



GOVERNMENT OF GUJARAT

ROADS & BUILDING DEPARTMENT

GANDHINAGAR PANCHAYAT (R & B) CIRCLE GANDHINAGAR.

NAME OF WORK :-

**Construction of New Slab Drain Under TRIBAL/MMGSY/B.K./2026-27/
Package No. 01 In Ta. Danta Dist.Banaskantha (1) Constg. Kumbhariya
Chamundamata Approach Road to Aeklavya Model School Road Km
0/000 to 0/100.**

SPECIFICATIONS

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NAME OF WORK :- Construction of New Slab Drain Under TRIBAL/MMGSY/B.K./2026-27/ Package No. 01 In Ta. Danta Dist.Banaskantha (1) Constg. Kumbhariya Chamundamata Approach Road to Aeklavya Model School Road Km 0/000 to 0/100.

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	<p>lower most plate. the diamond shaped plate mounted over flat angle iron frame will be connected to middle plate by square steel section of 47mmx47mm, thickness 12SWG having a spacing of 100mm between the diamond shaped plate and middle plate and this square section will be riveted to the bottom point of the diamond shaped plate. logo, letters and numerals on the ACM should be made up of Retro Reflective sheeting of Type-1 AEGP Class-A grade as per the latest MORD section 1700 and IRC 67-2012 specifications. All the section of the frame and posts shall be painted with primer and two coats of epoxy paint. The design, painting and lettering shall be done as per the Signage Guide and as directed by Engineer-In-charge. . A warranty for 5 years for the Retro reflective sheeting for Class-A</p>	
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GENERAL TECHNICAL SPECIFICATION

1. General :

All measurement shall be made in the metric system. Different items of work shall be measured in accordance with the procedures forth in the relevant specification read in conjunction with General Conditions of Contract. The same shall not, however, apply in the case of lump-sum items. All measurements and computations, unless otherwise, indicated, shall be carried nearest to the following limits :

i	Length and breadth	10 mm
ii	Height, depth or thickness of earthwork, sub-base, bases, surfacing and structural members.	05 mm
iii	areas	0.01 Sq.Mtrs.
iv	Cubic contents	0.01 Cubic Mtr.

In recording dimensions of work the sequence of length, width and height or depth or thickness shall be followed.

2. Measurements of lead of materials :

Where lead is specified in the contract the same shall be deemed to mean as described hereunder.

Lead shall be determined on the bases of the shortest practicable route and not the one actually taken and the decision of the Engineer-in-charge in this regard shall be taken as final. Distances upto and including 100 metres shall be measured in units of 50 meters exceeding 100 metres but not exceeding 1 km. In units of 100 metres, and exceeding 1 km. in units of 500 metres. The half and greater than half of the units shall be reckoned as one and less than half of the units ignored. In this regard, the source of the material shall be divided into suitable blocks and for each block the distance from the centre of the block to the centre of placing pertaining to that block shall be taken as the lead distance. Where no lead is specified, it shall mean all lead.

3. Surface Regularity :

The surface regularity of complete wearing surfaces in the longitudinal and transverse directions shall be within the tolerances indicated in Table below. The longitudinal profile shall be checked with a 3 metre long straight edge at the middle of each traffic lane along a line paralleled to the centre of the road. The transverse profile shall be checked with a set of three camber boards at interval of ten meters.

PERMITTED TOLERANCES OF SURFACE REGULARITY FOR PAVEMENT COURSES

Sr. No.	Type of construction	Longitudinal	Profile with 3 metre straight edge	Cross Profile
		Maximum permissible undulations mm.	Maximum numbers of undulations permitted in any 300 metres length exceeding 6 mm	Maximum permissible variation for specified profile under camber template mm

Note : 1. @ These are for machine laid surface. If laid manually, tolerance upto 50 percent above these values in this column may be permitted. However this relaxation does not apply to the Value of maximum undulation for longitudinal cross profiles mentioned in columns 3 and 8 on the table.

2. Surface evenness requirements in respect of both the longitudinal and cross profiles should be simultaneously satisfied.

3.1 Rectification :

Where the surface irregularity fall outside the specified tolerances, the contractor shall be liable to rectify these in the manner described below and to the satisfaction of the Engineer- In-Charge at his own cost.

3.2 Bituminous Constructions :

For bituminous constructions, for wearing course, where the surface is high or low, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications. In all cases where the removal and replacement of a bituminous layer is involved, the area treated shall not be less than 5 metres long and less than 1 lane wide.

**5. Following materials shall conform to the Indian Standards shown
‘Against Them’ :**

1.	Cement	IS : 269
2.	Sand for Masonary	IS : 2116
3.	Sand for Concrete	IS : 383
4.	Coarse aggregate	IS : 383
5.	Mild Steel	IS : 432
6.	High yield strength deformed bars :	
	(a) Hot Rolled	IS : 1139
	(b) Cold Twisted	IS : 1786
7.	Cast Steel	IS : 1030
8.	Cast Iron	IS : 210
9.	Structural Steel	
	(a) Mild Steel	IS : 226
	(b) HT Steel	IS : 961
	© Fusion welding quality steel	IS : 2062
	(d) Rivet steel	IS : 1148 or
		IS : 1149 as applicable.
10.	HT Steel	IS : 1785
11.	Grease	IS : 1002
12.	Electrodes for metal or welding of N.J.	IS : 814

SPECIFICATION FOR MATERIALS

M-1 Water:

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in LS. 456-1978.

1.2. If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in LS. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4. Hard and bitter water shall not be used for curing.

1.5. Potable water will be generally found suitable for curing mortar or concrete.

M-2 Lime:

2.1 Lime shall be hydraulic lime as per I.S. 712-1973. Necessary test shall be carried out as per I.S. 6932 (Parts I to X), 1973.

2.2 The following field tests for limes are to be carried out:

- (1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white colour, lime in form of porous lumps of dirty white colour indicates quick lime, and solid lumps are the unburnt lime stone.
- (2) Acid tests for determining the carbonate content in lime, excessive amount of impurities and rough determination of class of lime.

2.3 Storage shall comply with I.S. 712-1973. The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

2.4 Field testing shall be done according to I.S. 1624-1974 to show the acceptability of materials.

M-3 Cement:

3.1 Cement shall be ordinary Portland slag cement as per LS. 269-1976 or Portland slag cement as per I.S. 455-1976.

M-4 White Cement:

4.1 The white cement shall conform to I.S. 80412-E 1978.

M-5 Coloured Cement:

5.1 Coloured cement shall be with white or gray Portland cement as specified in the item of the work.

5.2 The pigments used for coloured cement shall be of approved quality and shall not exceed 10 % of cement used in the Mix. The mixture of pigment shall be properly ground to have a uniform colour

and shade. The pigments shall have such properties to provide for durability under exposure to sunlight and weather.

5.3. The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

M-6 Sand:

6.1. Sand shall be natural sand, clean, well graded, hard strong durable and gritty particle free from injurious amounts of dust clay, kankar nodules, soft or flaky particles shale, alkali; salts organic, matter, loam, mica or other deleterious substance and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test, if necessary the sand shall be washed to make it clean.

6.2. Coarse Sand:

The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under:

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing sieve
4.75 mm.	100	600 Micron	30 – 80
2.36 mm.	90 To 100	300 Micron	5 – 70
1.18 mm.	70 – 100	150 Micron	0 – 50

6.3 Fine Sand:

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing sieve
4.75 mm.	100	600 Micron	40 – 85
2.36 mm.	100	300 Micron	5 – 50
1.18 mm.	70 – 100	150 Micron	0 - 10

M-7 Stone Dust:

7.1 This shall be obtained from crushing hard black trap or equivalent. It shall not contain more than 8% of silt as determined by field test with measuring cylinder. The method of determining silt contents by field test is given as under

7.2 A sample of stone dust to be tested shall be placed without drying in 200 mm. measuring cylinder. The quantity of the sample shall be such that it fills the cylinder up to 100 mm. mark. The clean water shall be added up to 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.

7.3. The height of silt visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8% silt shall be washed so as to bring the silt content within the allowable limit.

7.4. The fineness modulus of stone dust shall not be less than 1.80.

M-8 Stone Grit:

8.1. Grit shall consist of crushed or broken stone and be hard strong, dense, durable, clean, of proper gradation and free from skin or coating likely to prevent adhesion of mortar Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. Unless special stone of particular quarries is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement.

8.2. The grit shall conform to the following gradation as per sieve analysis:

I.S. Sieve Designation	Percentage by weight passing through sieve
12.50 mm	100 %
10.00 mm	85 – 100 %
4.75 mm	0 – 20 %
2.36 mm	0 – 5 %

8.3. The crushing strength of grit will be such as to allow the concrete in which it is used to built- up the specified strength of concrete.

8.4. The necessary tests for grit shall carried out as per the requirements of I.S. 2386 (Parts I to VII) 1963, as per instructions of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.

M-9 Cinder:

9.1 Cinder is well burnt furnace residue which has been fused or sintered into lumps of varying sizes.

9.2. Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only. It shall be sound clean free from clay, dirt, ash or other deleterious matter.

9.3. The average grading for cinder aggregates shall be as mentioned below:

I.S. Sieve Designation	Percentage passing
20 mm	100
10 mm	86
4.75 mm	70
2.36 mm	52

M-10 Lime Mortar:

10.1. Lime shall conform to specification M-2. Water shall conform to specification M-1.

Sand shall conform to specification M-6.

10.2. Proportion of Mix:

10.2.1. Mortar shall consist of such proportions of slaked lime and sand as may be specified in the item. The slaked lime and sand be measured by volume. .

10.3. Preparation of mortar:

10.3.1. Lime mortar shall be prepared by wet process as per I.S. 1625-1971. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and grind for the 180 revolutions with sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

10.4 Storage:

10.4.1 Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

10.5 Use:

10.5.1. All mortar shall be used as soon as possible after grinding. It should be used on the day on which it is prepared, but in no case mortar made earlier than 36 hours shall be permitted for use.

M-11 Cement Mortar:

11.1. Water shall conform to specification M-1. Cement shall conform to specification M-3. Sand shall conform to M-6. 11.2. Proportion of Mix:

11.2.1: Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50 Kg. / Bag of cement being equal to 0.0342 Cu.m. The mortar may be hand mixed or machine mixed as directed.

11.3. Preparation of mortar:

11.3.1 In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogenous mixture of uniform colour is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of

uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.

11.3.2 The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-12 Stone Coarse Aggregate for Nominal Mix Concrete:

12.1. Coarse aggregate shall be machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

12.2. The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less than the cover, whichever is smaller.

TABLE

I. S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size			I. S. Sieve Designation 20 mm	Percentage passing for single sized aggregates of Nominal size		
	40 mm	20 mm	40 mm		40 mm	20 mm	40 mm
80 mm.	---	---	---	12.5 mm.	---	---	---
63 mm.	100	---	---	10 mm.	0.5	0.02	0.30
40 mm.	85 – 100	100	---	4.75 mm.	---	0.5	0.5
20 mm.	0 – 20	85 – 100	100	2.35 mm.	---	---	---
16 mm.	---	---	85 – 100				

Note: This percentage may be varied some what by Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

12.3. The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

M-13 Black Trap or Equivalent Hard Stone Coarse Aggregate:

13.1. Aggregate For Design Mix Concrete: Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard strong dense- durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

13.2. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.

13.3. The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

13.4. If aggregate is covered with dust it shall be washed with water to make it clean.

M-14 Brick Bats Aggregate:

14.1. Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm. to 50 mm. size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

14.2. The brick hats shall be measured by volume by suitable boxes or as directed.

M-15 Brick:

15.1. The bricks shall be hand or machine molded and made from suitable soils and kiln-burnt. They shall be free from crack and nodules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

The bricks shall be molded with a frog of 100 mm. x 40 mm. and 10 mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.

15.2. The size of modular bricks shall be 190 mm. x 90 mm. x 90 mm.

15.3. The size of the conventional bricks shall be as under: (9" x

4 3/8 " x 2 3/4 ") i.e. 225 x 110 x 75 mm.

