



GUJARAT MINERAL DEVELOPMENT CORPORATION LTD

(A Govt. of Gujarat Enterprise)

T-No-3/ULP/CULVERT WORK & ALLIED PROTECTION WORK /2024

Work of Construction of RCC Culvert and allied protection work in
diverted Nallah
at
GMDC lignite project Umarsar ,
Tal: Lakhpat, Dist: Kutchh.

TECHNICAL BID-IV

ITEM WISE SPECIFICATIONS

GUJARAT MINERAL DEVELOPMENT CORPORATION LTD

(A Govt. of Gujarat Enterprise)

**Khanij Bhavan, near University Ground, 132 feet Ring Vastrapur,
Ahmedabad-380 052**

Phone: (079) 27913200, 27913501 Fax No: (079) 27911540

Email: civil@gmdcltd.com Website: www.gmdcltd.com

ITEM NO.1:

Excavation in all sort of strata and formations incl. depositing the un useful excavated stuff as and where directed incl sorting and stacking useful materials as directed upto 1000 mt lead & lift etc. complete incl. dewatering. (Depth 0 TO 3.0 mt) (For all type canal & foundation trenches of C.D. works) IN OVERBURDEN INCL HARD MURRUM

1.0. General

1.1. Any soil which generally yields to the application of pickaxes and shovels, phawar as rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf loam., clay, peat EIC., fall under this category,

2.0. Clearing the site

2.1. The site on which the structure is to be built shall be cleared, and all obstructions loose stone, materials and rubbish of all kind bush wood and trees shall be removing as directed The materials so obtained shall be property of the Government and shall be conveyed und stacked as directed within 50 m lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt

2.2. The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

3.0. Setting out

After clearing the site the centre lines will be given, by the Engineer-in-charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all 'parts of the work. Contractor shall supply labours materials, EIC. Required for setting out the reference marks and bench 'marks and shall maintain them as long as required and directed.

4.0. Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately it not specified. The bottom of the excavated area shall be leveled both longitudinally and transversely as directed by removing and watering as required No. earth filling will be allowed for bringing it to level if by mistake or any excavation is made deeper or wider than, that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m depth shall be measured under this item.

5.0. Disposal of the excavated stuff

5.1. The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering EIC.

5.2. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 1000 M. and all lift.

6.0. Mode of measurements & payment

6.1. The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-m-charge. No payment shall be made for surplus excavation made in excess of above requirements or due

to stopping and sloping back as found necessary on account of conditions of soil and requirements of safety.

6.2. The rate shall be for a unit of one cubic meter.

ITEM NO.2:

Back filling with appropriate excavated material behind the structures or refilling the trenches with excavated useful material including watering ramming, consolidation, dressing of canal bed, canal side slope with required tools & tackles etc complete with all lead and lift.

1.0 Workmanship

1.1. The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken

1.2. As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, brick bats, mortar dropping EIC., and tilled with earth in layers not exceeding 20 cross Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars, where rammer cannot be used

1.3. The plinth shall be similarly tilled with earth in layers not exceeding 20 cms adequately watered and consolidated by ramming with iron or wooden rammers when filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

1.4. The finished level of filling shall be kept to shape intended to be given to floor.

1.5. In case off large heavy duty flooring like factory flooring the consolidation may be done by power rollers, where so specified the extent of consolidation required shall also be as specified.

1.6. The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

2.0. Mode of Measurements & Payment

2.1. The payment shall be made for filling in plinth and trenches. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

2.2. The rate shall be for a unit of one cubic meter.

ITEM NO.3:

Prov. & Laying in position Controlled cement concrete using cement, sand and crushed aggregate by mass and machine mix for C.C work in canal lining incl. necessary formworks centering scaffolding compaction by plate vibrator, curing as directed with all lead & lift etc. complete incl dressing the bed and trimming the canal section if required and minor filling with murrum / earth as per site condition to the correct profile, incl providing bitumen joints as per drawing and specified interval. (With using paver machineries.) a. For 10cms thick cast-in-citu canal lining in M-15 grade of conc. with MSA-20mm incl providing pair of horizontal and transverse sleepers of size 150x75mm and 3.0 mt c/c in c.c. M-10 grade concrete.

1.0. Materials

- 1.1. Water shall conform to M-I Cement shall conform to M-3. Sand shall conform to M-6.
6. Stones aggregate 40 mm nominal size shall conform to M-12.

2.0. Workmanship

2.1. General

2.1.1. Before casting concrete the bed of foundation trenches shall be cleared of all loose materials. Levelled, watered and rammed as directed.

2.2. Proportion of Mix:

2.2.1. The proportion of cement, sand and coarse aggregate shall be one part of cement, 3 parts of sand and 6 parts of stone aggregates and shall be measured by volume.

2.3. Mixing :

2.3.1. The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by the Engineer-in-charge. When hand mixing is permitted by the Engineer-in-charge in case of break-down of machines and in the interest of the work, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However, in such case 10% more cement than otherwise provided 1. 1/2 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose.

2.4. Transporting & Placing the Concrete:

2.4.1. The concrete shall be handed from the place of mixing to the normal position in not more than 15 minutes by the method as directed and shall be placed into its final position, compacted and finished within 30 minutes of mixing with water i.e. before the setting commences.

2.4.2. The concrete shall be laid in layers of 15 cms. to 20 cms

2.5 Ramming

2.5.1. The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and to allow all the interstices to be filled with mortar.

2.6. Curing:

2.6.1. After the final set, the concrete shall be kept continuously wet if required by ponding for a period of not less than 7 days from the date of placement.

2.7. Mode of Measurement & Payment:

2.7.1. The concrete shall be measured for its length, breadth and depth, limiting dimensions to those specified on plan or as directed.

2.7.2. The rate shall be for a unit of one Square metre.

ITEM NO.4:

Providing and casting cement concrete M-150 and curing complete including cost of formwork, manpower, machineries, tools, tackels, Labours etc. complete.- For Foundation, Plinth and at Ground Level

1.0. Materials

- 1.1. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8. Coarse aggregate shall conform M-12.
- 1.2. The shuttering to be provided shall be of ordinary timber plank and shall conform to M-26.
- 1.3. The dimensions of scantlings and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

2.0. General

- 2.1. The concrete mix shall be designed from preliminary tests.
- 2.2. The proportioning of cement and aggregates shall be done by weight and necessary precautions shall be taken in the production to ensure that the required work cube strength

is attained and maintained. The controlled concrete shall be in grades of M-100, M-150, M-200, M-250, M-300, and M-350 & M-400 with prefix controlled added to it. The letter M refers to mix and the numbers specify 28 days works cube compressive strength of 150 mm. cubes of the mix expressed in Kg. /cm.

- 2.3.** The proportion of cement, sand and coarse aggregate shall be determined of weight. The weight batch machine shall be used for maintaining proper control over the proportion of aggregates as per mix design. The strength requirements of different grades of concrete shall be as per table provided above:

In all cases, the 28 days compressive strength specified in above the criteria for acceptance or rejection of the concrete. Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for purpose as concrete belonging to the lower of the grades between which its strength lies.

3.0. Workmanship

- 3.1.** The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work question and can be property compacted with means available except where it can be shown to the satisfaction of the Engineer-in-charge, that supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate shall be controlled by obtaining the coarse aggregates in different sizes and bending them in the right proportions as required. Aggregates of different sizes shall be stocked in separate stock piles. The required quantity of material shall be stock piled several hours, preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests.
- 3.2.** In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag, a reasonable number of bags shall be weighted separately to check the net weight. Where cement is weighted form bulk stocks at site and not by bags, it shall be weighed separately from the aggregate. Water, shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in clean and serviceable condition. Their accuracy shall be periodically checked.
- 3.3.** It is most important to keep the specified water cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates I.S. 2386 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content. Minimum quantity of cement to be used in controlled concrete shall not be less than 220 kg./m³ in plain concrete and not less than 250 kg/m³ in reinforced concrete.
- 3.4** The form work shall conform to the shape lines and dimensions as shown on the plans and be constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor toe safe-guard against

any settlement of the form-work during the course of concreting and after concreting. The form work of shuttering, centring, scaffolding, bracing EIC shall be as per design.

4.0. Clearing and Treatment of forms:

4.1. All rubbish, particularly chipping shaving and saw dust shall be removed from the interior of the form before the concrete work is placed and the-form in contact with concrete shall be cleaned and thoroughly wetted or treated. The surface shall be then coated with soap solution applied before concreting is done. Soap solution for the purpose shaft prepared by dissolving yellow soap in water to get consistency of paint. Alternatively a coat of raw linseed oil shall be applied after thoroughly cleaning the surface. Care shall be taken that the coating does not get on construction joint surface and reinforced bars.

5.0 Stripping time:

5.1. In normal circumstances and where ordinary cement is used forms may be struck after expire of following periods.

- (a) Sides of walls columns and vertical faces of beams.....24 to 48 hours.
- (b) Beam soffits, (props, left under).....7 days.
- (c) Removal of props slabs:
 - (i) Slabs spanning up to 4.5. m.....7 days.
 - (ii) Spanning over 4.5 mm.....14 days.
- (d) Removal of props t beams and Arches:
 - (i) Spanning up to 6 mm.....14 days.
 - (ii) Spanning over 6 m.....21 days.

6.0 Procedure when removing the form work:

6.1. All form work shall be removed without such shock or vibrations as would damage the reinforced concrete surface. Before the soffits form work and struts are removed, the soffits and the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened.

