainage have been provided. Where this exception is permitted, the selection of the material and the construction procedure to obtain an acceptable layer shall be the responsibility of the Contractor. The cost of providing suitable traffic conditions for construction equipment over any area of the Contract will be the responsibility of the Contractor and no extra payment will be made to him. The remainder of the embankment shall be constructed as specified in Clause 305.3.

305.4.6 Embankment Construction under Water and Waterlogged Areas

305.4.6.1 Embankment Construction under Water

Where filling or backfilling is to be placed under water, only acceptable granular material or rock shall be used unless otherwise approved by the Engineer. Acceptable granular material shall be of GW, SW, GP, SP as per 18:1498 and consist of graded, hard durable particles with maximum particle size not exceeding 75 mm. The material should be non-plastic having uniformity coefficient of not less than 10. The material placed in open water shall be deposited by end tipping without compaction.

305.4.6.2 Embankment Construction in Waterlogged and Marshy Areas

The work shall be done as per IRC:34.

305.4.7 Earthwork for High Embankment

The material for high embankment construction shall conform to Clause 305.2.1.7. In the case of high embankments (more than 6 m), the Contractor shall normally use fly ash in conformity with Clause 305.2.1.1 or the material from the approved borrow area.

Where provided, stage construction of embankment and controlled rates of filling shall be carried out in accordance with the Contract including installation of instruments and its monitoring.

Where required, the Contractor shall surcharge embankments or other areas of fill with approved material for the periods specified in the Contract. If settlement of surcharged fill results the Contractor shall bring the resultant level up to formation level with acceptable material for use in fill.

305.4.8 Settlement Period

Where settlement period is specified in the Contract, the embankment shall remain in place for the required settlement period before excavating for abutment, wing wall, retaining wall, footings, etc., or driving foundation piles. The duration of the required settlement period at each location shall be as provided for in the Contract or as directed by the Engineer.

305.5 Plying of Traffic

Construction and other vehicular traffic shall not use the prepared surface of the embankment and/or sub-grade without the prior permission of the Engineer. Any damage arising out of such use shall, however, be made good by the Contractor at his own cost as directed by the Engineer.

305.6 Surface Finish and Quality Control of Work

The surface finish of construction of sub-grade shall conform to the requirements of Clause 902. Control on the quality of materials and works shall be exercised in accordance with Clause 903.

305.7 Sub-grade Strength

305.7.1 It shall be ensured prior to actual execution that the material to be used in the sub-grade satisfies the requirements of design CBR.

305.7.2 Sub-grade shall be compacted and finished to the design strength consistent with other physical requirements. The actual laboratory CBR values of constructed sub-grade shall be determined on remoulded samples, compacted to the field density at the field moisture content and tested for soaked/unsoaked condition as specified in the Contract.

305.8 Measurements for Payment

305.8.1 Earth embankment/sub-grade construction shall be measured separately by taking cross sections at intervals given in Sub-Section 113.3 after completion of clearing and grubbing and after completion of embankment/sub-grade. The volume of earthwork shall be computed in cubic metres by the method of average end areas.

305.8.2 The measurement of fill material from borrow areas shall be the difference between the net quantities of compacted fill and the net quantities of suitable material brought from roadway and drainage excavation. For this purpose, it shall be assumed that one cum of