15.4. Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length $\pm 1/8"$ (3.0 mm) Width $\pm 1/16"$ (1.50 mm) Height $\pm 1/6"$ (1.50 mm.)

15.5. The crushing strength of the bricks shall not be less than 35 Kg./Sq.Cm. The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV) 1976.

M-16 Stone:

16.1. The stone shall be of the specified variety such as Granite/Trap Stone/Quartzite or any other type of good hard stones.

The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with I.S. 1134-1974. The minimum crushing strength of the stone shall be 200 Kg. / Sq.Cm unless otherwise specified.

16.2 The samples of the stone to be used shall be got approved before the work is started.

16.3 The Khanki facing stone shall be dressed by chisel as specified in the item for Khanki facing in required shape and size. The face of stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface.

M-17 Laterite stone:

17.1. Laterite stone shall be obtained from the approved quarry. It shall be compacted in texture, sound, durable and free from soft patches. It shall have a minimum crushing strength of 100 Kg. /Sq.Cm. in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water. After quarrying the stone shall be allowed to weather for some time before using in work.

17.2. The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, edges true and square.

17.3. Those types of stone in which white clay occur, should not be used.

17.4. Special corner stones shall be provided where so directed.

M-18 Mild Steel Bars:

18.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. -t56- 1978.

18.2 All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

18.3. For the purpose of payment, the bar shall be measured correct up to 100 mm. length and weight payable worked out at the rate specified below:

1.	6 mm.	0.22 Kg./Rmt.	8.	20 mm	2.47 Kg./Rmt.
2.	8 mm	0.39 Kg./Rmt.	9.	22 mm	2.98 Kg./Rmt.
3.	10 mm	0.62 Kg./Rmt.	10.	25 mm	3.85 Kg./Rmt.
4.	12 mm	0.89 Kg./Rmt.	11.	28 mm	4.83 Kg./Rmt.
5.	14 mm	1.21 Kg./Rmt.	12.	32 mm	6.31 Kg./Rmt.
6.	16 mm	1.58 Kg./Rmt.	13.	36 mm	7.99 Kg./Rmt.
7.	18 mm	2.00 Kg./Rmt.	14.	40 mm	9.86 Kg./Rmt.

M-19 High Yield Strength Steel Deformed Bars:

19.1. High yield strength steel deformed bars be either cold twisted or hot rolled shall conform to I.S. 1739-1966 and I.S. 1139- 1966 respectively.

19.2. Other provision and requirements shall conform to specification No. M-18 for Mild steel bars.

M-20 High Tensile Steel Wires:

20.1. The high tensile wires for the use in pre stressed concrete work shall confirm to I.S. 2090-1962.

20.2. The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per Para 6.1 of I.S.

1785-1962. Testing shall be done as per I.S. requirements. 20.3. The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborandum.

20.4. The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

M-21 Mild Steel Binding Wires:

21.1. The mild steel wire shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to I.S. 280-1972.

21.2. The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-22 Structural Steel:

22.1 All structural steel shall conform to I.S. 226-1965. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall conform to I.S. 1148-1973.

22.2 When the steel is supplied by the Contractor test certificates of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-23 Galvanised Iron Sheets:

23.1 The galvanised iron sheets shall be plain or corrugated sheets of specified in item. The G.I. Sheets shall conform to I.S. 277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise they shall have clean and bright surface and shall be free from dents, holes, rust or white powdery deposit.

23.2 The length and width of G.I. sheer shall be as directed as per site condition.

M-23 A: G.I. Valleys gutter ridges:

23. A.1 The G.I. ridges and hips shall be of plain galvanised sheets class-3 of the thickness as specified in item. These shall be 600 mm. in width and properly bent up to shape without damage to the sheets in process of bending.

23.A.2. Valleys gutters and flashings shall also be galvanised sheet of thickness as specified in item. Valleys shall be 900 mm. wide overall and fishing shall be 380 mm. wide overall. They shall be bent to the, required shape without damage to the sheet in the process of bending.

M-26 Shuttering:

26.1. The shuttering shall be either of wooden planking of 30 mm minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical bellies properly cross braced together so as to make the centering rigid. In places of bullied props, brick pillar of adequate section built in mud mortar may be used.

26.2. The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

26.3. If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in; charge, before the reinforcement bars are placed in position.

26.4. The props shall consist of bullies having 100 mm. minimum diameters measured at mix length and 80 mm. at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm. thick and minimum bearing area if 0-10 sq. m. lay on sufficiently hard base.

26.5. Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

26.6 The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planed on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

26.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

26.8 The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before, the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacturer may be applied in place of soap solution. In case of steel shuttering

either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

26.9 The shuttering for beams and slabs shall have camber of 4 mm. per metre (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-charge.

M-27 Expansion Joints-Pre-Molded Filler:

27.1 The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of pre molded bituminous joint filler.

27.2 Pre molded bituminous joint filler, i.e. performed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

27.3 Thickness of the pre-molded joint filler shall be 25 mm. unless otherwise specified.

27.4 Pre molded bituminous joint filler shall conform to I.S. 1838-1961

M-44 Paints:

44.1 (A) Oil paints:

44.1.1 Oil paints shall be of the specified colour and shade, and. approved. The ready mixed paint shall only be used. However, if ready mixed paint or specified shade or tint is not available, white ready mixed paint with approved stainer will be allowed. In such a case, the contractor shall ensure that the shade of the paint so allowed shall be uniform.

44.1.2 All the paints shall meet with following general requirements:

- (i) Paint shall not show excessive setting in a freshly opened full can and shall easily be redispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, livering, caking or colour separation and shall be free from lumps and skins.
- (ii) The paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.
- (iii) The paint shall not skin within 48 hours in a three quarters filled closed container.
- (iv) The paint shall dry to a smooth uniform finish free from roughness, grit, unevenness and other imperfections.

44.1.3 Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever.

44.2 (B) Enamel Paints:

44.2.1 The enamel paint shall satisfy in general requirements as mentioned in specification of oil paints. Enamel paint shall conform to I.S. 2933 - 1975.

Name of Work :- Construction of New Slab Drain Under TRIBAL/MMGSY/B.K./2026-27/ Package No. 01 In Ta. Danta Dist.Banaskantha (1) Constg. Kumbhariya Chamundamata Approach Road to Aeklavya Model School Road Km 0/000 to 0/100.

ITEM WISE SPECIFICATIONS

Item No. 1

Clearing and grubbing road land including uprooting trunk, vegetation, grass bushes, shrubs, sapling and trees girth upto 300 mm removal of stumps of trees cut earlier and disposal of unservicable materials [C] By Mechanical means in area of light jungle

201.1. Scope

Clearing and grubbing shall be performed less than one month in advance of earthwork operations and shall consist of cutting, trimming, removing and disposing of all materials such as trees, tree branches, bushes, shrubs, stumps roots, grass, weeds, anthills, jungle top organic soil not exceeding 150 mm in thickness, rubbish, loose stones, boulders, etc. which are undesirable and unsuitable for use in the works, from the designated area of road land, embankment slopes, drains, cross-drainage structures and such other areas as specified on the drawings or from areas as directed by the Engineer. It shall include grubbing, necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, removal and disposal of cleared materials in accordance with the requirements of these Specifications.

Recleaning of the site of any vegetation, grass shrubs before commencement of work shall be carried out as directed by the Engineer and shall be incidental to the work of clearing and grubbing.

201.2. Preservation of Property / Amenities

Roadside trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all highway facilities within or adjacent to the road which are not to be disturbed shall be protected from injury or damage by providing and installing suitable safeguards as shown in the drawing or as approved by the Engineer.

During clearing and grubbing the Contractor shall take all adequate precautions for preservation of all vegetation adjacent to road land against soil erosion, water pollution, etc. and where required, shall undertake additional works to that effect. Before start of operations, the Contractor shall submit to the Engineer for approval, his work

plan including the procedure to be followed for disposal of waste materials, etc. and the schedule for carrying out additional work where required.

201.3. Conservation of Top-soil

The top-soil removed during clearing and grubbing of site, if suitable for re-use shall be transported, conserved and stacked as directed by the Engineer. This shall be incidental to the work.

201.4. Methods, Tools and Equipments

Only such methods, tools and equipment as are approved by the Engineer shall be adopted for the work. If the area has thick vegetation/roots/trees, a crawler or dozer shall be used for clearance purposes. All trees, stumps, etc. falling within excavation and fill line shall be cut to such depth below ground level that in no case these fall within 500 mm of the sub grade. Also, all vegetation such as roots, under-growth, grass and other deleterious matter unsuitable for re-use in the embankment/sub grade shall be removed between fill lines to the satisfaction of the Engineer. On areas beyond these clearing limits trees and stumps required to be removed shall be cut down to 500 mm below ground level so that these do not present an unsightly appearance.

All branches of trees extending above the roadway shall be cut or trimmed so as to provide a clear height of 5 m above the road surface and shoulders.

All excavations below the general ground level arising out of the removal of trees, stumps etc. shall be filled with material conforming to prescribed requirements and compacted to specified density, given by the Engineer.

201.5. Removal of Ant-hills

Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed by excavating to a suitable depth as directed by the Engineer. The excavated ant-hills material shall be carted away from the site. Cavities in the ground due to removal of ant-hills shall be filled with approved material and compacted to specified densities, as directed by the Engineer.

201.6 Disposal of Materials

All materials including trees, stumps, etc. arising from clearing and grubbing operations shall be the property of Government and shall be disposed off by the Contractor as here-in-after provided or as directed by the Engineer.

Trunks, branches and stumps of trees shall be cleaned of limbs and roots and stacked. Also boulders, stones and other materials usable in road construction shall be neatly stacked as directed by the Engineer. Stacking of stumps, boulders, stones etc. shall be done at specified spots with all lifts and upto a lead of 1000 m.

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

201.7. Measurements for Payment

Clearing and grubbing for road embankment, drains and cross-drainage structures shall be measured on area **basis in terms of hector**.

Cutting of trees upto 300 mm in girth including removal of stumps and roots, and cutting/trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations. Removal of stumps of trees upto 300 mm girth left over after trees have been cut by any other agency of the Contractor or Government shall also be considered incidental to the clearing and grubbing operations.

Where the proposed work site passes through dense forest area, clearing and grubbing including cutting of trees of all girths and removal of their roots and stumps, etc. for construction of road embankment, drains and cross-drainage structures shall be measured on area basis.

201.8 Acceptance

Acceptance of clearing and grubbing shall be based on visual inspection of the work for compliance with the above specifications to the satisfaction of the Engineer.

201.9 Rate

201.9.1. The Contract unit rates for the various items of clearing and grubbing shall be paid/payable in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. These will also include removal of stumps and roots of trees less than 300 mm in girth as well as stumps left over after cutting of trees carried out by another agency of the Contractor or Government, excavation and backfilling to required density, where necessary, and handling, salvaging, piling and disposing of the cleared materials with all lifts and upto a lead of 1000 m.

201.9.2. The Contract unit rate for cutting (including removal of stumps and roots) of trees of girth above 300 mm and removal of stems and roots of trees of girth above 300 mm left over after trees have been cut by any other agency or the government shall include excavation and backfilling to required compaction, handling,

salvaging, piling and disposing of the cleared materials with all lifts and upto a lead of 1000 m as directed by the Engineer.

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

Item No.2

Earth work for embankment with selected soil including breaking clods, dressing, with all, lead and lift (excluding watering and consolidation) (A) From borrow area with All lead and lift & CBR not less than 6.