7.0 Centring:

7.1. The centring to be provided shall be got approved. It shall be sufficiently strong to ensure absolute safety of the form work and concrete work before, during and after pouring concrete. Watch should be kept to see that behaviour or centring and form work is satisfactory during concreting. Erection should also that it would allow removal of forms in proper sequence without damaging either the concrete or the forms to be removed.

7.2. The props of centring shall be provided on firm foundation or base of sufficient strength to carry the loads without any settlement.

7.3. The centring and form work shall, be inspected and approved by the Engineer-in-charge before concreting. But this will not relieve the contractor of his responsibility for strength, adequacy and safety of form work and centring. If there is a failure of form work or centring, contractor shall be responsible for the damages to property.

8.0 Scaffolding:

8.1. All scaffolding, hoisting arrangements and ladders EIC. required for the facilitating of conceding shall be provided and removed on completion of work by contractor at his own expense. The scaffolding, hoisting arrangements and ladders EIC shall be strong enough

to with sand all live, dead and impact loads expected to act and shall be subject to the approval of the Engineer-in-charge. However contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workman EIC.

- 8.2. The scaffolding, hoisting arrangements and ladder shall allow easy approach to the work spot and afford easy inspection.
- 8.3. The rate is applicable to all condition of working and height up to 4 mts. The rate shall include the cost of materials and labour for various operations involved such as:
- (a) Splayed edges, notching, allowance for overlaps and passing at angles, battens centring, shuttering propping, bolting, wedging easing, striking and removal.
 - (b) Filleting to form stop chamfered edges or splayed external angles not exceeding 20 mm: width to beams, columns and the like.
 - (c) Temporary openings in the forms for pouring concrete, if required removing rubbish EIC.
 - (d) Dressing with oil to prevent adhesion of concrete with shuttering and.
 - (e) Raking or circular cutting.
- 9.0 **Re-Use:**
- 9.1. Before re-use, all form shall be inspected by Engineer-in-charge and their suitability ascertained. The forms shall be scarred, cleaned and joints are gone over, repaired where required. Inside surface shall be retreated to prevent adhesion of concrete.
- 10.0. **Mode of measurement & payment**
- 10.1. The consolidated cubical contents of concrete work as specified in item shall be measured. No deduction shall be made for
- (a) Ends of dissimilar materials such as joints, beams, posts, girders, falters, purling trusses, corbels and steps EIC. up to 500 Sq. Cm. in section.
- 10.2. Form work shall be measured as the area in square meters to shuttering in contract with concrete except in the case of inclined member and portion of curved profile and upper side in which case on area of underside shall be measured for payment.
- 10.3. Form work to secondary beams shall be measured up to the sides of main beams but no deduction shall be made form the form work of the main beam at the inter section point. No deduction shall be made form the form work of a column at inter section of beams.
- 10.4. The rate includes cost of all materials labour, tools and plant required for mixing, placing in position, vibrating and compacting, finishing, as directed, curing and all other incidental expenses for producing concrete of specified strength. The rate **includes** the cost of form work.
- 10.5. The rate shall be for a unit of **one cubic meter**.

ITEM NO.5:

Prov. and Laying in position Controlled cement concrete using cement, sand and crushed aggregate by mass and machine mix for R.C.C/CC work including necessary formworks centering scaffolding compaction by mechanical vibrator, curing as directed with all lead & lift etc complete Excluding the cost of reinforcement FOR SKIN CONC., FRICTION BLOCKS, ST. BASIN C. Concrete grade M-25 and MSA-20mm.

Same as per Item No. 5.

ITEM NO.6

Prov. and Laying in position Controlled cement concrete using cement, sand and crushed aggregate by mass and machine mix for R.C.C/CC work including necessary formworks centering scaffolding compaction by mechanical vibrator, curing as directed with all lead & lift etc complete Excluding the cost of reinforcement. Concrete grade M-25 and MSA-20mm

Same as per Item No. 5.

ITEM NO.7

Providing and laying controlled cement concrete M.350 and curing complete including the cost of machineries, tools, tackles, manpower, labour, formwork for reinforced concrete, curing, etc. complete. work in (A)Foundations, footings, Base of columns, Slabs and Mass Concrete. (Cement Level 500 Kg/M³.)

Same as per Item No. 5.

ITEM NO.8

Supplying, fabricating and placing/fixing in position TMT reinforcement bars FE-500/500 D (Ductile) of TATA or equivalent (Min.elongation14.5%as per relevant latest IS standards for manufacturing of reinforcement) confirming to IS1786 reinforcement for RCC structures/ items as per design including transporting steel to the work site, handling, de-coiling, cutting-bending cranking by machines, fabricating to required shape, placing in position and tying/binding the system with MS18 gauge wires, welding if necessary, keeping it in position during concreting by means of stays, blocks, ties, spacers, chairs, hangars, etc. for all floors / all levels / all heights complete as per drawings, specifications and direction of Engineer in Charge. Measurement will be paid on the length basis and converted into weight by using standard co-efficient (rolling margin's and wastage shall not be paid). The quoted rate should be inclusive of the cost of Binding wire, and the same will not be measured and paid separately. For all civil, plumbing, electrical & infrastructure works.

The work includes providing & laying in position HYSD / Mild steel / Thermo Mechanically Treated bar of the following grade. Grade Designation Bar type confirming to governing IS specification Characteristic strength by MPa Elastic Modulus GPa S 415 IS 1786 High yield strength deformed bar 415 200 S 240 IS 432 Part-II 240

TMT BAR 415/FE-500/500 D TMT bar shall conform to min 415 /500 MPa yield strength. Tensile strength of in 500 MPa and elongation percentage min 22. The chemical composition of bars shall be as below.

% Max	
Carbon	0.25
Sulphur	0.05
Phosphorus	0.05
Sulphur & Phosphorus	0.01

All steel shall be procured form original procedures no rolled steel shall be incorporated in the work. Only new steel bars shall deliver to the site. Every bar discarded cracked ends of bars shall be discarded.

1. The work shall consist of furnishing and placing reinforcement the shape and dimensions shown on the drawings or as directed by the engineer-in-charge.

2. Steel shall be clean and free from loose and loose mill scale at the having position and subsequent concreting.
3. Reinforcing steel conform accurately to the dimensions given in the bar bending schedules shown on relevant drawings. Bars shall be bent cold to the specification shape and dimensions or as directed by the Engineer-in-Charge using a proper bar bender, operated by hand power to attain proper radius of bends. Bars shall be bending or straightened in such a manner that will not injure the material. Bars bent during transport or handling shall be straightened before being used on work they shall be not heated to facilitate bending. Unless otherwise specified a "U" type hook at the end of each bar shall be invariably provided. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the beyond the ends of the curve shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars ten diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any splitting of the concrete.
4. All reinforcement bars shall be accurately placed in exact position shown on the drawings, and shall be security held in position during placing of concrete by annealed binding wire not less than 1 mm in size and confirming to IS: 280 by using stay block or metal chairs, spacers, metal hangers supporting wires or other approved device at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation of the work. All devices used for positioning shall be on non-corrodible material wooden and metal support will not extent to the surface or concrete, except where shown on the drawings. Placing bars on layers of freshly laid concrete as the work progress for adjusting for spacing will not be allowed pieces of brocket stone or brick and wooden block shall not be used layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices, reinforcement after being placed in position shall be maintained in a clean condition unit completely embedding concrete special care shall be exercised to prevent any displacement of reinforcement from corrosion concrete cover shall be provided as indicated on the drawing. All bars producing from concrete and to which other bars to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.
5. Bars crossing each other, where required shall be secured by bidding wire (annealed) of size not less than 1 mm and confirming to IS 28 in such a manner that they do not slip over each other at the time of fixing and concreting.
6. As far as possible bars of full length shall be used. In case this is not possible overlapping bars shall be done as directed by the Engineer-in-Charge. When practicable overlapping bars shall not touch each other but be kept apart of 25mm or 1.25 times the maximum size of the coarse aggregate whichever is greater by concrete between them, where not feasible overlapping bars shall be bound with annealed steel wire, and not less than 1 mm thickness twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither sphere nor bending moment is maximum.
7. Whenever indicated on the drawings or desired by the Engineer-in-charge. Bar transmit the full stresses of bars. The ends of the bars that are joined by coupling shall be upset for a sufficient length so that the effective cross section at the base of treads is not less than the normal cross section of the bar. Threads shall be standard white worth threads still for coupling shall conform to IS 226.
8. When permitted or specified on the drawing joints reinforcement bars shall be but welded so as to transmit their full stresses. Welded joints shall preferably be located at points where steel not be subjected to more than at any one section and not more than 20 percent of the folds are welded. Only electric arc welding using a process which excludes air from the molten metal and confirms to any of all other special provision for the work will be accepted. Enable means slab be provided for holding the bars supply as position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be

cleaned properly ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding shall conform to IS 814 welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed by the Engineer-in-charge.

9. Reinforcement shall be measured in length including overlaps separately for different diameters as actually used in the work , where welding or coupling is restored to in place of lap-joints such joints shall be measured for payment as the equivalent length of overlap as per design requirement .From the length so measured the weight of reinforcement shall be calculated in tons on the same basis of I.S. 1732 Length shall include hooks at ends wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.
10. Rate for reinforcement shall include of all steel, the carting to work site cutting, bending, placing binding and fixing in position as shown on the drawing Sqm. And as directed by the Engineer-in-charge. It shall also include cost of all devices for keeping reinforcement in approved position cost of joints as per approved methods and all wastage and spacer bars.
11. The rate shall be paid for complete item on "Kg." Basis.

ITEM NO.09

Providing and filling rubbles including hand packing and filling interstices with quarry spalls behind abutments and between returns as directed.