1. The land width on which the earth work is to be done shall be cleared off all the trees having girth of 30cm and less, loose stones, vegetations, bushes, slumps and all other objectionable material shall be arranged in convenient stack along the road boundary or as directed at place within 50 meters lead and handed over to the department in convenient section. Unsuitable material shall be burnt or otherwise disposed off by the contractor at his own cost without causing any nuisance, inconvenience or damage to the works property or people in the neighborhood. In all cases the materials shall be disposed off in an a neat manner.
2. After cleaning the site, the alignment of the road shall be properly set out true to line, curves, slopes, graded and sections as shown on the plan or directed by the Engineer in charge. The contractor shall provide all labours and materials such as lime, strings, pegs, nails, bamboos, stone, mortar, concrete etc. required for setting out, establishing bench marks and giving profiles. The contractor shall be responsible for maintaining benchmarks, profiles, alignments and other marks as long as they are required for the work in the opinion of the Engineer in charge. If the contractor defaults in this respect they may be restored by the department at the cost of contractor.
3. When existing embankment is to be widened, continuous horizontal benches, each at least 0.30meter wide shall be cut into the existing slopes for insuring adequate bond with the fresh embankment material to be added. The material obtained from the cutting of benches can be utilized in the widening of the embankment. Where the width of widened portion, is insufficient to permit the use of rollers. Compaction shall be carried out with the help of tandem / sheep foot

rollers, hand rollers, mechanical tampers or other approved plant. The dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other type of hauling equipment.

4. The soil to be used for the embankment shall be free from trees, slumps, roots, rubbish or any other objectionable materials. Only materials considered suitable by the Engineer in charge shall be used for the construction and that considered unsuitable other disposed off as directed by him. The selection the materials to be used in the construction of embankment shall be made after the soil surveys and investigations are carried out by the department. The embankment shall consist of earth available from road side borrow pits on either side with lead and all lifts
5. The material satisfying the density requirements given in the table below shall be employed for embankment construction.

Type of Work	Laboratory Dry Density when tested as per IS 2720 {Part VII}
Embankment upto 3 meter height	Not less than 1.44 gm/cc
Embankment exceeding 3 meter height or embankment of any height subject to long period of inundation.	Not less than 1.52 gm/cc
Top 0.50 meter of embankment below the subgrade level and shoulder {where earth shoulder are specified}	Not less than 1.65 gm/cc

Field density shall be percentage of laboratory density as recommended by Gujarat Engineering Research Institute. Location, shape and size of borrow pits shall be as indicated by the Engineer-in-charge. Pits shall not be dug continuously. Ridges of not less than 8 metres width should be left at intervals not exceeding 300 metre. Small drain shall be cut through the ridges of facilities drainage. The outer edge of borrow pits shall be so regulated that the bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of final section of the bank, the maximum depth in any case being limited to 1.5 metres. Also no pits shall be dug within

5 metres of the tow of the final section of the road embankment.

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

- (i) upto 30 metres on either side of C.D. Works;
- (ii) upto 15 metres on either side of cart track crossing for which approaches are to be constructed
- (in) in the length in which earth obtained from cutting is specified to be used in the embankment.

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

6. The embankment shall be constructed in uniform layers not exceeding 250mm in loose thickness. The soil shall be spread uniformly over the entire width of the embankment unless otherwise directed by the Engineer in charge. The consolidation including watering and rolling of earthwork shall be carried out by the contractor. The operation of laying successive layers of earth shall have to suitably with the consolidation work. If the soil as delivered to the road bed is too wet, it shall be dried by exposure to the sun till the moisture content is acceptable for compaction. All clods of hard lumps of earth shall be broken to have maximum size of 15 cm, when being placed in the embankment and a maximum of size 5 cm when being placed in the top 45cm of the embankment and a maximum size of 15cm when being placed in the top 45cm of the embankment. The work of next layer shall be allowed only after the first layer below it has been thoroughly compacted to the density specified.
7. Where an embankment is to be placed on sloping ground the surface of the ground shall be benched in the steps of trenches or broken up in such a manner that the material shall have perfect bond with the existing surface. Where the embankment is to be laid over an existing road surface the surface shall be scarified to minimum depth of 5 cm so as to provide ample bond between the old and new material. However when the pavement shall be broken up in place not to exceed 0.1 mt and may be left under the new embankment. If the existing road surface is of granular or bituminous type and lies within 1 mt. of the new subgrade level the same shall be scarified to a depth of minimum 50mm so as to provide ample bond between the old and the new material.

8. To avoid interference with the construction of abutment, wing walls or return wall, culvers / bridge structures, the contractor shall at point to be determined by the Engineer in charge, suspend the work on embankment forming approaches to such structures, until such time as the construction of the latter is sufficiently advanced to permit the completion of approaches without the risk of interference or damage to the bridge work. Unless directed otherwise the filling ground culverts, bridges and other structure upto a distance to twice the height of the embankment from the back of the embankment shall be carried out independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing walls unless permission has been given by the Engineer in charge but in any case not until the concrete or masonry has been in position for 14 days. The embankment shall be brought up simultaneously with the laying of fill material. The material used for the filter shall conform to the requirements for filter medium and will be paid extra in the relevant item. Where it may be impracticable to use power roller or other heavy equipment, the compaction shall be carried out by mechanical tampers or other methods approved by the Engineer in charge. Care shall be taken to see that the compaction plant does not hit or come to close to any structural member so as to cause any damage to them.
9. The Embankment shall be finished in conformity with the alignment, levels, cross section and dimensions shown on the plans or as directed by Engineer in charge. Where the alignment of the road is a curve, the top of the embankment shall be formed with the super elevation and the increased width shown on the drawing or as the Engineer in charge may direct. Finishing operations shall include the work of shaping and dressing the shoulders, road bed and the side slopes to conform the cross section.
10. The earthwork measurements shall be paid on cross sectional measurements and computing the volumes of **earthwork in cubic meter** by average area method. The contractor shall sign day to day leveling work and also original cross section, longitudinal section etc., on token of his acceptance. The working section both longitudinal and cross of the ground shall be taken by the Engineer in charge before the actual work is started. The contractor or his authorized representative shall attend day to day leveling work and sign with date the field book daily, in token of his acceptance. If there is any disagreement, the

contractor shall inform of it in writing the officer concerned with specified reference to the section officer before starting further work. Once the work is started, no cognizance of any complaint will be taken. Merely not signing of level books shall not be deemed as disagreement. The Executive Engineer shall also verify leveling work to the extent of 5% before commencement of earthwork and on finalization. The contractor shall maintain the embankment by filling the rust, raincuts, depressions due to shrinkage etc. to proper formation and grade till this item is finally measured and accepted by the Department. The measurements shall be taken on compacted earthwork. No deduction for shrinkage shall be made from gross measured quantity of compacted earthwork. However the contractor shall have to bear loss of quantity due to all settlement as well as other types of deformations etc., if any, that might have taken place at the time of taking final measurements of this item.

11. The rate of earthwork includes clearing jungles, dogbelling, fixing profiles erecting necessary pillars for stones for bench marks for leveling purpose, excavating earth from borrow areas, breaking clods, conveying and spreading earth in layers with all lead and lift, finishing the entire embankment and incidentals necessary to complete the work to the specifications. The cutting stuff of cutting in ordinary soils, soft murrum, soft rock, hard murrum and hard rock shall be utilized in embankment construction under this item within the lead specified in that particular item. No payment shall be made under this item for the cutting stuff used in the embankment but labour for cutting will be paid as per specifications in that particulars item and only balance quantity of earthwork brought from borrow pits will be paid in this item.

Item No.3

Rolling of earthwork in layers with vibratory roller 80 Kn to 100 Kn static weight including filling in depressions which occurs during the process.

1. For spreading materials in layers and bringing the appropriate moisture content, the embankment materials shall be spread uniformly over the entire width of the embankment in layers not exceeding 250 mm in thickness. Successive layers of embankment shall not be placed until the layer under constriction has been thoroughly collected to the requirements set down hereunder:-

Moisture content of the materials shall be checked at the source of supply and if found less than the specified for compaction, the same, shall be made good either at the source or after spreading the soil in loose thickness for compaction. In the latter case, water shall be sprinkled directly from a hose line or from a truck mounted water tank, and flooding shall not be permitted under any circumstances.

If the materials delivered to the road bed is too wet it shall be dried, by evaporation and exposure to the sun, till the moisture content is brought down to acceptable level for compaction. Should circumstances arise, where owing to wet weather, the moisture content cannot be reduced to the required level by the above procedure, work of compaction shall be suspended.

Moisture content of each layer of soil shall be checked in accordance with ISI 2720 (Part-II) and unless otherwise mentioned shall be so adjusted, making due allowance for evaporation losses, that at the time of the compaction it is in the range of 1 percent to 2 percent below the optimum moisture content determined in accordance with ISI (Part-VII). Highly expansive clays shall however be compacted at 2 to 4 percent above the optimum moisture content.

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

Clods or hard lumps of earth shall be broken to have maximum size to 150mm when being placed in the lower layers of the embankment and maximum size of 60 mm when being placed in the top 0.5 metre portion of the embankment below the sub grade.

Hauling equipment shall be distributed uniformly over entire surface of the previously constructed layer to minimize cutting of uneven compaction.

Where the embankment is to be constructed on low area ground that will not support the weight of truck or other hauling equipment, the lower part of the fill should be constructed by dumping successive loads in a uniformly distributed layers of a thickness not greater than that necessary to support the hauling equipment while placing subsequent layers.

2.0 COMPACTION:

Only compacting equipment approved by the Engineer-in-charge shall be employed to compact the materials. The contractor shall demonstrate the efficiency of the plants he intends to use for carrying out compaction trials.

Each layer of the materials shall be thoroughly compacted to the densities specified in Table 1:2.

Table 1:2 Compaction requirements for Embankment.

Sr. No.	Type of Work / Materials	Field by density as per percentage of maximum laboratory dry density as per IS : 2720 (Pt. VIII)
1.	Top 0.5 metre portion of embankment below sub grade level and shoulders.	Not less than 100.
2.	Other portion of embankment	Not less than 95.
3.	Highly expensive class	85 to 90

Subsequent layers shall be placed only after finished layer has been tested according to M.O.S.T. specification MoRTH Clause 902 and accepted by the Engineer-in-charge.

When density measurements reveal any soft areas in the embankment further compaction shall be carried out as directed by the Engineer-in-charge: If in state of that the specific compaction is not achieved, the materials in the soft areas shall be removed and replaced by approved materials and compacted to the density requirement, to the satisfaction of the Engineer-in-charge..

3.0 Measurements for Payment:

Consolidation of earth embankment construction shall be measured by taking cross section at initials in the original position before the work starts and after its completion and computing of **the volume of earthwork in cubic meters** by the method of average and areas. The measurement of fill material from borrow are shall be the difference between the net quantities of suitable materials brought from roadway and drainage excavation. For this purpose it shall be assumed that one cubic meter of suitable materials brought to site from roadway and drainage excavation forms one cubed meter of compacted fill and all bulking or shrinkage shall be ignored

Stripping including storing and reapplication of top soil shall be measured as volume in cubic meter.

- 4.0 The contract unit rate includes cost of mechanical roller required for consolidation including all labour equipments fuel, hire charges, tolls, and incidentals necessary.

Item No. 4

Excavation for foundation in sand, gravel, clay soft soils and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff as directed. (A) Depth upto 3.0 M. and lead upto 100m for 10 Cum.

1.0. General:

1.1 Any soil which generally yields to the application of pickaxes and shovels, phawaras, rakes or any such ordinary excavating implement or organic soil, gravel, silt, sand turf loam, clay, peat etc., 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 removed as directed. The materials so obtained shall be property of the Government and be conveyed and stacked as directed within upto 100m for 10 cum. lead. The roots of the trees coming in the sides shall be cut and coated with hot asphalt.

2.2 The rate of site clearance is damaged be included in the rate of earthwork for which no extra will be paid.

3.0 Setting out: After clearing the site, the center 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 labourers, materials, etc. 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 strutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be levelled 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 other reason excavation is made deeper or wider than 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 3.0 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 levelling the ground in layers including ramming and watering etc.

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 all required load and all lift.

6.0. Mode of measurement and 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-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to slopping 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.5

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

1. Material for the purpose shall be of approved quality Any material which is found inferior shall be rejected and the contractor shall remove such rejected material from the site at his own cost The material shall be collected from quarries approved by the Executive Engineer The material shall be granular and gritty
2. The material shall be got approved by the Executive Engineer prior to collection on site It shall be free from all rubbish, dust and any organic materials as well as clods of black cotton soils Materials shall not be allowed to be collected from within the road boundary. Material to be used as crust and for side shoulders shall be as per C.B.R. report and that to be used as bind in W.B.M. road construction shall have P.I. value of less than 6 as determined in accordance with IS 2720 (Part-V). The material to be used should be got tested prior to its use in road construction. Testing charges shall be borne by the contractor.
3. River or nala or sea sand required for the work shall be clear, sound, properly, graded, free from organic materials silt clay etc. and shall be got approved by the Engineer-in-charge. The sand shall be obtained and brought from the source approved by the Engineer-in charge. The sand shall be well graded.

4. Stacking shall be done by filling in the standard steel boxes of 2 m x 1.5 m x 0.5 m size which shall be supplied by the Department if available on rent. Otherwise contractor shall make his own arrangement. No deduction for voids shall be made from the grade measurements. Where any doubt exists as to whether the quantity of slacks of murrum in an hectometre is not confirming with the cubic content of the standard pharas (2 x 1.5 x 0.5 M) the same shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of murrum in any stack in a particular hectometre is found to be less than the standard measurements viz.. 1.5 cmt the entire collection in the hectometre shall be paid on the basis of the quantity so found. Regular stacks shall be done by the Contractor on a fairly level ground. Stacking of the murrum shall be done in a manner as directed by the Engineer-in-charge.
5. For road work completed stacking of murrum as per requirement shall be earned out in 2 K.M. length before spreading. The collection shall always, be commenced at one end of the K.M. and be carried continuously toward the other end unless the Engineer-in-charge shall direct otherwise.
6. The payment shall be made on cubic metre basis without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials are collected, measured and finally accepted by the Department. The spreading of materials shall not be allowed till the materials are fully stacked and completed kilometer wise
7. The rate includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labour, tools, equipment and other incidental expenses.
8. The rate quoted are inclusive of all shall such tools, duties, fees, royalties, taxes etc.
9. The materials for the purpose shall be of approved quality. Any materials 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 or his authorised agent Para 3 to 8 shall apply. The sand used as crust shall be as per C.B.R. Report
10. Cutting shall be in soft rock such as limestone, sand stone, laterite, hard conglomerate or other softer disintegrated rock which may be quarried or split with crow bars, boulders which do not requiring and any rock which in dry state may be hard, requiring blasting but which when wet becomes soft and manageable be means other than blasting. The classification of excavation shall be decided by the Engineerin- charge and Ns decision shall be final and binding on the Contractor
11. Cutting shall be in any rock or boulders for which the use of mechanical plant for blasting is required. The classification of excavation shall be decided by the

Engineer-in-charge 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-in-charge.

12. In the opinion of the Engineer-in-charge where blasting is prohibited for any reason, excavation shall be carried out by chiselling, wedging or any other agreed method.
13. Blasting shall be carried out with the written permission of the Engineer-in-charge. All the statutory law, regulation rules, etc. pertaining to the acquisition, transport, storage, handling and use of explosives shall be strictly followed.
14. The Contractor may adopt any method or methods of blasting consistent with the safety and job requirements, after approval from the Engineer-in-charge.
15. The magazine for the storage of explosives shall be built to the designs and specifications of the Explosives Department concerned and located at the approval site. No unauthorised person shall be admitted into the magazine which when not in use shall be kept securely locked. No matches or inflammable material shall be allowed in the magazine. The magazine shall have an effective lightning conductor. The following shall be hang in the lobby of magazine.
 - (a) A copy of the relevant rules regarding safe storage both in English and in the language with which the workers concerned are familiar.
 - (b) A statement of upto date stock in the magazine.
 - (c) A certificate showing the last date of testing of the lightning conductor.
 - (d) A notice that smoking is strictly prohibited.
16. In addition to these, the Contractor shall also observe the following instructions and any further additional instructions which may be given by the Engineer-in-charge and shall be responsible for damage to property and any accident which may "occur to workmen or the public on account of any perations connected with the storage/handling or use of explosive and blasting. The Engineer-in-charge shall frequently check the Contractor's compliance with these precautions.
17. All the materials, tools and equipments used for blasting operations shall be approved type. The Engineer-in-charge may specify the type of explosives to be allowed in special cases. The fuse to be used in wet locations shall be sufficiently water resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and denfinitely known to permit such a safe length being cut as will permit sufficient time to the fires or reach safely before explosion takes place. Detonators shall be capable of giving effective blasting of the explosives. The blasting powder explosives, detonators etc. ashalt be fresh and not damaged due to dump., moisture or any other cause. They shall be inspected totally and removed immediately.
18. The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the handling explosives and blasting operations.

19. The blasting shall be carried out during fixed hours of the day preferably during the midday lunch hour or at the close of the works as ordered in writing by the Engineer-in-charge. The hours shall be made known to the people in the vicinity. All the charges shall be prepared by the man in charge only.
20. Red danger flags shall be displayed prominently in all directions during the blasting operations. People except those who actually light the fuse, shall be prohibited from entering this areas. The flags shall be planted 200 meters from the blasting site in all directions and all persons including workmen shall be excluded from the flagged area at least 10 minutes before the firing, a warning whistle being sounded for the purpose.
21. The enlarge holes shall be drilled to required depths and in suitable places. Blasting should be as light as possible consistent with through breakage of the material necessary for economic loading and hauling. Any method of blasting which leads to overshooting shall be discontinued.
22. When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and powder dropped in. The powder shall be gently tamped with copper rods with rounded ends. The explosive powder shall then, be covered with tamping materials which shall be tamped light but firmly. 54 General Technical Specification of Roads.
23. When blasting is done with dynamite and other high explosives, dynamite cartridges shall be prepared by inserting the square cut end of a fuse into the detonator and finishing it with nippers at the open end, the detonator gently pushed into the primer leaving 1/3rd copper tube exposed outside. The paper of the cartridge shall then be closed up and securely bound with wire, or twine,. The primer shall be housed into the explosive. Bore holes shall be of such size that the cartirdge can easily go down. The holes shall be cleared of all debris and explosive inserted. The space of about 20 cm. above the charge shall then be gently filled with dry clay, passed home and the rest of the tamping formed of any convenient material gently packed with a wooden hammer.
24. At a time, not more than 10 such charges will be prepared and fired: The man in charge shall blow a whistle in a recognised manner for cautioning the people. All the people shall then be required to move to safe distances. The charge shall be lighted by the man in charge only. The man in charge shall count "the numbers explosions, He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back top the work site.
25. In case of a misfire, the following procedure shall be observed.
 - (1) Sufficient time shall be allowed to account for the delayed blast. The man incharge shall inspect all the charges and determine the missed charges.
 - (2) If it is the blasting powder charge it shall be completely flooded with water. A new hole shall be drilled at about 45 cm from the old hole and fired. This should blast the old charge should it not blast the old charge the procedure shall be repeated till the old charge is blasted.
 - (3) In case of charges of gelatin, dynamite, etc. the man in charge shall gently remove the tramping and the primer with the detonator. A fresh detonator and primer shall then be used to blast the charge alternatively the hole may be cleared of 30 cm. of

tamping and the direction then ascertained by placing a stick in the hole. Another hole may then be drilled 15 cm away and parallel of H,. This hole shall then be charged and fired. The misfired hole should explode at the same time. The man in charge shall at once report to the contractor's office and Engineer-in-charge all cases of misfire, the cause of the same and what steps were taken in connection therewith.

26. If a misfire has been* found to be due to defective detonator or dynamite, the whole quantity in the box from which defective article was taken must be sent to the authority by the Engineer-in-charge for inspection to ascertain whether all the remaining materials in the box are also defective.
27. A careful and day to day account of the explosive shall be maintained by the contractor in the approved register and manner which shall be open to inspection by the Engineer-in-charge at all times.
28. Excavation shall be measured after removal of over burden by taking cross Sections at suitable intervals in the original position before the work starts and after its completion, and computing the volumes in cubic meters by the methods of average end areas. 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-in-charge, the Contractor shall leave depth indicators during excavation 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. 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 40 percent deduction therefrom.

The payment will be made on Cubic Metre basis of the finished work

Item No. 6

Providing & filling in foundation with ordinary cement concrete M 100 mix and providing necessary vertical pin headers including formwork vibrating ramming & curing complete.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm cubes expressed in kg. / cm².

3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metres in volume. While measuring aggregate by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is dump, allowance for "bulking" shall be made as per I.S.: 2386 (Part- III).

3. Ingredients required for ordinary concrete containing one 50 Kg bag of cement of different proportions of mix shall be as given in Table below.

TABLE

Grade of concrete	Mix by Volume	Total quantity of dry aggregate by volume per 50 Kg. / of cement to be taken as per sum of individual volume of fine and coarse aggregates, maximum	Proportion of fine aggregate to coarse aggregate.	Quantity of water per 50 Kg. of cement maximum.
1	2	3	4	5
Ordinary	Liters			Liters
M-100	1:3:6	300	Generally 1 : 2 for aggregate to coarse aggregate by volume but subject to and upper limit of 1 : 1 ½ and a lower limit 1 : 3	34
M-150	1:2:4	220		32
M-200	1:1 ½ : 3	160		30
M-250	1 : 1 : 2	100		27

NOTE - The proportions of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer & the maximum size of coarse aggregate becomes larger.

Example - For an average grading of fine aggregate (that is Zone II of I.S.: 383-1963) the proportions shall be 1:1.1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

Note-2 A mix leaner than M.100 (1:3:6) may be used for non- structural parts, if provided in the contract. In such case grading of aggregates shall be by volume. Other requirements for mixing, placing & curing shall be the same.

5. Following shall be the maximum nominal size of coarse aggregate for the different items of work.

Sr. No.	Item of Construction	Maximum size of coarse aggregate
(i)	R.C.C. well curb, R.C.C. well staining and R.C.C. Pipes	40 mm.
(ii)	R.C.C. well staining	63 mm
(iii)	Well cap or pipe cap; solid type pipes abutment and wing-walls, and their pipe caps	40 mm
(iv)	R.C.C. works in cross girders deck slab, wearing coats, kerb, light posts, blast walls, approach slab etc. and hollow type piers, abutment, wing-walls and their pier caps.	20 mm
(v)	R.C.C. bearings	20 mm
(vi)	For any other item of construction not covered by items (i) to (v)	As specified on the drawing or as desired by the Engineer-in-charge in case it is not specified on drawing.

For heavily reinforced concrete members as in the case of ribs of main beams nominal maximum size of aggregate shall usually be restricted to 5 mm less than the minimum lateral clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement, whichever is the smaller.

6. Fine aggregate shall be clean, hard, coarse sand. It shall be free from dust and such other substances. The sand be got approved by the Engineer-in-charge.

7. All materials shall be stored as to prevent their deterioration or intrusion of their quality and fitness for the work. Any material which has deteriorated or has been damaged or is otherwise considered defective by the Engineer-in-charge shall not be used in the works.

8. Cement shall be stored above the ground level in perfectly dry and water tight sheds. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned at least once every 3 to 4 months. The aggregate shall be stored in such a way as to prevent admixture of foreign materials. Different size of fine or coarse aggregate shall be stored in separate stock-

piles sufficiently away from the each other to prevent intermixing the materials.

9. The water for mixing shall be potable water to satisfaction of the Engineer-in-charge. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the job.

10. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate show complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

11. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Enough water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 per cent above that specified.

12. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer-in-charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

13. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes places. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any

part of the structure until the approval of the Engineer-in-charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in-charge, concrete shall be deposited in horizontal layers to neither a compacted depth of nor more than 0.45 metre when internal vibrators are used and not exceeding 0.30 metre in all other cases.