1. The work shall consist of laying boulders directly on the prepared surface for protection against scour.
2. The stones used in apron shall be sound, hard, and durable & fairly regularly in shape, Stone subject to marked deterioration by water or weather shall not be used. The thickness and shape of apron shall be as indicated on the drawings or as directed by the Engineer-in-charge. The surface on which the apron is to be laid shall be leveled and prepared for the length and width as shown on the drawings. The size of stone shall be as large as possible & weight shall be as specified in the item but in no case any fragment shall weight less than 40kg. The specific gravity of stone shall be as high as possible and it shall not be less than 250. To ensure regular and orderly disposition of the full intended quantity of stone in the apron, template cross walls in dry masonry shall be built about a meter wide and to the full light of the specified thickness of the apron at intervals of 30 meters and all along the length and width of the apron. Within these walls, the stone then shall be hand-packed.
3. This work shall consist of constructing rubble apron flooring laid over a cement concrete (M-15) bedding. Cement concrete nominal mix (Grade M-15) of 300mm thickness shall then be laid in accordance with provisions given in section 1700 except that the surface of the concrete shall not be given a smooth finish.
4. Payment shall be made on CMT basis of chata, the materials shall have to be stacked at site before laying. Preparation of base for laying bedding shall be deemed incidental to the work nothing shall deducted for voids.
5. The rate shall include cost of materials, labour & tools to complete the job.

ITEM NO.10:

Providing & laying rubble pitching (each stone weighting not less than 40 Kg.) laid in cement mortar 1:4 proportion with the surface pointed with cement mortar with 1:3 proportion for following thickness including machineries, tools, tackles, manpower, labour, curing etc. complete for all lead & lifts.(a) 40 cm Thickness.

Pitching:

The pitching shall be provided as indication in the drawings. The thickness and shape of the stone pitching shall be shown on the drawing.

The stone shall be sound, hard, and durable and fairly regular in shape. Quarry stone should be used. Round boulder shall not be allowed. The stones subject to marked deterioration by water or weather shall not be accepted.

The size and weight of the stone shall conform to clause 5.3.5.1.of IRC: 89. No. stone, weighing less than 40 kg shall, however, be used. The size of spalls shall be a minimum of 25 mm and shall be suitable to fill the void in the pitching.

here the required size stones are not economical available, cement concrete blocks in M15 grade conforming to section 1700 or stones in wire crates may be used in place of isolated stones of equivalent weight. Cement concrete blocks will be preferred wherever practicable. Use of geosynthetics has been dealt with in section 700.

ITEM NO.11:

Pointing on coursed stone masonry with cement mortar 1:3 (1- cement: 3- coarse sand) including machineries, tools, tackles, manpower, labour, curing etc. complete for all lead & lifts (A) Flush pointing.

Pointing:

The pitching shall be provided as indication in the drawings. The thickness and shape of the stone pitching shall be shown on the drawing.

The stone shall be sound, hard, and durable and fairly regular in shape. Quarry stone should be used. Round boulder shall not be allowed. The stones subject to marked deterioration by water or weather shall not be accepted.

The size and weight of the stone shall conform to clause 5.3.5.1.of IRC: 89. No. stone, weighing less than 40 kg shall, however, be used. The size of spalls shall be a minimum of 25 mm and shall be suitable to fill the void in the pitching.

here the required size stones are not economical available, cement concrete blocks in M15 grade conforming to section 1700 or stones in wire crates may be used in place of isolated stones of equivalent weight. Cement concrete blocks will be preferred wherever practicable. Use of geosynthetics has been dealt with in section 700.

ITEM NO.12:

Providing & Fixing P.V.C 100mm diameter for weep hole having width as per wall thickness including necessary iron gratings as per drawings including machineries, tools, tackles, manpower, labour, curing etc. complete for all lead & lifts.

General:

The weep holes in the masonry / mass cement concrete of abutment and returns shall be provided of the PVC 100 mm diameter pipe. The pipe shall be fixed of suitable length and in full thickness of the masonry/concrete work. As necessary i.e. grating shall be provided on back side of abutment and returns on the inlet of opening of weep holes.

Materials:

- 1) The PVC pipes of 100 mm diameter specified in the description of this item shall confirm to I.S:626-1900. The interior of pipe shall have a smooth finish, regular surface and regular internal diameters.
- 2) The tolerance in all dim. Shall be as per I.S. 1926 – Part – I 1980.
- 3) The grating shall be C.I. 100 mm diameter and as per I.R.C. Specification.
- 4) Workmanship:

The weep holes shall be provided at 1 MT. C/C and shall be placed in staggered. After laying weep holes, it shall be clear of earth and other materials from its complete length.

Payments:

The rate for payment of this item shall be on 1-No. basis of complete item.

ITEM NO.13:

Providing and laying filter media 600 mm thick as directed at the back of abutment return and wing wall as per detailed specification including machineries, tools, tackles, manpower, labour, curing etc. complete for all lead & lifts.

Filter Media

1. The material for the filter shall consist of sand, gravel, stone or coarse sand. To prevent escape of the embankment material through the voids of the stone pitching / cement concrete blocks as well as to allow free movement of the water without creating any uplift head on the pitching , one or more layers of graded materials, commonly known as a filter media, shall be provided underneath the pitching.

The gradation of the filter material shall satisfy the following requirements:

2. Provision of a suitable designed filter is necessary under the slope pitching to prevent the escape of underlying embankment material through the void of stone pitching /cement concrete blocks when subjected to the attack of flowing water and wave action, etc. In order to achieve this requirement, the filter may be provided in one or more layers satisfying the following criteria:

$$\frac{D_{15}(\text{Filter})}{D_{85}(\text{Base})} < 5$$

$$4 < \frac{D_{15}(\text{Filter})}{D_{15}(\text{Base})} < 20$$

$$\frac{D_{50}(\text{Filter})}{D_{50}(\text{Base})} < 25$$

Notes:

- i) Filter design may not be required if embankment consist of CH or Ch soils with liquid limit greater than 30, resistant to surface erosion. In this case, if a layer of material is used as bedding for pitching, it shall be well graded and its D85 size shall be at least twice the maximum void size in pitching

- ii) In the foregoing. D 15 means the size of that sieve which allows 15 per cent by weight of the filter material to pass through it and similar is the meaning of D 50 and D 85
- iii) If more than one filter layer is required, the same requirement as above shall be followed for each layer. The finer filter shall be considered as base material for selection of coarser filter.
- iv) The filter shall be compacted to a firm condition. The thickness of filter is generally of the order of 300mm. where filter is provided in two layers, thickness of each layer shall be 150mm.

Construction operation

Before laying the pitching, the sides of banks shall be trimmed to the required slope and profiles put by means of line and pegs at intervals of 3 meter to ensure regular straight work and a uniform slope throughout. Depressions shall be filled and thoroughly compacted,

The filter granular material shall be laid over the prepared base and suitably compacted to the thickness specified on the drawings.

The lowest course of pitching shall be started from the toe wall and built up in courses upwards. The toe wall shall be in dry rubble masonry (uncoursed) conforming to Clause 1405.3 in case of dry rubble pitching and shall be in nominal mix cement concrete (M15) conforming to clause 1704.3 in case of cement concrete blocks pitching.

The stone pitching shall commence in a trench below the toe of the slope. Stone shall be placed by derrick or by hand to the required length, thickness and depth conforming to the drawings. Stones shall be set normal to the slope, and placed so that the largest dimension is perpendicular to the face of the slope, unless such dimension is greater than the specified thickness of pitching.

1. The largest stones shall be placed in the bottom course and for use as headers for subsequent courses.
2. In hand placed pitching, the stone of flat stratified nature should be placed with the principal bedding plane normal to the slope. The pattern of laying shall be such that the joints are broken and voids are minimum by packing with spalls, wherever necessary, and the top surface is as smooth as possible.
3. When full depth of pitching can be formed with a single stone , the stones shall be laid breaking joints and all intersection between adjacent in with shall be filled in with spalls of proper size and wedged in with hammers to ensure tight packing.
4. When two or more layers of stones must be laid to obtain the design thickness of pitching, dry masonry shall be used and stones shall be well bonded. To ensure regular and orderly disposition of the full intended quantity of stone as shown, template cross walls in dry masonry shall be built about a meter wide and to the full height of the specified thickness at suitable intervals and all along the length and width of the pitching. Within these walls the stones shall be hand packed as specified.

ITEM NO.14:

Box cutting the road surface to proper slope and camber for making a base for road working incl. removing the excavated stuff and depositing on the road side slopes as directed up to 50m. lead.

1.1. Scope

This work shall consist of excavation, removal and satisfactory disposal of all 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, trimming and finishing of the road to specified dimensions or as directed by the Engineer.

1.2 Classification of Excavated Material

1.2.1. 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 moorum, a mixture of these and similar material which yields to the ordinary application of pick, spade and/or shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having dimension in any one direction not exceeding 75 mm occurring in such strata 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 surface such as water bound and bitumen/tar bound; soling of roads, paths etc. and hard core; compact moorum or stabilised soil requiring grafting tool or pick or both and shovel, closely applied; gravel and cobble stone having maximum dimension in any one direction between 75 and 300 mm;
- (iii) lime concrete, stone masonry in lime mortar 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 having maximum dimension in any direction of more than 300mm, 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 (reinforcement cut through but not separated from the concrete) below ground level ; and
 - (iii) boulders requiring blasting.
- (d) Hard Rock (blasting prohibited)

Hard rock requiring blasting as described under (c) but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging or any other agreed method.

- (e) 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.

1.2.2. 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.