15. Unless otherwise agreed to by the Engineer-in-charge concrete shall not be dropped into place from a height exceeding 2 metres. When trunking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept, clean, thoroughly wetted and covered with a 13 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the well surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm in thickness, and shall be well rammed against old work particular attention being given to corners and close spots.

16. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators can not be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of break downs.

17. Immediately after compaction, concrete shall be protected against harmful effects of weather, including rain, running water, shocks, vibration, traffic, rapid temperature

changes, frost and driving out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer-in-charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

18. Form work shall include all temporary or permanent forms required for forming the concrete together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories:

(1) Shuttering i.e., form work required for forming the concrete.

(2) Scaffolding i.e., form-work required for supporting shuttering.

Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be of substantial rigid construction and shuttering shall be true to shape and dimensions shown on the drawings: All bolts and rivets shall be counter-sunk and well ground to provide a smooth, plane surface.

19. Forms shall be mortar-tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports. They shall be strong enough to withstand all pressure, ramming and vibration, without deflection from the prescribe lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the formwork either before or during the placing of concrete. Suitable camber shall be provided in horizontal members of structure, specially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chambers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

20. The inside surfaces of shuttering shall, except in the case of permanent form work or where otherwise agreed to by the Engineer-in- charge, be coated with an approved material to prevent adhesion of concrete to the form work. Release agents shall be applied strictly in accordance with the manufacturer's instructions and shall not be allowed to come into contact with any reinforcement or pre stressing tendons and

anchorage. Different release agents shall not be used in form work for concrete which will be visible in the finished works:

21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before the form work is removed. Wherever applicable arrangements must be made to ensure that the form work does not restrain the shortening and hogging of the beams or slabs during tensioning of the tendons. The form work should take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structures having regard to the deformation of a false work, scaffolding or propping and the instantaneous or deferred deformation due to various causes affecting pre stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. Form work shall be tight enough to prevent any appreciable loss of cement during vibrations, suitable tolerances should be provided in the form work, immediately before concreting all forms shall be thoroughly cleaned. Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength alignment and general fitness, but such inspection shall not relieve the contractor of his responsibility for safety of men, machinery, materials and for results obtained.

22. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formwork, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. Where field operations are controlled by strength tests of concrete, the removal of the load-supporting or soffits forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subjected at the time of striking props including the effect of any further addition of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and walls may be removed after 2 days. The props of slabs and beams may be removed after 14 and 21 days respectively. All formwork shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their

removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm cover to the finished concrete surface. Where it is intended to reuse the formwork, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-charge are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

24. In the case of reinforced concrete work workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend up on the nature of work and methods of vibration of concrete shall be determined by regular slump tests. Following slump shall be adopted for different types of works.

Sr. No.	Type of Work	Slumps	
		Where vibrators are used	Where vibrators are not used
(i)	Mass concrete in R.C.C. foundations, footings and retaining walls	10 mm to 25 mm	80 mm
(ii)	Beams, slabs and columns simply reinforced	25 mm to 40 mm	100 mm to 120 mm

(iii)	Thin R.C.C. section or section with congested steel.	40 mm to 50 mm	125 mm to 150 mm
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25. Works strength tests shall be made in accordance with I.S.: 516. Each test shall be conducted on ten specimens five of which shall be tested at seven days and the remaining five at 28 days. The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic metre of concrete or a part thereof. However, if concreting done in a day is less than 15 cubic meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is charged irrespective of the quantity of concrete proud. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-charge when procedure of tests given above reveal a poor quality of concrete and in other special cases.

26. The average strength of the group of cubes cast for each day shall not be less than the specified works cube-strength. 20 per cent of the cubes cast for each day may have values less than the specified strength, provided the lowest value is not less than 85 per cent of the specifies strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall approved by he Engineer-in-charge. One carpenter with helper will invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall provide so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, Kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Assistant Engineer / Additional Assistant Engineer Overseer or as instructed by the Engineer-in-charge. After removal of form work checks that concrete produced is of good quality. Plastering shall not be allowed to the expressed faces of concrete.

28. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.

29. All necessary labour, materials equipment, etc., for sampling, preparing test cubes, curing etc., shall be provided by the Contractor. Testing of the materials and concrete

may be arranged by the Engineer-in-charge in an approved laboratory at the cost of the contractor.

30. The payment will be made on cmt basis of the finished work.

31. The unit rate of concrete shall include the cost of all materials, labour, tools and plan required for mixing, placing in position, vibrating and compacting finishing as per directions of the Engineer-in-charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as show on the drawings and according to these specifications. The rate shall also include the cost of making/fixing and removing of all centers and forms required for the work.

Item No.7

Providing and casting in situ controlled cement concrete M200 mix for RCC work in piers, abutment and RCC return as per drawing including centering, shuttering, scaffolding where necessary laying, vibrating, curing and finishing complete. (A) All Height {Piers, Return wall, Abutment}.

1. For controlled concrete, design of the mix shall be approved after preliminary tests and all necessary precautions shall be taken in its production to ensure that the required works cube strength is attained and maintained. The controlled concrete shall be in eight grades designated as M.100, M.150, M.200, M.250, M.300, M.400 and M.450 with the suffix controlled added to it.

2. In the designation of a concrete mix letter 'M' refers to the mix and the number to the specified 28 days works cubs compressive strength of that mix on 150mm cubes, expressed in kg/cm² where Ordinary Portland cement conforming to IS : 269 or ortland blast furnace cement conforming to IS : 455 is used, the compressive strength equirements for various grades of concrete shall be as give below on the next page :-

Grade of concrete	Compressive works test strength in kg/cm ² on 150 mm cubes, conducted in accordance with IS : 516	
	Min. at 7 days	Min. at 28 days
M 100	70	100
M 150	100	150
M 200	135	200
M 250	170	250

M 300	200	300
M 350	235	350
M 400	270	400
M 450	300	450

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

3. Concrete mix shall be designed on the basis of preliminary tests so as to attain a strength at least 33 per cent higher than that required on work tests. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the 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 should be controlled by obtaining the coarse aggregates in different sizes and blending them in the right proportions as required. Aggregates of different sizes shall be stocked in separate stock piles. Required quantity of material shall be stock piled several hours, preferably a day before. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests.

4. 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 manufacturer's weight per bag a reasonable number of bags shall be weighed separately to check the net weight. Where cement is weighed from bulk stocks at site and not by bags, it shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

5. It is most important to keep the specified water cement ratio constant and at its correct value. To this end moisture content of 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 cement .For the determination of moisture content in the aggregates IS : 2386 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in 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 210 kgs. Per cubic metre in plain concrete and not less than 300 kg/per cubic metre in reinforced concrete structural member. The Minimum quantity of cement for prestressed concrete work shall not less than 360 kg/per cubic metre of concrete nor shall it be more than 540 kg/per cubic meter of concrete.

6. Following shall be the maximum nominal size of coarse aggregate for the different items of work :

Sr.No.	Item of construction	Maximum nominal size of coarse aggregate
i	RCC well curb, RCC well staining and RCC piles.	40 mm
ii	PCC well staining	63 mm
iii	Well cap or pile cap; solid type piers, abutments and wing-walls their pier caps	40 mm
iv	RCC works in cross girders, deck slab, wearing coarse, kerb, light posts, blast walls approach slab etc., and hollow type piers, abutments wing walls and their pier caps.	20 mm
v	RCC bearings	20 mm
vi	For any other item of construction not covered by items (i) to (v) above	As specified on the drawing or as desired by the Engineer in charge in case it is not specified on drawing

.For heavily reinforced concrete members as in the case of ribs of main Beam

nominal maximum size of aggregate shall usually be restricted to 5 mm. less than the minimum internal clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement whichever is the smaller. Fine aggregate shall be clean, hard, coarse sand. It shall be free dust and such other substances. The sand be get approved by the Engineer in charge.

8. All materials shall be stored as to prevent their deterioration of there quality and fitness for the work. Any material which has deteriorated or has been damaged or is otherwise considered defective by the Engineer in charge shall not be used in the works.

9. Cement shall be stored above the ground level in perfectly dry and Watertight sheds. Wherever buld storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned atleast once every 3 to 4 months. The aggregates shall be stored in such away as to prevent admixture of foreign materials. Different sizes of fine or coarse aggregate shall be stored in separate stock piles sufficiently away from such other to prevent intermixing the materials.

10. The water for mixing shall be potable water to satisfaction of the Engineer in charge. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the job.

11. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each indidual particle of the coarse aggregate shows complete coating of mortar containing its roportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have ben put into the mixer.

12. Mixer which have been out of use more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to be the Engineer in charge, the first batch of concrete from the mixer shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

13. The method of transporting and placing concrete shall be approved by the Engineer in charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work and reinforcement contained in it shall be cleaned and made free from standing water, dust, snow or ice

immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer in charge has been obtained.

14. If concreting is not started within 24 hours of the approval being given. It shall have to be obtained again from the Engineer in charge. Concreting then shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously when this time shall be within 3 hours of the addition of cement to the mix an within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer in charge. Concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 metre when internal vibrator are used not exceeding 0.30 metre in all other cases.

15. Unless otherwise agreed to be the Engineer in charge concrete shall not be dropped in to place from a height exceeding 2 metres. When trucking or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shal be roughened,swept clean, thoroughly wetted and cover with a 10 mm. thick layer of mortar composed of cement an sand in the same ratio as in the concrete mix itself. This 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layers of concrete to be placed on this surface shall not exceed 150 mm. In thickness and sha be well rammed against old particular attention being given to corners and close sports.

16. All concrete shall be compacted to produce a dense homogeneous mas with the assistance of Vibrators, unless otherwise permitted by the Engineer in charge for exceptional cases, such as concreting under water, where vibrators can not be used.Sufficient vibrator in serviceable condition shall be kept at site so that spare equipment is always available in the event of break downs.

17. Immediately after compaction, concrete shall be protected against harmful effects of weather including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and drying out process. It shall be covered with wet sacking,Hessian or other

similar, absorbent material approved by the Engineer in charge soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over the foundation concrete may be started after 48 hours of its laying but the curing o concrete shall be continued for a minimum period of 14 days.

18. Form work shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. Form work shall however be divided into following two district categories :-

Shuttering i.e. form work required for forming the concrete. (2) Scaffolding i.e. form work required for supporting shuttering. Forms for shuttering shal be constructed only, in metal suitably lined. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be substaintial rigid construction and shuttering shall be true to shape and dimensions hsow on the drawings. All bolts and riverts shall be counter suck and well ground to provide a smooth, plane surface.

19. Forms shall be mortar tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports. They shall be strong enough to with stand all pressure, ramming and vibration, without deflection from the prescribed lines occurring during and after placing the concrete. Screw jacks or hardwood wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete. Suitable camber shall be provided in horizontal members of structure specially in long span to counterate the effects of any deflection. The form work shall be so fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence. Without damaging the surface of concrete or disturbing other sections.. Unless otherwise specified or directed, chamfers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of form work to avoid sharp corners.

20. The inside surface of shuttering shall except in the case of permanent form work or where otherwise agreed to be the Engineer in charge, be coated with an approved material to prevent adhesion of concrete to the form work. Release agents shall be applied strictly in accordance with the manufacture's instruction sand shall not be allowed to come into contact with any reinforcement. Or pre stressing tendons and anchorages. Different release agent shall not be used in form work for concrete which will be visible in the finished works.

21. Special measures shall be taken to ensure that the form does not hinder the shrinkage of concrete because without these cracking could occur before the form work is removed. Wherever applicable arrangements must be made to ensure that the form work does not restrain the shortening and hogging of the beams or slabs during tensioning of the tendons. The formwork should take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structure having regard to the deformation due of false work, scaffolding or propping and the instantaneous or deferred deformation due to various causes affecting pre stressed structure. Where they are reentrant angles in the concrete has set in order to avoid cracking due to shrinkage of concrete. Form work shall be tight enough to prevent any appraisable loss of cement during vibrations. Suitable tolerance should be provided in the form work. Immediately before concreting all forms shall be thoroughly cleaned. Contractor shall give the engineer in charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness, but such inspection shall not relieve the contractor of his responsibility for safety of men, machinery, material and for results obtained.

22. The Engineer in charge shall be informed in advance by the contractor of his intention to strike any form work. While fixing the time for removal of form work, due consideration shall be given to local conditions that influence the setting of concrete and of concrete and of the materials used in the mix. Where field operations are controlled by strength tests of concrete the removal of the load supporting of soffit forms may commence when concrete has attained strength props including the effect or any further additional of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and walls may be removed after 2 days. The props of slabs and beams may be removed after 14 days respectively. All form work shall be removed without causing any damage to the concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm. cover to the finished concrete surface. Where it is intended to be cleaned and made good to the satisfaction of the Engineer in charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the cement concrete member to a depth of atleast 25 mm. below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregated mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure through filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honey combs, in the opinion of the Engineer in charge are of such an extent or character as to effect the strength of the structure materially or to endanger the life of the steel reinforcement he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

24. In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of Consistency, which shall depend upon the nature of work and methods of vibration of concrete shall be determined regular slump tests. Following slump shall be adopted for different types of works.

Sr.No.	Type of work	Where vibrators are used	Where vibrators are not used
		Slumps	
i	Mass concrete in RCC foundations, footings and retaining walls	10 mm to 25 mm	80 mm
ii	Beams, slabs and columns simply reinforced	25 mm to mm	100 mm to 120 mm
iii	Thin RCC section or section with congested steel	40 mm to 50 mm	125 mm to 150 mm

25. For controlled concrete preliminary tests shall consist of three sets of separate tests and in each set, tests shall be conducted on six specimens. Not more

than one set of six specimens shall be made on any particular day of the six specimen in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests at 27 days are intended only to indicate the strength likely to be attained at 28 days. Work strength tests shall be made in accordance with IS : 516 EACH test shall be conducted on ten specimens five of which shall be tested at seven days and the remaining five at 23 days. The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic metre of concrete or a part thereof. However if concreting done in a day is less than 15 cubic metre the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer in charge. Similar works tests shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer in charge when procedure to tests given above reveals a poor quality of concrete and in other special cases.

26. The average strength of the group of cubes cast for each day shall not be less than the specified works cube strength. 20 per cent of the cubes cast each day may have values less than the specified strength, provided the lowest value is not less than 85 per cent of the specified strength.

27. RCC work shall have exposed concrete surface. Centering design and its erection shall be approved by the Engineer in charge. One carpenter with helper will invariably be kept throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over reinforcement laid in position. For access to different parts, suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Asstt.Engineer/Addl.Asstt.Engineer/Overseer or as instructed by the Engineer in charge. After removal of form work and shuttering the executive Engineer shall inspect the work and satisfy by random checks that concrete produced is of good quality. Plastering shall not be allowed to the exposed faces of concrete.

28. In reinforced concrete the volume covered by reinforcement shall not be deducted. The slab be measured as running continuously through and the beam as the portion below the slab.

29. All necessary labour, material, equipment etc. for sampling preparing test cubes, curing etc. shall be provided by the contractor. Testing of the materials and concrete may be arranged by the Engineer in charge in an approved laboratory at the cost of the contractor.

30. The payment will be made on cmt. Basis of the finished work.

31. The unit rate for concrete shall include the cost of all materials, labour, tools and plant required for mixing, placing in position, vibrating and compacting finishing as per directions of the Engineer in charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the drawings and according to these specifications. The rate shall also include the cost of making fixing and removing of all centres and forms required for the work.

Item No. 8

Providing and casting in-situ controlled cement concrete M 250 for R.C.C. works in pier cap abutment cap and dirt wall including controlled cement concrete M 250 bed block or pedestals of required size below bearing as per detailed drawing centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete

The work shall be carried out as per relevant specification of this Tender Item No. – 7. The grade of concrete shall be M-200 The concreting shall be done as per detailed drawing. The contract unit rate includes centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete.

The contract rate shall be for a unit of 1 Cu.M. for completed item.

Item No.9

Providing and casting in situ ordinary cement concrete M. 300 for R.C.C. solid slab including centering scaffolding curing and finishing complete.

The work shall be carried out as per relevant specification of this Tender Item No. – 6. The grade of concrete shall be M-100 The concreting shall be done as per detailed drawing. The contract unit rate includes centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete.

The contract rate shall be for a unit of 1 Cu.M. for completed item.

Item No. 10

Providing and casting in situ controlled cement concrete M-300 for approach slab including formwork curing and finishing complete.

The work shall be carried out as per relevant specification of this Tender Item No. – 7. The grade of concrete shall be M-200 The concreting shall be done as per detailed drawing. The contract unit rate includes centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete.

The contract rate shall be for a unit of 1 Cu.M. for completed item.

Item No. 11

Providing and casting in situ Controlled cement concrete M-400 for average 100 mm thick wearing coat laid as directed including tamping vibrating finishing curing and filling in joints with bitumen completed.

The work shall be carried out as per relevant specification of this Tender Item No. – 7. The grade of concrete shall be M-200 The concreting shall be done as per detailed drawing. The contract unit rate includes centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete.

The contract rate shall be for a unit of 1 Cu.M. for completed item.

Item No.12

Providing and casting in situ ordinary cement concrete M.250 for kerb/kerb block including formwork curing and finishing complete.

The work shall be carried out as per relevant specification of this Tender Item No. – 6. The grade of concrete shall be M-100 The concreting shall be done as per detailed drawing. The contract unit rate includes centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete.

The contract rate shall be for a unit of 1 Cu.M. for completed item.

Item No.13

Providing & filling in foundation with ordinary cement concrete M 150 mix and providing necessary vertical pin headers including formwork vibrating ramming & curing complete.(A) Height from 0.0 to 5.00 mt

The work shall be carried out as per relevant specification of this Tender Item No. – 6. The grade of concrete shall be M-100 The concreting shall be done as per detailed drawing. The contract unit rate includes centering, shuttering, scaffolding, wherever necessary laying, vibrating, curing and finishing complete.

The contract rate shall be for a unit of 1 Cu.M. for completed item.

Item No.14

Providing and laying in position FE 550D TMT bar reinforcement with Providing fusion bonded Epoxy coating not less than 175 micron thickness and up to 300 micron to reinforcement bars as per IS-13620-1993/ASTM-775 M including testing of coating at plant including cutting, bending, hooking and tying complete as per detailed for the following.

1.0. GENERAL

This work shall consist of furnishing and placing coated, or uncoated TMT or high strength deformed reinforcement, bars (intentioned) of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer in charge.

2.0. MATERIAL**2.1. TMT Bars**

Reinforcements may be either TMT/medium tensile steel or high strength deformed bars. They may be uncoated or coated 'with epoxy or with approved protective coatings.

2.2. TMT bars reinforcement for RCC work shall conform to IS 1786 FE-415 and shall be of tested quality. It shall also comply with relevant part of IS 456-1966

2.3. All reinforcement shall be clean and free from dirt, paint, grease or oil, oil scale or loose or thick rust at the time of placing

2.4. All steel shall be procured from original producers no re-rolled steel shall be

incorporated in the work

2.5. Only new steel shall be delivered to the site every bar shall be inspected before placing to its position and defective brittle or burnt bar shall be discarded cracked ends of bars shall be discarded

3.0. Pitch

3.1. Distance between bars shall be as specified in drawings and as directed by the Engineer in Charge. all bars shall be placed at an accurate distance from each other and shall be bind tightly to maintain the desired pitch Suitable means shall be provided for holding bars securely in position

4.0. Binding wire

4.1. Mild steel binding wire shall be of 1.63 mm or 1.22 mm (16 to 18 gauge diameter and shall conform IS 280-1972

4.2. The use of black wire will be permitted for binding reinforcement bars. It shall be free from dirt, paint, grease or oil, oil scale or loose or thick rust and any other undesirable coating which may prevent adhesion of cement mortar at the time of binding

4.3. Only new binding wire shall be delivered to the site all binding wire shall be inspected before binding to its position and defective brittle, rusted, used wire, shall be discarded

5.0. PROTECTION OF REINFORCEMENT

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

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

the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

6.0. Workmanship

6.1. The work shall consist of furnishing and placing reinforcement to the shape and dimensions shown as on the drawings or as directed by The Engineer in charge.

6.2. Reinforcing steel shall conform accurate to the dimensions given in the bar bending schedules shown on relevant drawing

7.0. BENDING OF REINFORCEMENT

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

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

7.3. Bars shall be bent cold to the specified shape and dimensions or directed by the Engineer using a proper bar bender operated by hand power to obtain the correct radius of bends and shape. Bars, shall not be bent or straightened in a manner that will damage parent material or the coating bars bent during transport or handling shall, be straightened before being used on work and shall not be heated to facilitate straightening.

8.0. PLACING OF REINFORCEMENT

8.1. The reinforcement cage should generally be fabricated in the yard at ground level, and then shifted and placed in position. The reinforcement shall be placed strictly, in accordance with the drawings and shall be assembled in position, only when structure is otherwise ready for placing of concrete. Prolonged time gap, between assembling of reinforcements and casting of concrete, which may result in rust formation on the surface, shall not be permitted.

8.2. Reinforcement bars shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed), conforming to IS:280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1 mm.

8.3. Bars shall be kept in. position usually by the following methods:

In case of beam an slab construction, industrially produced polymer cover blocks of

thickness equal to the specified cover shall be placed between the bars and formwork subject to satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer, provided they have the same strength and specification as those of the member.

8.4. In case of dowels for Columns and walls the vertical reinforcement shall be kept in position by means of timber templates with slots in them accurately, or with cover blocks tied to the Reinforcement Timber templates shall be removed after the concreting has progressed up to a level just below their location.

8.5. Layers of reinforcements shall be separated by spacer bars at approximately One meter intervals. The minimum diameter of spacer bars shall be 12 mm or: equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater. Horizontal reinforcement shall not be, allowed to sag between supports.

8.6. Necessary stays, blocks, metal chairs, spacers, metal hangers. supporting wires etc, or other subsidiary, reinforcement shall be provided to fix the reinforcements firmly in its correct position.

8.7. Use of pebbles, broken stone, metal pipe, brick, mortar or wooden blocks etc as devices for positioning reinforcement shall not be permitted.

8.8. Bars coated with epoxy or any other approved protective coating shall be placed on supports that do not damage the coating. Supports shall be installed in a manner such that planes of weakness are not created in hardened concrete. The coated reinforcing steel shall be held in place by use of plastic or plastic coated binding wires especially manufactured for the purpose.

8.9. Placing and fixing of reinforcement shall be inspected and approved by the Engineer before concrete is deposited.

9.0. Lapping

9.1. All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, except where shown on the drawing; will be permitted without approval of the Engineer. The lengths of the splice shall be as indicated on drawing or as approved by the Engineer. Where practicable, overlapping bars shall not touch each other, and shall be kept apart by 25 mm or $1\frac{1}{4}$ times the maximum size of coarse aggregate, whichever is greater. If this is not feasible, overlapping bars shall be bound with annealed steel binding wire, not less than 1 mm diameter and twisted tight in such a manner as to

maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points, along the span where stresses are low.

10.0 Welding

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

10.2. While welding may be permitted for TMT reinforcing bars conforming to IS: 432, welding of deformed bars conforming to IS: 1786 shall in general be prohibited. Welding may be permitted in case of bars of other than S 240 grade including special. Welding grade of S 415 grade bars conforming to IS: 1786, for which necessary chemical analysis has been secured and the carbon equivalent (CE) calculated from the chemical composition using the formula: $CE = C + Mn + Cr + Mg + V + Ni + Cu \times 6.5$ is 0.4 or less.

10.3. The method of welding shall conform to IS: 2751 and IS: 9417 and to any supplemental specifications to the satisfaction of the Engineer

10.4. Bars shall be bent cold to the specified shape and dimensions or as directed by Engineer in charge using the proper bender tool, operated by hand or power to attain proper radius of bends. Bars shall not be bend or straightened in a manner that will injure the material. Bars bent during transport or handling shall be straightened before being used in the work. Bars shall not be heated to facilitate bending.