1.3. Construction Operations

1.3.1. 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. The Contractor shall provide all labour, survey instruments and materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete, etc., required in connection with the setting out of works and the establishment of bench marks. The Contractor shall be responsible for the maintenance of bench marks and other marks and stakes as long as in the opinion of the Engineer, they are required for the work.

1.3.2. Stripping and storing topsoil: When so directed by the Engineer, the topsoil existing over the sites of excavation shall be stripped to specified depths constituting Horizon "A" and stockpiled at designated locations for re-use in covering embankment slopes, cut slopes, berms and other disturbed areas where re-vegetation is desired. Prior to stripping the topsoil, all trees, shrubs etc. shall be removed along with their roots, with approval of the Engineer.

1.3.3 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 decided upon beforehand.

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 approved 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. If trees were removed, new trees shall be planted, as directed by the Engineer. The cost of planting new trees shall be deemed to be incidental to the work.

1.3.4. 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.

1.3.5. Rock excavation: Rock, when encountered in road excavation, shall be removed upto the formation level or as otherwise indicated on 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 formation the rock protrudes above the specified levels. Rocks and large boulders which are likely to cause differential settlement and also local drainage problems should be removed to the extent of 500 mm below the formation level in full formation width including drains and cut through the 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 to 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 to Clause 303.

1.3.6 Marsh excavation: The excavation of soils 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. 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 called for on the drawings or as staked by the Engineer, and to the bottom of the marsh, firm support or levels indicated.

1.3.7. Excavation of road shoulders/verge/median for widening of pavement or providing treated shoulders: In works involving widening of existing pavements or providing treated shoulders, unless otherwise specified, the shoulder/verge/median shall be removed to their full width and to levels shown on drawings or as indicated by the Engineer. 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 relaid as directed by the Engineer, at the cost of the Contractor.

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

1.3.9 Slides: If slips, slides, over-breaks or subsidence occur in cuttings during the process of construction, they shall be removed at the cost of 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.

1.3.10. 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.

1.3.11. Disposal of excavated materials: All the excavated materials shall be the property of the Employer. The material obtained from the excavation of roadway, shoulders, verges, drains, cross-drainage works etc., shall be used for filling up of (i) roadway embankment, (ii) the existing pits in the right-of way and (iii) for landscaping of the road as directed by the Engineer, including levelling and spreading with all lifts and lead upto 1000 m and no extra payment shall be made for the same.

All hard materials, such as hard moorum, rubble, etc., not intended for use as above shall be stacked neatly on specified land as directed by the Engineer with all lifts and lead upto 1000 m.

Unsuitable and surplus material not intended for use within the lead specified above shall also, if necessary, be transported with all lifts and lead beyond initial 1000 m, disposed of or used as directed by the Engineer.

1.3.12 Backfilling: Backfilling of masonry/concrete/hume pipe drain excavation shall be done with approved material 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 refilled to the original surface making due allowance for settlement, in layers generally not exceeding 150 mm compacted thickness to the required density, using suitable compaction equipment such as mechanical tamper, rammer or plate compactor as directed by the Engineer.

1.4 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 expense.

1.5. Preservation of Property

The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roadside trees, drains, sewers or other 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 expense. 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 a prior notice to the effect.

1.6 Preparation of Cut Formation

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

Where the material in the subgrade (that is within 500 mm from the lowest level of the pavement) has a density less than specified in Table 300-2, the same shall be loosened to a depth of 500mm and compacted in layers in accordance with the requirements of Clause 305.

Any unsuitable material encountered in subgrade level shall be removed as directed by the Engineer and replaced with suitable material 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 subbase/base course in accordance with Clauses 310 and 311 to receive the sub-base/base course.

1.7. 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 (hard or soft) 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 earlier and conserved (Clauses 301.3.2. and 305.3.3) shall be spread over cut slopes, where feasible, berms 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.

1.8. Measurements for Payment

Excavation for roadway shall be measured by taking cross-sections at suitable intervals in the original position before the work starts and after its completion and computing the volume 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 stacks of excavated rubble after making 35 per

cent deduction therefrom. When volumes are calculated in this manner for excavated material other than rock, deduction made will be to the extent of 16 per cent of stacked volumes.

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

(i)	Loosening and recompacting the loosened material at subgrade	...cu. m.
(ii)	Loosening and removal of unsuitable material and replacing with a suitable material and compacting to required density	...cu. m.
(iii)	Preparing rocky subgrade	...sq. m..
(iv)	Stripping including storing and reapplication of topsoil	...cu. m.
(v)	Disposal of surplus material beyond initial 1000 m lead	..cu. m.

1.9. Rates

1.9.1. The Contract unit rate 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 and depositing the same on sites of embankments, spoil banks or stacking as directed within all lifts and lead upto 1000 m or as otherwise specified;
- (iii) trimming bottoms and slopes of excavation;
- (iv) dewatering;
- (v) keeping the work free of water as per Clause 311; and
- (vi) all labour, materials, tools, equipment, safety measures, testing and incidentals necessary to complete the work to Specifications.

Provided, however, where presplitting is prescribed to achieve a specified slope in rock excavation, the same shall be paid for vide Clause 303.5.

1.9.2. 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.

1.9.3. Clause 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.

1.9.4. The Contract unit rate for item of preparing rocky subgrade 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.

1.9.5. 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, but leads upto 1000 m.

1.9.6. The Contract unit for disposal of surplus earth from roadway and drain excavation shall be full compensation for all labour, equipment, tools and incidentals necessary on account of the additional haul or transportation involved beyond the initial lead of 1000 m.

ITEM NO.15:

Rolling and consolidation of soling including filling in depression which occur during the process, with power roller 8 tonne to 12 tonne including all machineries, tools, tackles, manpower, labours etc. complete.

The sand for the purpose shall be of approved quality. Any material which is found inferior shall be rejected and the contractor shall remove such rejected materials from the site at his own cost. The material shall be approved by the Executive Engineer of his authorized agent

1. Preparation of base:

The sub-grade/sub-base/base to receive the water bound macadam course shall be prepared to the specified grade and camber and made free of dust and other extraneous material. Any ruts or soil yielding places shall be corrected in an approved manner and roiled until from where water bound macadam is to be laid over. An existing black topped surface 50 mm x 50 mm furrows shall be cut at an angle of 45 degrees to the road at 1 meter intervals in the latter before laying the coarse aggregate.

2. Spreading course aggregate:

The coarse aggregates shall be spread uniformly upon the prepared base in arch quantities that the thickness of the compacted layer is 100 mm (or grading 1 and 75-100 mm for grading 2 and 3 as specified). The spreading shall be done from stock piles along the side of the roadway or directly from vehicle. In no case shall the aggregate be dumped in heaps directly on the surface prepared to receive the aggregate nor shall hauling over uncarpeted or partiality compacted base be permitted. The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. No segregation on large or fine particles shall be allowed and the coarse aggregate as may be required. No segregation of large or line particles shall by allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material. The coarse aggregate shall not normally be spread more than 3 days in advance of the subsequent construction operations.

3. Rolling:

Immediately following the spreading of the coarse aggregate rolling shall be started with three wheeled power rollers of 6 to 10 tonne capacity or tandem or vibratory rollers of approved type. The weight of the roller shall depend upon the type of the aggregate and as may be indicated by the Engineer-in-charge. Except on super elevated portions 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 inwards parallel to the center line of the road. In successive passes uniformly lapping proceeding tracks by at least one half widths. Rolling shall continue until the aggregate are thoroughly keyed and the creeping of aggregates ahead or toiler is longer visible, during rolling slight sprinkling of water may be done. If necessary 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 and longitudinally with templates and any irregularities corrected by loosening the surface, adding and removing necessary amounts of aggregates and re-rolling until the entire surface conforms to desired number and grade, in no case shall the use of screenings be permitted to make up depressions.

4. Application of screenings/ sand/ gritty material:

After the coarse aggregate has been rolled to Clause 3.3 screenings/sand/gritty material 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 /sand/gritty material are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings/sand/gritty material shall not be dumped in piles but spread uniformly in successive thin layers either by the spreading motion of hand shovels or by mechanical spreaders or directly from trucks. Trucks operation for spreading the screenings/sand/gritty material shall be driven as not to disturb the coarse aggregate. The screenings/approved quality sand/gritty material 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 aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregate.

The spreading, rolling and brooming of screening/sand/gritty material shall be carried out in only such lengths of the road which could be completed within one day's operation.

5. Sprinkling and grouting:

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

6. Setting and drying:

After the final compaction of water bound macadam course, the road shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings /sand/gritty material as directed, slightly sprinkled with water if necessary and roiled. No traffic shall be allowed on the road until the macadam has set. The Engineer-in-charge shall have the discretion to stop having traffic from using the completed water bound macadam course if in his opinion it would cause excessive from to the surface.

7. Surface Finish:

The surface finish of construction shall conform to the following requirements:

8. General:

All works performed shall conform to the lines, grades, cross sections and dimensions shown on the drawings or as directed by the Engineer-in-charge subject to the permitted tolerances described hereinafter.

8.1. Horizontal Alignments:

Horizontal alignments shall be reckoned with respect to the centre line of the carriage way as shown on the drawings. The edges of the carriage way as constructed shall be correct within a tolerance of ± 25 mm thick. The corresponding tolerance for edges of the roadway and lower layers of pavements shall a 40 mm.

8.2. Longitudinal profile:

The levels of the sub grade and different pavement course as constructed shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the Engineer-in charge Beyond the tolerances mentioned below;

Sub grade	± 25 mm
Sub-base	± 20 mm
Base course	± 15 mm
Wearing course	± 10 mm

Provided, however, the negative tolerance for wearing course shall not be permitted in conjunction with the positive tolerance for base course if the thickness of the former is thereby reduced by more than 6 mm.