10.5. Unless otherwise specified a 'U' type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bane shall not be less then twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times of the diameter of the round bar. In case of bars which are not round and in case of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area the hooks shall be suitably encased to prevent any spiting of the concrete.

10.6. All reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm in size and by using say blocks or metal chairs spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals, Bars shall not be allowed to sag between supports not displaced during concreting or any other operations of the work All devices used for positioning shall be of not corrodible material wooden and metal supports shall not extended to the surface

of the concrete, except where shown in drawings. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall not be allowed. Pieces of broken stone or brick and wooden blocs shall not be used. Layers of bars shall be separated by spacer bars pre-cast mortar blocks or other approved devices. Reinforcement after bending placed in position shall be maintained in a clean condition until completely embedded in concrete, Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawings. All bars protruding from concrete and to which other bars are to be lapped and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout

10.7. Bars crossing each other where required shall be secured by binding wire (annealed) of size not less than 1 mm in such a manner that they do not slip over at the time of fixing and concreting.

10.7. As far possible bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the Engineer in charge. When practicable overlapping bars shall not touch each other, but be kept apart by 25 mm. Where not feasible overlapping bars shall be bound with annealed wires not less than 1 mm thick twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending moments is maximum.

10.8. Whenever indicated on drawing or desired the Engineer in charge bars shall be jointed by coupling which shall have a cross section sufficient to transmit the full stresses of bars. The end of the bars that are jointed by coupling shall be upset for 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 threads. Steel for coupling shall conform to IS 226.

10.8. When permitted or specified on the drawings joints of reinforcement bars shall be butt-welded so as to transmit their full stresses. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds shall be staggered so that at any one section not more than 20 percent of the rods are welded. Only electric arc welding using a process which excludes air from the molten metal and conforms to any or other special

provisions for the work shall be accepted Suitable means shall be provided for holding bars securely in position during welding It shall be ensured that no voids are left in welding and when welding is done in two or three stages previous surface shall be cleaned properly Ends of bars shall be cleaned of all loose scale rust stages paint and other foreign matter before welding Only competent welders shall be employed on the work. The M S electrodes used for welding shall conform IS 814 Welded pieces of reinforcement shall be tested. Specimen shall be taken form the actual site and their number shall frequency to test shall be as directed by the Engineer in charge

11.0 MODE OF MEASUREMENTS & PAYMENT

11.1. For the purpose of payment the bar shall be measured correct up to 10 mm length and weight payable works out at the rate specified below

1.	6 mm.	0.22 Kg./Rmt.	8.	20 mm	2.47 Kg./Rmt.
2.	8 mm	0.39 Kg./Rmt.	9.	22 mm	2.98 Kg./Rmt.
3.	10 mm	0.62 Kg./Rmt.	10.	25 mm	3.85 Kg./Rmt.
4.	12 mm	0.89 Kg./Rmt.	11.	28 mm	4.83 Kg./Rmt.
5.	14 mm	1.21 Kg./Rmt.	12.	32 mm	6.31 Kg./Rmt.
6.	16 mm	1.58 Kg./Rmt.	13.	36 mm	7.99 Kg./Rmt.
7.	18 mm	2.00 Kg./Rmt.	14.	40 mm	9.86 Kg./Rmt.

11.1. Excess consumption over 5% will be charged at penal rate.

11.2. Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Where welding or coupling is resorted to, in place lap joints, such joints shall be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in tones on the same basis of as per table given above even though steel is supplied to the contractor by the department on actual weight. Length shall include hooks at the ends. Wastage and annealed steel wire for binding shall not be measured and the cost of these items shall be deemed to be included in the rate for reinforcement.

11.3. The rate for reinforcement includes cost of steel binding wires, its carting to work site with all leads and lifts, cutting, bending, placing in position, binding and fixing in position as shown on the drawings and as directed. It shall also include all devices for keeping reinforcement in approved position, cost of joining as per approved method and all wastage and spacer bars.

11.4. The rate shall be for a unit of One M.T

Item No. 15

Providing and laying W.B.M of B.T.M.C metal of size 45 mm to 90 mm size including 0.27 Cu.M. Stone Screeing & 0.08 Cu.M. stone dust as filler including spreading, watering & consolidation by vibratory roller 80KN to 100KN static weight. 100 mm thick compacted.

404. WATER BOUND MACADAM SUB-BASE/BASE**404.1. Scope**

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

404.1.2. It is, however, not desirable to lay water bound macadam on an existing thin black topped surface without providing adequate drainage facility for water that would get accumulated at the interface of existing bituminous surface and water bound macadam.

404.2. Materials

404.2.1. Coarse aggregates : Coarse aggregates shall be either crushed or broken stone, crushed slag, overburnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed gravel/ shingle is used, not less than 90 per cent by weight of the gravel/ shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-6. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS : 2386 (Part 5).

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

TABLE 400-6. PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE COURSES

Test	Test Method	Requirements
1 * Los Angeles Abrasion value*	IS:2386	40 per cent (Max)
Or Aggregate (Max) Impact value	IS:2386 (Part-4) or IS:5640**	30 per cent (Max)
2 Combined Flakiness and Elongation Indices (Total)	IS:2386 (Part-1)	30 per cent (Max)

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

** Aggregates like brick metal, kankar, laterite etc. which get softened in presence of water shall be tested for Impact value under wet conditions in accordance with IS: 5640.

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

404.2.3. Crushed slag : Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed slag shall not be less than 11.2 kN per m³ and the percentage of glossy material shall not be more than 20. It should also comply with the following requirements:

- | | | | |
|-------|--------------------|---|---|
| (i) | Chemical stability | : | To comply with requirement of appendix of BS : 1047 |
| (ii) | Sulphur content | : | Maximum 2 per cent |
| (iii) | Water absorption | : | Maximum 10 per cent |

404.2.4. Overburnt (Jhama) brick aggregates : Jhama brick aggregates shall be made from overburnt bricks or brick bats and be free from dust and other objectionable and deleterious materials.

404.2.5. Grading requirement of coarse aggregates : The coarse aggregates shall conform to one of the Gradings given in Table 400-7 as specified, provided, however, the use of Grading No.1 shall be restricted to sub-base courses only.

TABLE 400-7. GRADING REQUIREMENTS OF COARSE AGGREGATES

Grading No	Size Range	IS Sieve Designation	weight passing er Percent by
1	90 mm to 45 mm	125mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0 - 15
		22.4 mm	0-5

Note :

The compacted thickness for a layer with Grading 1 shall be 100 mm while for layer with other Gradings i.e. 2 & 3, it shall be 75 mm.

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

Screenings shall conform to the grading set forth in Table 400-8. The consolidated details of quantity of screenings required for various grades of stone aggregates are given in Table 400-9. The table also gives the quantities of materials (loose) required for 10 m² for sub-base/base compacted thickness of 100/75 mm.

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

TABLE 400-8. GRADING FOR SCREENINGS

Grading Classification	Size of Screenings	IS Sieve Designation	Per cent by weight passing the IS Sieve
A	13.2 mm	13.2 mm 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10

TABLE 400-9. APPROXIMATE QUANTITIES OF COARSE AGGREGATES AND SCREENINGS REQUIRED FOR 100/75 MM COMPACTED THICKNESS OF WATER BOUND MACADAM (WBM) SUB-BASE/BASE COURSE FOR 10M² AREA

Classification	Size Range	Compacted thickness	Lose Qty.	Screenings			
				Stone Screening		Crushable type such as Moorum or Gravel	
				Grading Classification & Size	For. WHM Sub-base/base course (Loose quantity)	Grading Classification & Size	Loose Qty.
Grading 1	90 mm to 45 mm	100 mm	1.21 to 1.43m ³	Type A 13.2mm	0.27 to 0.30 m ³	Not uniform	0.30 to 0.30 m ³

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

The quantity of binding material where it is to be used, will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be 0.06-0.09 m³/10m² and 0.08-0.10m³/10m² for 100 mm compacted thickness.

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

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

404.3. Construction Operations

404.3.1. Preparation of base: The surface of the subgrade/ sub-base/base to receive the water bound macadam course shall be prepared to the specified lines and crossfall (camber) and made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained if necessary by sprinkling water. Any sub-base/base/surface irregularities, where predominant, shall be made good by providing appropriate type of profile corrective course (levelling course) to Clause 501 of these Specifications.

As far as possible, laying water bound macadam course over an existing thick

bituminous layer may be avoided since it will cause problems of internal drainage of the pavement at the interface of two courses. It is desirable to completely pick out the existing thin bituminous wearing course where water bound macadam is proposed to be laid over it. However, where the intensity of rain is low and the interface drainage facility is efficient, water bound macadam can be laid over the existing thin bituminous surface by cutting 50 mm x 50 mm furrows at an angle of 45 degrees to the centre line of the pavement at one metre intervals in the existing road. The directions and depth of furrows shall be such that they provide adequate bondage and also serve to drain water to the existing granular base course beneath the existing thin bituminous surface.

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

404.3.3. Spreading coarse aggregates : The coarse aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub-base/ base to proper profile by using templates placed across the road about 6 m apart, in such quantities that the thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 1 and 3, as specified in Clause 404.2.5. Wherever possible, approved mechanical devices such as aggregate spreader shall be used to spread the aggregates uniformly so as to minimise the need for manual rectification afterwards. Aggregates placed at locations which are inaccessible to the spreading equipment, may be spread in one or more layers by any approved means so as to achieve the specified results.

The spreading shall be done from stockpiles along the side of the roadway or directly from vehicles. No segregation of large or fine aggregates shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

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

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

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

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

Rolling shall be discontinued when the aggregates are partially compacted with sufficient void space in them to permit application of screenings. However, where screenings are not to be applied, as in the case of crushed aggregates like brick metal, laterite and kankar, compaction shall be continued until the aggregates are thoroughly keyed. During rolling, slight sprinkling of water may be done, if necessary. Rolling shall not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the subgrade or sub-base course.

The rolled surface shall be checked transversely and longitudinally, with templates and any irregularities corrected by loosening the surface, adding or removing necessary amount of aggregates and re-rolling until the entire surface conforms to desired crossfall (camber) and grade. In no case shall the use of screenings be permitted to make up depressions.

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

It shall be ensured that shoulders are built up simultaneously along with water bound macadam courses as per Clause 407.4.1.

404.3.5. Application of screenings: After the coarse aggregate has been rolled to Clause 404.3.4, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit

spreading arrangement. Tipper operating for spreading the screenings shall be so driven as not to disturb the coarse aggregate.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand-brooms or both. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse 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 screenings shall be carried out in only such lengths of the road which could be completed within one day's operation.

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

In case of lime treated soil sub-base, construction of water bound macadam on top of it can cause excessive water to flow down to the lime treated sub-base before it has picked up enough strength (is still "green") and thus cause damage to the sub-base layer. The laying of water bound macadam layer in such cases shall be done after the sub-base attains adequate strength, as directed by the Engineer.

404.3.7. Application of binding material: After the application of screenings in accordance with Clauses 404.3.5 and 404.3.6, the binding material where it is required to be used (Clause 404.2.7) shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or mechanical brooms to fill the voids properly, and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

404.3.8. Setting and drying: After the final compaction of water bound

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

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

404.4. Surface Finish and Quality Control of Work

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

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

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

Item No.16

Providing and laying W.B.M of B.T.M.C metal of size 45 mm to 63 mm size including 0.12 Cu.M. Stone Screening & 0.08 Cu.M. stone dust as filler including spreading, watering & consolidation by vibratory roller 80KN to 100KN static weight. 75 mm thick compacted.

404. WATER BOUND MACADAM SUB-BASE/BASE

404.1. Scope

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

404.1.2. It is, however, not desirable to lay water bound macadam on an existing thin black topped surface without providing adequate drainage facility for water that would get accumulated at the interface of existing bituminous surface and water bound macadam.