8.3. Surface Regularity:

The surface regularity of completed sub-base, base course and wearing surface in the longitudinal and transverse directions shall be within the tolerance indicated in Table below:

Table show permitted tolerance of surface Regularity for payment course

Sr. No.	Type of Construction	Longitudinal Profile with 3 meter straight edge		Cross profile
		Maximum permissible undulation mm	Maximum number of undulations permitted in any 300 m, length exceeding	Maximum Permissible variation from specified Profile under camber
1	Water Bound Macadam with Normal size metal (20-50 mm and 40-63 mm size)	12	30	8

The longitudinal profile shall be checked with a 3 meter long straight edge at the middle of each traffic lane along a line parallel to the centre line of the road. The transverse profile shall be checked with a set of three cambers at intervals of 10 meters.

8.4. Rectification:

Where the surface irregularly of sub grade and the various pavement course fall outside the specified tolerances, the shall be liable to rectify these in the manner described below and to the satisfaction of the Engineer-in-charge. When the surface is high or low, the top 75 mm shall be scarified, reshaped with added material as

necessary and recompact as per the specification of W.B.M. The area treated at a place shall not be less than 5 meters long and 2 meters wide.

ITEM NO.16:

Construction of Granular sub base (grade-II) by providing well graded material mixing in a mechanical mix plant at OMC carriage of mixed material to work at site, spreading in uniform layer (two layers) with motor grader on prepared surface and compacting with smooth wheel roller to 80/100 KN static weight achieve desired density technically complete for grading complete as per clause 401 of MORTH. As per detail specification mentioned in technical bid.

1.1. Scope:

This work shall consist of laying and compacting well-graded material on prepared sub grade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base (termed as sub-base hereinafter as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer.

1.2. Materials:

1.2.1 The material to be used for the work shall be natural sharp clean graded sand; (CBR minimum 30%) crushed stone, B.T. metal of Size 12-75mm from approved quarry combination thereof depending upon the grading required. The material shall be free from organic or other deleterious constituents and conform to the grading given in Table-1.

1.2.2 Physical Requirements:

The material shall have a 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS: 812 (Part-III). The water absorption value of the coarse aggregate shall be determined as per IS: 2386 (Part-3), if this value is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS: 383. For grading II and III materials, the CBR shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent.

1. TABLE – GRADING FOR CLOSE – GRADED GRANULA SUB-BASE MATERIALS

IS : Sieve Designation	301 Percent by weight passing the IS Sieve		
	302 Grading-I	Grading- II	Grading-III
75.00mm	100	--	--
53.00mm	80-00	100	--
26.50mm	55-90	70-100	100
9.50mm	35-65	50-80	65-95
4.75mm	25-55	40-65	50-80
2.36mm	20-40	30-50	40-65
0.425mm	10-25	15-25	20-35
0.075mm	3-10	3-10	3-10
CBR Value (Minimum)	30	25	20

2. TABLE -GRADING FOR COARSE GRADED GRANULAR SUB-BASE MATERIALS

IS : Sieve Designation	303 Percent by weight passing the IS Sieve		
	Grading-I	Grading- II	Grading-III
75.00mm	100	--	--
53.00mm		100	

26.50mm	55-75	50-80	100
9.50mm			
4.75mm	10-30	15-35	25-45
2.36mm			
0.425mm			
0.075mm	<10	<10	<10
CBR Value (Minimum)	30	25	20

Note :- The material passing 425 micron (0.425mm) sieve for all the three grading when tested according to IS : 2720 (Part-5) shall have liquid limit and plasticity index not more than 25 and 6 percent respectively.

1.3. Strength of Sub base

It shall be ensured prior to actual execution that the material to be used in sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished. When directed by the Engineer, this shall be verified by performing CBR tests in the laboratory as required on specimens remolded at field dry density and moisture content and any other tests for the "quality" of materials as may be necessary.

1.4. Construction Operations:

1.4.1 Preparation of Sub grade: -

Immediately prior to the laying of sub-base, the sub grade already finished as applicable shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water in necessary and rolled with two passes of 80-100 KN smooth wheeled roller.

1.4.2 Spreading and compacting: -

The sub base material of grading specified in the Contract shall be spread on the prepared sub grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation or other means as approved by the Engineer.

When the sub-base material consists of combination of materials mentioned as above mixing shall be done mechanically by the mix-in-place method. Manual mixing shall be permitted only where the width of laying is not adequate for mechanical operations as in small-sized jobs. The equipment used for mix-in place construction shall be a rotavator or similar approved equipment capable of mixing the material to the desired degree. If so desired by the Engineer, trial runs with the equipment shall be carried out to establish its suitability for the work.

Moisture content of the loose material shall be checked in accordance with IS: 2720 (Part-2) and suitably adjusted by sprinkling additional water from a truck mounted or trailer mounted water tank and suitable for applying water uniformly and at controlled quantities to variable widths of surface or other means approved by the Engineer so that, at the time of compaction, it is from 1 percent above to 2 percent below the optimum moisture content corresponding to IS: 2720 (Part-8). While adding water, due allowance shall be made for evaporation losses.

Immediately thereafter, rolling shall start if the thickness of the compacted layer does not exceed 100mm a smooth wheeled roller of 80 to 100 KN weight may be used. For a compacted single layer up to 225 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 KN. Static weight with plain drum or pad foot drum or heavy pneumatic tired roller of minimum 200 to 300 KN weight having a minimum tire pressure of 0.7MN/m² or equivalent capacity roller capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall and super elevation and shall commence at the edges and progress towards the centre for portions having cross fall on both sides.

Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. During rolling, the grade and cross fall (camber) shall be checked and any high

spots or depressions, which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km. per hour.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material determined as per IS: 2720 (Part-8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All those, segregated or otherwise defective areas shall be made good to the full thickness of layer and re compacted.

1.5. Surface Finish and Quality Control of Work:

The surface finish of construction shall conform to the requirements. Control on the quality of materials and works shall be exercised by the Engineer-in-Charge.

1.6. Arrangements for Traffic:

During the period of construction, arrangement of traffic shall be maintained.

1.7. Measurements for Payment:

Granular sub base shall be measured as finished work in position on cross sectional measurement and computing the volume of GSB work in cubic meter by average area method.

The protection of edges of granular sub-base extended over the full formation as shown in the drawing shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same

1.8. Rate:

The contract unit rate for granular sub-base shall be payment in full for carrying out the required operations including full compensation for;

1. Making arrangements for traffic except for initial treatment to verges, shoulders and construction of diversions.
2. Furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts.
3. All labours tools, equipment and incidentals to complete the work to the Specifications.
4. Carrying out the work in part widths of road where directed and
5. Carrying out the required tests for quality control.

1.9. Mode of Measurement and Payment:

The rate includes cost of collection conveyance to the site with all lead and lift including labour, tools, equipments and other incidental expenses like royalties.

The payment shall be made on Cubic meter basis without deduction of voids.

ITEM NO.17:

Construction of dry lean cement concrete Sub- base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table 600-1, cement content not to be less than 150 kg/cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, spreading the concrete with shovels, rakes and levelling to grade and camber, compacting with 8-10 tonnes vibratory roller, finishing and curing including finished in a continuous operation for completion of one panel, transportation, loading, unloading, ramming with labours, tools, tackles etc. as per direction of Engineer in charge.

- 1.1. The work shall consist of construction of dry lean concrete sub-base for cement concrete pavement 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. The work shall include furnishing of all plant and equipment, materials and Labour and performing all operations, in connection with the work, as approved by the Engineer.
- 1.2. The design parameters of dry lean concrete sub-base, viz., width, thickness, grade of concrete, details of joints, if any, etc. shall be as stipulated in the Contract drawings.

2. Materials

2.1. Source of Materials:

The Contractor shall indicate to the Engineer the source of all materials with relevant test data to be used in the lean concrete work sufficiently in advance and the approval of the Engineer for the same shall be obtained at least 45 days before the scheduled commencement of the work. If the Contractor later proposes to obtain the materials from a different source, he shall notify the Engineer for his approval at least 45 days before such materials are to be used.

2.2. Cement:

Any of the following types of cement may be used with prior approval of the Engineer:

- (i) Ordinary Portland cement IS: 269
- (ii) Portland Slag Cement IS: 455
- (iii) Portland Pozzolona Cement IS: 1489

If the sub-grade is found to consist of soluble sulphates in a concentration more than 0.5 per cent, cement used shall be sulphate resistant and shall conform to IS: 6909.

Cement to be used may preferably be obtained in bulk form. It shall be stored in accordance with stipulations contained in Clause 1014 and shall be subjected to acceptance test prior to its immediate use.

3. Aggregates:

3.1. Aggregates for lean concrete shall be natural material complying with IS: 383. The aggregates shall not be alkali reactive. The limits of deleterious materials shall not exceed the requirements set out in IS: 383. In case the Engineer considers that the aggregates are not free from this, the same may be washed and drained for at least 72 hours before batching, as directed by the Engineer.

3.2. Coarse aggregate:

Coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or crushed gravel and shall be devoid of pieces of disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of the coarse aggregate shall be 25 mm. The coarse aggregate shall comply with Clause 602.2.4.2.

3.3. Fine aggregate:

The fine aggregate shall consist of clean, natural sand or crushed stone sand or a combination of the two and shall conform to IS: 383. Fine aggregate shall be free from soft particles, clay, shale, loam, cemented particles, mica, organic and other foreign matter. The fine aggregate shall comply with Clause 602.2.4.3.

3.4. The coarse and fine aggregates may be obtained in either of the following manner:

(i) In separate nominal sizes of coarse and fine aggregates and mixed together intimately before use.

(ii) Separately as 25 mm nominal single size, 12.5 mm nominal size graded Aggregates and fine aggregate of crushed stone dust or sand or a combination of these two. The material after blending shall conform to the grading as indicated in Table 600-1.

TABLE 600-1. AGGREGATE GRADATION FOR DRY LEAN CONCRETE

Sieve Designation	Percentage passing the sieve by weight
26.50mm	100
19.00mm	80-100
9.50mm	55-75
4.75mm	35-60
600.00 micron	10-35
75.00 micron	0-8

3.4. Water:

Water used for mixing and curing of concrete shall be clean and free from injurious amounts of oil, salt, acid, vegetable matter or other substances harmful to the finished concrete. It shall meet the requirements stipulated in IS: 456.

3.5. Storage of materials:

All materials shall be stored in accordance with the provisions of Clause 1014 of these Specifications and other relevant IS Specifications. All efforts must be made to store the materials in proper places so as to prevent their deterioration or contamination by foreign matter and to ensure their satisfactory quality and fitness for use in the work. The storage place must also permit easy inspection, removal and storage of materials. All such materials even though stored in approved godowns must be subjected to acceptance test immediately prior to their use. The requirement of storage yard specified in Clause 602.2.9 shall also be applicable.

4. Proportioning of Materials for the Mix

4.1. The mix shall be proportioned with a maximum aggregate cement ratio of 15:1. The water content shall be adjusted to the optimum as per Clause 601.3.2 of MOST for facilitating compaction by rolling. The strength and density requirements of concrete shall be determined in accordance with Clause 601.6 by making trial mixes.

4.2. Moisture content:

The right amount of water for the lean concrete in the main work shall be decided so as to ensure full compaction under rolling and shall be assessed at the time of rolling the trial length. Too much water will cause the lean concrete to be heaving up before the wheels and picked up on the wheels of the roller and too little will lead to inadequate compaction, a low in-situ strength and an open- textured surface.

The optimum water content shall be determined and demonstrated by rolling during trial length construction and the optimum moisture content and degree of compaction shall be got approved from the Engineer. While laying in the main work, the lean concrete shall have moisture content between the optimum and optimum +2 per cent, keeping in view the effectiveness of compaction achieved and to compensate for evaporation losses.

4.3. Cement content:

The minimum cement content in the lean concrete shall not be less than 150 kg/cu.m. of concrete. If this minimum cement content is not sufficient to produce concrete of the specified strength, it shall be increased as necessary without additional cost compensation to the Contractor.

4.4. Concrete strength:

The average compressive strength of each consecutive group of 5 cubes made in accordance with Clause 903.5.1.1 shall not be less than 10 MPa at 7 days. In addition, the minimum compressive strength of any individual cube shall not be less than 7.5 MPa at 7 days. The design mix complying with the above Clauses shall be got approved from the Engineer and demonstrated in the trial length construction.

4.5. Sub-grade

The sub-grade shall conform to the grades and cross sections shown on the drawings and shall be uniformly compacted to the design strength in accordance with these Specifications and Specification stipulated in the Contract. The lean concrete sub-base shall not be laid on a sub-grade softened by rain after its final preparation; surface trenches and soft spots, if any, must be properly back-filled and compacted to avoid any weak or soft spot. As far as possible, the construction traffic shall be avoided on the prepared sub-grade. A day before placing of the sub-base, the sub-grade surface shall be given a fine spray of water and rolled with one or two passes of a smooth wheeled roller after a lapse of 2-3 hours in order to stabilize loose surface. If Engineer feels it necessary, another fine spray of water may be applied just before placing sub-base.

5. Construction

5.1. General:

The place and programme of the lean concrete sub-base construction shall be matching suitably with the programme of construction of the cement concrete pavement over it. The sub-base shall be overlaid with cement concrete pavement only after 7 days after sub-base construction.

5.2. Batching and mixing:

The batching plant shall be capable of proportioning the materials by weight, each type of material being weighed separately in accordance with Clause 602.9.3.2 of MOST. The cement from the bulk stock shall be weighed separately from the aggregates. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity for the laying arrangements. The batching and mixing shall be carried out preferably in a forced action central batching and mixing plant having necessary automatic controls to ensure accurate proportioning and mixing. Other types of mixers shall be permitted subject to demonstration of their satisfactory performance during the trial length. The type and capacity of the plant shall be got approved by the Engineer before commencement of the trial length. The weighing balances shall be calibrated by weighing the aggregates, cement, water and admixtures physically either by weighing with large weighing machine or in a weigh bridge. The accuracy of weighing scales of the batching plant shall be within ± 2 per cent in the case of aggregates and ± 1 percent in the case of cement and water.

The design features of Batching Plant should be such that the shifting operations of the plant will not take very long time when they are to be shifted from place to place with the progress of the work.

5.3. Transporting:

Plant mix lean concrete shall be discharged immediately from the mixer, transported directly to the point where it is to be laid and protected from the weather by covering the tippers/ dumpers with tarpaulin during transit. The concrete shall be transported by tipping trucks, sufficient in number to ensure a continuous supply of material to feed the laying equipment to work at a uniform speed and in an uninterrupted manner. The lead of the batching plant to paving site shall be such that the travel time available from mixing to paving as specified in Clause 601.5.5.2 of MOST will be adhered to.

5.4. Placing:

Lean concrete shall be laid/placed by a paver with electronic sensor. The equipment shall be capable of laying the material in one layer in an even manner without segregation, so that after compaction the total thickness is as specified. The paving machine shall have high amplitude tamping bars to give good initial compaction to the sub-base.

The laying of the two-lane road sub-base may be done either in full width or lane by lane. Preferably the lean concrete shall be placed and compacted across the full width of the road, by constructing it in one go or in two lanes running forward simultaneously. Transverse and longitudinal construction joints shall be staggered by 500-1000 mm and 200-400 mm respectively from the corresponding joints in the overlaying concrete slabs.

5.5. Compaction

5.5.1. The compaction shall be carried out immediately after the material is laid and leveled. In order to ensure thorough compaction which is essential, rolling shall be continued on the full width till there is no further visible movement under the roller and the surface is closed. The minimum dry density obtained shall be 97 per cent of that achieved during the trial length construction vide Clause 601.7 of MOST. The densities achieved at the edges i.e. 0.5m from the edge shall not be less than 95 per cent of that achieved during the trial construction vide Clause 601.7 of MOST.

5.5.2. The spreading, compacting and finishing of the lean concrete shall be carried out as rapidly as possible and the operation shall be so arranged as to ensure that the time between the mixing of the first batch of concrete in any transverse section of the layer and the final finishing of the same shall not exceed 90 minutes when the concrete temperature is above 25 and below 30 degree Celsius and 120 minutes if less than 25 degree Celsius, this period may be reviewed by the Engineer in the light of the results of the trial run but in no case shall it exceed 2 hours. Work shall not proceed when the temperature of the concrete exceeds 30 degree Celsius. If necessary, chilled water or addition of ice may be resorted to for bringing down the temperature. It is desirable to stop concreting when the ambient temperature is above 35°C. After compaction has been completed, roller shall not stand on the compacted surface for the duration of the curing period except during commencement of next day work near the location where work was terminated the previous day.

5.5.3. Double drum smooth-wheeled vibratory rollers of minimum 80 to 100 KN static weights are considered to be suitable for rolling dry lean concrete. In case any other roller is proposed, the same shall be got approved from the Engineer, after demonstrating its performance. The number of passes required to obtain maximum compaction depends on the thickness of the lean concrete, the compatibility of the mix, and the weight and type of the roller etc., and the same as well as the total requirement of rollers for the job shall be determined during trial run by measuring the in-situ density and the scale of the work to be undertaken.

5.5.4. In addition to the number of passes required for compaction there shall be a preliminary pass without vibration to bed the lean concrete down and again a final pass without vibration to remove roller marks and to smooth the surface.

Special care and attention shall be exercised during compaction near joints, kerbs, channels, side forms and around gullies and manholes. In case adequate compaction is not achieved by the roller at these points, use of plate vibrator shall be made, if so directed by the Engineer.

5.5.5. The final lean concrete surface on completion of compaction and immediately before overlaying shall be well closed, free from movement under roller and free from ridges, low spots, cracks, loose material, pot holes, ruts or other defects. The final surface shall be inspected immediately on completion and all loose, segregated or defective areas shall be corrected by using fresh lean concrete material laid and compacted as per Specification. For repairing honeycombed surface, concrete with aggregates of size 10 mm and below shall be spread and compacted. It is necessary to check the level of the rolled surface for compliance. Any level/thickness deficiency should be corrected after applying concrete with aggregates of size 10 mm and below after roughening the

surface. Similarly the surface regularity also should be checked with 3m straight edge. The deficiency should be made up with concrete, with aggregates of size 10 mm and below.

5.5.6. Segregation of concrete in the dumpers shall be controlled by premixing each fraction of the aggregates before loading in the bin of the batching plant, by moving the dumper back and forth while discharging the mix on it and other means. Even paving operation shall be such that the mix does not segregate.

5.6. Joints:

Contraction and longitudinal joints shall be provided as per the drawing. At longitudinal or transverse construction joints, unless vertical forms are used, the edge of compacted material shall be cut back to a vertical face where the correct thickness of the properly compacted material has obtained.

5.7. Curing:

As soon as the lean concrete surface is compacted, curing shall commence. One of the following two methods shall be adopted:

(a) The initial curing shall be done by spraying with liquid curing compound. The curing compound shall be white pigmented or transparent type with water retention index of 90 per cent when tested in accordance with BS 7542. Curing compound shall be sprayed immediately after rolling is complete. As soon as the curing compound has lost its tackiness, the surface shall be covered with wet hessian for three days.

(b) Curing shall be done by covering the surface by gunny bags/hessian which shall be kept continuously moist for 7 days by sprinkling water.

6. Trial Mixes

The Contractor shall make trial mixes of dry lean concrete with moisture contents like 5.0, 5.5, 6.0, 6.5 and 7.0 per cent using cement content specified and the specified aggregate grading but without violating the requirement of aggregate-cement ratio specified in Clause 601.3.1. Optimum moisture and density shall be established by preparing cubes with varying moisture contents. Compaction of the mix shall be done in three layers with vibratory hammer fitted with a square or rectangular foot as described in Clause 903.5.1.1. After establishing the optimum moisture, a set of six cubes shall be cast at that moisture for the determination of compressive strength on the 3rd and the seventh day. Trial mixes shall be repeated if the strength is not satisfactory either by increasing cement content or using higher grade of cement. After the mix design is approved, the Contractor shall construct a trial section in accordance with Clause 601.7. If during the construction of the trial length, the optimum moisture content determined as above is found to be unsatisfactory, the Contractor may make suitable changes in the moisture content to achieve a satisfactory mix. The cube specimens prepared with the changed moisture content should satisfy the strength requirement. Before production of the mix, natural moisture content of the aggregate should be determined on a day-to-day basis so that the moisture content could be adjusted. The mix finally designed should neither stick to the rollers, nor become too dry resulting in raveling of surface.

7. Trial Length

7.1. The trial length shall be constructed at least 14 days in advance of the proposed date of commencement of work. At least 30 days prior to the construction of the trial length, the Contractor shall submit for the Engineer's approval a "Method Statement" giving detailed description of the proposed materials, plant, equipment, mix proportion, and procedure for batching, mixing, laying, compaction and other construction procedures. The Engineer shall also approve the location and length of trial construction

which shall be a minimum of 60 m length and for full width of the pavement. The trial length shall contain the construction of at least one transverse construction joint involving hardened concrete and freshly laid sub-base. The construction of trial length will be repeated till the Contractor proves his ability to satisfactorily construct the sub-base.

7.2. In order to determine and demonstrate the optimum moisture content which results in the maximum dry density of the mix compacted by the rolling equipment and the minimum cement content that is necessary to achieve the strength stipulated in the drawing, trial mixes shall be prepared as per Clause 601.6.

7.3. After the construction of the trial length, the in-situ density of the freshly laid material shall be determined by sand replacement method with 20 cm diameter density cone. Three density holes shall be made at locations equally spaced along a diagonal that bisects the trial length; average of these densities shall be determined. These main density holes shall not be made in the strip 50 cm from the edges. The average density obtained from the three samples collected shall be the reference density and is considered as 100 per cent. The field density of regular work will be compared with this reference density in accordance with Clause 601.5.5.1 and 903.5.1.2. A few cores may be cut as per the instructions of the Engineer to check segregation or any other deficiency.

7.4. The hardened concrete shall be cut over 3m width and reversed to inspect the bottom surface for any segregation taking place. The trial length shall be constructed after making necessary changes in the gradation of the mix to eliminate segregation of the mix. The lower surface shall not have honey-combing and the aggregates shall not be held loosely at the edges.

7.5. The trial length shall be outside the main works. The main work shall not start until the trial length has been approved by the Engineer. After approval has been given, the materials, mix proportions, moisture content, mixing, laying, compaction plant and construction procedures shall not be changed without the approval of the Engineer.

8. Tolerances for Surface Regularity, Level, Thickness, Density and Strength:

The tolerances for surface regularity, level, thickness, density and strength shall conform to the requirements given in Clause 903.5. Control of quality of materials and works shall be exercised by the Engineer in charge with Section 900.

9. Traffic

No heavy commercial vehicles like trucks and buses shall be permitted on the lean concrete sub-base after its construction. Light vehicles if unavoidable may, however, be allowed after 7 days of its construction with prior approval of the Engineer.

10. Measurements for Payment

The unit of measurement for dry lean concrete pavement shall be the cubic meter of concrete placed, based on the net plan areas for the Specified thickness shown on the drawings or as directed by the Engineer.

11. Rate

The Contract unit rate payable for dry lean concrete sub-base shall be payment in full for carrying out the required operations including full compensation for all labour, materials and equipment's, mixing, transport placing, compacting, finishing, curing, testing and incidentals to complete the work as per Specifications, all royalties, fees, storage and rents where necessary and all leads and lifts.

ITEM NO.18:

Providing and laying HDPE sheet of 75-100 micron thick and provide lap of 0.3m length in longitudinal and transverse direction of approved quality as directed by engineer in charge.

A separation membrane shall be used between the concrete slab and the sub base. Separation membrane shall be impermeable plastic sheeting 125 micron thick laid flat without creases. Before placing the separation membrane, the sub-base shall be swept clean of all the extraneous material using air compressor. Wherever overlap of plastic sheets is necessary, the same shall be at least 300, mm and any damage sheeting shall be replaced at the contractor's expense. The separation membrane may be nailed to the lower layer with concrete nails as per MORTH Section 600.

ITEM NO.19:

Construction of un-reinforced, dowel jointed, Controlled cement concrete pavement over a prepared sub-base of M-40 with 53 grade cement, coarse and fine aggregate conforming to IS:383, maximum size of coarse aggregate not exceeding 25mm, mixed in batching plant or in well-equipped mixer machine as per approved mix design, transported to site, laid with trimix vacuumed de watering process using vacuumed dewatering , mechanical vibrator , mechanical floater , mechanical Towel for finishing by mixture on including cutting grooves of size etc. as per drawing and finished in a continuous operation for completion of one panel(4 mt X 4Mt, however dimension will be as per the drawing) including provision of contraction, expansion, construction and longitudinal joints, joint filler as per the drawings, separation membrane, sealant primer, joint sealant, debonding strip, admixture as approved, curing compound, formwork, rails, guidewires, finishing to lines and grades as per drawings as specified in clause 602 of MORTH including the cost of all material, labour charges, transportation and conveyance, loading and unloading etc. complete with all lead and lift as per specification and directed by the engineer. (Min. Cement consumption:475 Kg/Cmt)

Material

Cement , grit kapachi , sand , controlled M 40 , plant , machinery vibrator , floating machine RCC and refer CPWD General technical specification book let relevant pages.

Workmanship

Laying M-40 grade concrete with cement not less than 425 kg/cum, in floors, 400 mm thick well compacted, mechanically vibrated, finished to required levels, de-watered by vacuum process TREMIX or equivalent floated with neat cement and power trowel led to get desired smooth finishing over 75 mm thick plain cement concrete of mix 1:3:6 as a leveling course over rubble soling, including MS shuttering wherever required, curing etc. complete for both operations of concrete work. The reinforcement for Trimix 400 mm thick floor shall be 8 T or @ 250 c/c both ways. The construction joints to be formed by cutting with mechanical saw. The size of the groove to be cut in both directions i.e. along the panels and across the panels in concrete should be 4 mm x 30 mm to form panel of size 3 m to 4 m wide x 6 m to 8 m long. The operation should be carried out after final curing of concrete. The groove joints should be filled with clean dry sand at bottom and finished with poly sulphide joint sealant at top 4 mm x 4 mm size. The surface tolerance should not exceed 3 mm in three-meter length measured by straight edge in any direction. (Specifications:

27.1 The base to receive the concrete shall be prepared as directed by Engineer in Charge.

27.2 The CCM-15 and M-10 grade concrete shall be provided of specified thickness as per IS:456-2000.

27.3 The reinforcement shall be provided as per IS.

27.4 Joints shall be cut and filled as specified above. The payment for all above works will be paid under relevant items.

27.5 The dewatering shall be done by using vacuum process TRIMIX or equivalent floated with neat cement & power traveled to get desired smooth finishing.

27.5.1 Process of Vacuum: The surface where the TREVIIX flooring is to be provided shall be cleaned properly.

27.5.2 Equipment: All equipment's required for vacuum process TRIMIX are included under the item.

27.6.1 Mode of Measurement and Payment: The payment of work completed in all respect shall be per sqm basis of contract rate.

Vacuum De-watered Flooring (Tremix):

The specification of work should conform to those specified by the manufacturer (Trimix or equivalent), as to achieve the desired results but in no case shall be lesser than as mentioned hereunder.

1. General: The Contractor shall submit the plan of work going to be followed by him, well in advance (at least a week). A sketch shall be accompanied giving details of the construction joint locations, sequence of floor casting, etc. The work shall be planned and executed so that there is no delay between the placement, screeding, de-watering and floating of concrete.

2. Concrete in Floor

The surface where the concrete is going to be laid for the floor shall be thoroughly cleaned of all dust, loose particles etc. It shall then be wetted to have just a moist surface and sprinkled with cement slurry. Then two sidetrack rails on which leveling beam and a surface vibrator be mounted, shall be erected to proper/desired levels and gradient as to have the specified thickness of concrete and the required slope in the floor. A stop end then be placed at the starting end. Both track rails and stop ends should be preferably of mild steel. The concreting then be started with desired/specified grade of concrete. However it is advisable to use M15 grade concrete minimum for better final results using 350 kg of cement per cum. Of concrete and maintaining a water cement ratio of 0.53 to 0.54 (unless otherwise specified). The placing of machine mixed concrete begins from starting end and is continued in horizontal manner. Poker vibrators will be used to vibrate the laid concrete thoroughly with minimum 40 mm dia. Needless. On completion of laying of approximate 5/6 Sqm area the surface vibrator then be run over the concrete. Surface to achieve better overall compaction of concrete.

This process is continued and the surface vibrator be run the second time along with leveling beam on the finished concrete surface. Then the vacuum mat be placed on this leveled concrete and the excess water from the concrete is sucked off. It should be done in accordance with the manufacturer's recommendation, paying special attention over the edges. A time of approximate 1.5 to 2.0 minutes per centimeter thickness of concrete slab is normally adopted for Vacuum treatment. As a result of which the water cement ratio shall be reduced to in the order of 0.42 to 0.43, thereby reducing the total water content in the concrete by 15 to 25% care should be taken at this stage to avoid curling at the ends due to excess use of vacuum mats. Immediately thereafter normal floating operation should begin or if special topping is specified then the same is worked into the concrete surface with the float disc. The floater suggested here are power operated skim floater. The floating is continued till desired finish is obtained. The curing of the surface shall be done by ponding method for at least 7 clear days prior to putting the surface to use. Reinforcement 8 TOR at a spacing of 250mm C/c, both ways shall be placed in concrete, unless otherwise specified, 50mm below the top surface of concrete.

This mesh shall be for individual panels formed by side construction joint and expansion joint. Tie bars, 400 mm long, shall be provided at construction joints using 10 TOR @ 250 c/c. Dowel bars, 400 mm long, shall be provided at expansion joints using 16 or 20 dia. MS bars @ 300 c/c.

1. Joints in Floor

a) The contraction (dummy) joints in concrete shall be spaced at approximately 40 Sqm area and / or as per item and shall be made by sawing the already laid and finally cured concrete to obtain 4mm x 35mm deep joints. These joints shall be cleaned of all dust and be filled in with clean dry sand up to full depth. The top 10mm deep layer of sand then be removed by appropriate tools/templates and the same shall be sealed properly by poly schlafiedjoint sealant 4mm x 10 mm deep

b). The Expansion joints shall be spaced at approximately 120 sqm. Area and/or as specified and shall constitute formation of 12/20/25 mm clear joint between the two concretes. This joint

be formed by placing the Shalitek board in position against the old concrete leaving 12/20/25mm x 10mm deep joint at top, which shall be filled in by poly sulphid joint sealant. The 16/20mm dia. MS dowel bars shall be so placed that the half length of bar be bonded in to concrete on one side of the joint and the other half shall be prevented from bonding with concrete. In addition, a recess at its slip end shall be provided to accommodate the movement of the slab during expansion of the concrete. The un bonded portion of the dowel bar shall be covered with an expansion cap using 25mm dia. PVC pipe, 225mm long (unless otherwise specified).

c). The side construction joints shall be buttered against each other and later on a joint groove shall be cut as specified in 'a)' above.

Payment and Mode of measurement

The complete finished job of RCC M 40 grade trimix flooring road shall be measured in the unit of measurement will be in cubic meters payment shall be done in cubic meter basis only. The contractor has to cut and develop necessary joints and expansion joints. The rate includes all kind of scaffolding, shuttering, machinery, plant, manpower to complete the item of RCC M 40 trimix flooring/ RCC road at the GMDC contractor have to produce necessary testing certificate from govt. approved laboratory, both for third party inspection without any extra cost.

ITEM NO.20:

Providing and fixing in position mild steel dowel bar of 32mm diameter and 500 mm length at 200 mm c/c in transverse direction at expansion joint which is provided at 4.0 m c/c longitudinally with plastic cap of 3 to 5 mm thick black coloured as a cover of dowel bar which sustain the movement of dowel bar including cutting, placing of same, with all machinery, tools, tackles, labours etc. complete..

1. This item provides for necessary mild steel bar of 32 mm. diameter for anchoring in foundations strata as per detailed drawings and as directed by Engineer-in-charge. For this purpose, 100 mm holes shall be kept in staining itself at regular intervals as shown in drawing or as directed by Engineer in-charge. Mild steel bars shall be supplied by the department at the rate and place shown in schedule A of the tender. The item includes transporting the bars to the site of work, handling, and cutting, bending, hooking and placing the same in position as required as per drawing. The grout holes shall be not less than 100 mm. diameter. The anchorage length of bars shall not be less than 60 times diameter of bar. Grouting shall be of 1:2 proportions (1 part of cement, 2 parts of sand) and shall be done under pressure as directed. These dowels bars shall be inserted through holes kept in the well staining to the bottom of the grout holes. Grout holes shall not be less than 1 Mt. in depth. In case, no dowel bars are ultimately decided to be provided in the holes of the staining kept for the purpose, the same shall be filled with the concrete of the same proportion as of well staining at the cost of the contractor.
2. Mode of measurement will be per Rmt of dowel bar considered as one number from bottom of grout hole to the top of staining,
2. Unit rate includes cost of material, labour, tools and plant and grouting the staining holes to complete the work.

ITEM NO.21:

Providing and fixing in position TMT tie bar of 12mm diameter and 500mm length at 430 mm c/c in longitudinal direction as per IS 1786 (Latest) including all machineries, tools, tackles, manpower, labours etc. complete.

The work includes providing & laying in position HYSD / Mills steel / Thermo Mechanically Treated bar of the following grade. Grade Designation Bar type confirming to governing IS specification Characteristic strength by MPa Elastic Modulus GPa S 415 IS 1786 High yield strength deformed bar 415 200 S 240 IS 432 Part-II 240

TMT BAR 415 TMT bar shall conform to min 415 MPa yield strength. Tensile strength of in 500 MPa and elongation percentage min 22. The chemical composition of bars shall be as below.

	% Max
Carbon	0.25
Sulphur	0.05
Phosphorus	0.05
Sulphur & Phosphorus	0.01

All steel shall be procured from original procedures no rolled steel shall be incorporated in the work. Only new steel bars shall deliver to the site. Every bar discarded cracked ends of bars shall be discarded.

1. The work shall consist of furnishing and placing reinforcement the shape and dimensions shown on the drawings or as directed by the engineer-in-charge.
2. Steel shall be clean and free from loose and loose mill scale at the having position and subsequent concreting.
3. Reinforcing steel conform accurately to the dimensions given in the bar bending schedules shown on relevant drawings. Bars shall be bent cold to the specification shape and dimensions or as directed by the Engineer-in-Charge using a proper bar bender, operated by hand power to attain proper radius of bends. Bars shall be bending or straightened in such a manner that will not injure the material. Bars bent during transport or handing shall be straightened before being used on work they shall be not heated to facilitate bending. Unless otherwise specified a "U" type hook at the end of each bar shall be invariably provided. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the beyond the ends of the curve shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars ten diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any splitting of the concrete.
4. All reinforcement bars shall be accurately placed in exact position shown on the drawings, and shall be security held in position during placing of concrete by annealed binding wire not less than 1 mm in size and confirming to IS: 280 by using stay block or metal chairs, spacers, metal hangers supporting wires or other approved device at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation of the work. All devices used for positioning shall be on non corrodible material wooden and metal support will not extent to the surface or concrete, except where shown on the drawings. Placing bars on layers of freshly laid concrete as the work progress for adjusting for spacing will not be allowed pieces of brocket stone or brick and wooden block shall not be used layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices, reinforcement after being placed in position shall be maintained in a clean condition unit completely embedding concrete special care shall be exercised to prevent any displacement of reinforcement from corrosion concrete cover shall be provided as indicated on the drawing. All bars producing from concrete and to which other bars to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.
5. Bars crossing each other, where required shall be secured by bidding wire (annealed) of size not less than 1 mm and confirming to IS 28 in such a manner that they do not slip over each other at the time of fixing and concreting.

6. As far as possible bars of full length shall be used. In case this is not possible overlapping bars shall be done as directed by the Engineer-in-Charge. When practicable overlapping bars shall not touch each other but be kept apart of 25mm or 1.25 times the maximum size of the coarse aggregate whichever is greater by concrete between them, where not feasible overlapping bars shall be bound with annealed steel wire, and not less than 1 mm thickness twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending moment is maximum.
7. Whenever indicated on the drawings or desired by the Engineer-in-charge. Bar transmit the full stresses of bars. The ends of the bars that are joined by coupling shall be upset for a sufficient length so that the effective cross section at the base of threads is not less than the normal cross section of the bar. Threads shall be standard white iron threads still for coupling shall conform to IS 226.
8. When permitted or specified on the drawing joints reinforcement bars shall be but welded so as to transmit their full stresses. Welded joints shall preferably be located at points where steel not be subjected to more than at any one section and not more than 20 percent of the folds are welded. Only electric arc welding using a process which excludes air from the molten metal and conforms to any of all other special provision for the work will be accepted. Enable means slab be provided for holding the bars supply as position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned properly ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding shall conform to IS 814 welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed by the Engineer-in-charge.
9. Reinforcement shall be measured in length including overlaps separately for different diameters as actually used in the work , where welding or coupling is restored to in place of lap-joints such joints shall be measured for payment as the equivalent length of overlap as per design requirement .From the length so measured the weight of reinforcement shall be calculated in tons on the same basis of I.S. 1732 Length shall include hooks at ends wastage and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.
10. Rate for reinforcement shall include of all steel, the carting to work site cutting, bending, placing binding and fixing in position as shown on the drawing Sqm. And as directed by the Engineer-in-charge. It shall also include cost of all devices for keeping reinforcement in approved position cost of joints as per approved methods and all wastage and spacer bars.
11. The rate shall be paid for complete item on "Kg." Basis.