404.2. Materials

404.2.1. Coarse aggregates : Coarse aggregates shall be either crushed or broken stone, crushed slag, overburnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed gravel/ shingle is used, not less than 90 per cent by weight of the gravel/ shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall

conform to the physical requirements set forth in Table 400-6. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS : 2386 (Part 5).

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

TABLE 400-6. PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE COURSES

Test	Test Method	Requirements
1 * Los Angeles Abrasion value*	IS:2386	40 per cent (Max)
Or Aggregate (Max) Impact value	IS:2386 (Part-4) or IS:5640**	30 per cent (Max)
2 Combined Flakiness and Elongation Indices (Total)	IS:2386 (Part-1)	30 per cent (Max)

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

** Aggregates like brick metal, kankar, laterite etc. which get softened in presence of water shall be tested for Impact value under wet conditions in accordance with IS: 5640.

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

404.2.3. Crushed slag : Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed slag shall not be less than 11.2 kN per m³ and the percentage of glossy material shall not be more than 20. It should also comply with the following requirements:

- | | | | |
|-------|--------------------|---|---|
| (i) | Chemical stability | : | To comply with requirement of appendix of BS : 1047 |
| (ii) | Sulphur content | : | Maximum 2 per cent |
| (iii) | Water absorption | : | Maximum 10 per cent |

404.2.4. Overburnt (Jhama) brick aggregates : Jhama brick aggregates shall be made from overburnt bricks or brick bats and be free from dust and other objectionable and deleterious materials.

404.2.5. Grading requirement of coarse aggregates : The coarse aggregates shall conform to one of the Gradings given in Table 400-7 as specified, provided, however, the use of Grading No.1 shall be restricted to sub-base courses only.

TABLE 400-7. GRADING REQUIRMENTS OF COARSE AGGREGATES

Grading No	Size Range	IS Sieve Designation	weight passing er Percent by
1	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0 - 15
		22.4 mm	0-5

Note : The compacted thickness for a layer with Grading 1 shall be 100 mm while for layer with other Gradings i.e. 2 & 3, it shall be 75 mm.

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

Screenings shall conform to the grading set forth in Table 400-8. The consolidated details of quantity of screenings required for various grades of stone aggregates are given in Table 400-9. The table also gives the quantities of materials (loose) required for 10 m² for sub-base/base compacted thickness of 100/75 mm.

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

TABLE 400-8. GRADING FOR SCREENINGS

Grading Classification	Size of Screenings	IS Sieve Designation	Per cent by weight passing the IS Sieve
A	13.2 mm	13.2 mm 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10

TABLE 400-9. APPROXIMATE QUANTITIES OF COARSE AGGREGATES AND SCREENINGS REQUIRED FOR 100/75 MM COMPACTED THICKNESS OF WATER BOUND MACADAM (WBM) SUB-BASE/BASE COURSE FOR 10M² AREA

Classification	Size Range	Compacted thickness	Loose Qty.	Screenings			
				Stone Screening		Crushable type such as Moorum or Gravel	
				Grading Classification & Size	For. WHM Sub-base/base course (Loose quantity)	Grading Classification & Size	Loose Qty.
Grading 1	63 mm to 45 mm	75 mm	0.91 to 1.07m ³	Type A 13.2mm	0.12 to 0.15 m ³	Not uniform	0.22 to 0.24 m ³

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

The quantity of binding material where it is to be used, will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be 0.06-0.09 m³/10m² and 0.08-0.10m³/10m² for 100 mm compacted thickness.

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

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

404.3. Construction Operations

404.3.1. Preparation of base: The surface of the subgrade/ sub-base/base to receive the water bound macadam course shall be prepared to the specified lines and

crossfall (camber) and made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained if necessary by sprinkling water. Any sub-base/base/surface irregularities, where predominant, shall be made good by providing appropriate type of profile corrective course (levelling course) to Clause 501 of these Specifications.

As far as possible, laying water bound macadam course over an existing thick bituminous layer may be avoided since it will cause problems of internal drainage of the pavement at the interface of two courses. It is desirable to completely pick out the existing thin bituminous wearing course where water bound macadam is proposed to be laid over it. However, where the intensity of rain is low and the interface drainage facility is efficient, water bound macadam can be laid over the existing thin bituminous surface by cutting 50 mm x 50 mm furrows at an angle of 45 degrees to the centre line of the pavement at one metre intervals in the existing road. The directions and depth of furrows shall be such that they provide adequate bondage and also serve to drain water to the existing granular base course beneath the existing thin bituminous surface.

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

404.3.3. Spreading coarse aggregates : The coarse aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub-base/ base to proper profile by using templates placed across the road about 6 m apart, in such quantities that the thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 1 and 3, as specified in Clause 404.2.5. Wherever possible, approved mechanical devices such as aggregate spreader shall be used to spread the aggregates uniformly so as to minimise the need for manual rectification afterwards. Aggregates placed at locations which are inaccessible to the spreading equipment, may be spread in one or more layers by any approved means so as to achieve the specified results.

The spreading shall be done from stockpiles along the side of the roadway or directly

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

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

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

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

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

Rolling shall be discontinued when the aggregates are partially compacted with sufficient void space in them to permit application of screenings. However, where screenings are not to be applied, as in the case of crushed aggregates like brick metal, laterite and kankar, compaction shall be continued until the aggregates are thoroughly keyed. During rolling, slight sprinkling of water may be done, if necessary. Rolling shall not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the subgrade or sub-base course.

The rolled surface shall be checked transversely and longitudinally, with templates and any irregularities corrected by loosening the surface, adding or removing necessary amount of aggregates and re-rolling until the entire surface conforms to desired crossfall (camber) and grade. In no case shall the use of screenings be permitted to make up depressions.

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

It shall be ensured that shoulders are built up simultaneously along with water bound macadam courses as per Clause 407.4.1.

404.3.5. Application of screenings: After the coarse aggregate has been rolled to Clause 404.3.4, screenings to completely fill the interstices shall be applied gradually over

the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit spreading arrangement. Tipper operating for spreading the screenings shall be so driven as not to disturb the coarse aggregate.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand-brooms or both. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse 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 screenings shall be carried out in only such lengths of the road which could be completed within one day's operation.

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

In case of lime treated soil sub-base, construction of water bound macadam on top of it can cause excessive water to flow down to the lime treated sub-base before it has picked up enough strength (is still "green") and thus cause damage to the sub-base layer. The laying of water bound macadam layer in such cases shall be done after the sub-base attains adequate strength, as directed by the Engineer.

404.3.7. Application of binding material: After the application of screenings in accordance with Clauses 404.3.5 and 404.3.6, the binding material where it is required to be used (Clause 404.2.7) shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or mechanical brooms to fill the voids properly, and rolled during which water shall be

applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the resulting slurry after filling of voids, form a wave ahead of the wheels of the moving roller.

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

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

404.4. Surface Finish and Quality Control of Work

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

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

404.4.3. The water bound macadam work shall not be carried out when the atmospheric temperature is less than 0°C in the shade.

404.4.4. Reconstruction of defective macadam: The finished surface of water bound macadam shall conform to the tolerance of surface regularity as prescribed in Clause 902. However, where the surface irregularity of the course exceeds the tolerances or where the course is otherwise defective due to subgrade soil mixing with the aggregates, the course to its full thickness shall be scarified over the affected area, reshaped with added material or removed and replaced with fresh material as applicable and recompacted. In no case shall depressions be filled up with screenings or binding material.

404.5. Arrangement for Traffic

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

404.6. Measurements for payment

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

404.7. Rate

The Contract unit rate for WATER BOUND MACADAM sub-base shall be payment in full for carrying out the required operations including full compensation for :

- (i) malting arrangements for traffic to Clause 112 except for initial treatment to verges, shoulders and construction of diversions;
- (ii) furnishing all materials to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts;
- (iii) all labour, tools, equipment and incidentals to complete the work to the Specifications;
- (iv) carrying out the work in part widths of road where directed; and
- (v) carrying out the required test for quality control.

Item No.17

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

1. Well graded pebbled or metal of 40mm to 63mm.size shall be used for providing filter media of 600 mm thick at the back of abutments, returns and wing walls as per detailed specifications. The grading and tolerances of metal of pebbles shall be as under:

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

The size shall be 40mm to 63mm where in tolerance limit for over size shall be up to 15% and that for lower size should be up to 15% and below 20mm it shall be allowable up to 5%.The filter material shall be tightly placed to a thickness of not less than 600mm.and provided over the entire surface behind abutments, wings or return walls to the full height.

2. Materials shall be first stacked in boxed of 2 m x 1.5 m x 0.5 m size on fairly level ground and measured.

3. The measurement for payment shall be made on C.Mt. basis No deduction shall be made for voids.

4. The unit rate includes the cost of materials, scaffolding labour and tools to complete the work.

The contract rate shall be for a unit of One C.Mt. of completed item.

Item No. 18

Providing & Laying weep hole in Abutments, and returns by using PVC 6 kg/Sqcm pipe of 110 dia including laying in proper grade and jointing the completed as per detailed specification.

2706. WEEP HOLE

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

2707. TESTS AND STANDARDS OF ACCEPTANCE

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

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

2708. MEASUREMENTS FOR PAYMENT

The measurement for payment for weep hole shall be made as under

Weep holes in concrete/brick masonry structure shall **be measured in numbers**. For structures in stone masonry, weep holes shall be deemed to be included in the item of stone masonry work and shall not be measured separately.

2709. RATE

The contract unit rate of weep shall include the cost of all labour, materials, tools and plant and other cost necessary for completion of work

Item No.19

Providing & laying rubble for apron (each stone weight not less than 40 Kg.) including packing & filling in the interstices with quarry spalls.

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, 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 and weight shall be as specified in the item but in no case any fragment shall weight less than 40 kg. The specific gravity of stone shall be as high as possible and it shall not be less than 2.50. 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 metre wide and to the full height of the specified thickness of the apron at intervals of 30 metres and all along the length and width of the apron. Within these walls, the stone then shall be hand-packed.

3. **Payment shall be made on CMT basis of chatta.** The materials shall have to be stacked at site before laying. Preparation of base, or laying bedding shall be deemed incidental to the work Nothing shall deducted for voids.

4. The rate shall include cost of materials, labour and tools to complete the job.

Item No. 20

Supplying & fixing pre moulded bituminous joint filler (iii) 25 mm thick

.1 The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of pre molded bituminous joint filler.

.2 Pre molded bituminous joint filler, i.e. performed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

.3 Thickness of the pre-molded joint filler shall be 25 mm. unless otherwise specified..4 Pre molded bituminous joint filler shall conform to I.S. 1838-1961

4.The contract unit rate of weep shall include the cost of all labour, materials, tools and plant and other cost necessary for completion of work

4. The contract rate shall be for a unit of One S.Mt. of completed item

Item No. 21

Providing and fixing in position mild steel dowel bars in pier caps or abutments caps for anchorage in free end as per detailed drawing including cutting, bending and welding complete.

1. For specifications for reinforcement shall apply.
2. The MS dowel bars shall be provided and anchored in pier caps abutment caps and super structure as per detailed drawings for free ends. GI pipes and other materials such as mastic asphalt as directed by Engineer in charge or as per drawing shall be provided GI pipes shall as approved by Engineer in charge.
3. The payment shall be **made per number of** dowel bars in anchored condition.
4. Unit rate shall include cost of all materials, labour and equipments to complete the job.

Item No. 22

Providing and fixing in position mild steel dowel bars in pier caps for anchorage in fixed end as per detailed drawing including cutting, bending and welding.

1. For specifications for reinforcement shall apply.
2. The MS dowel bars shall be provided and anchored in pier caps abutment caps and super structure as per detailed drawings for fixed ends. GI pipes and other materials such as mastic asphalt as directed by Engineer in charge or as per drawing shall be provided GI pipes shall as approved by Engineer in charge.
3. The payment shall be **made per number of** dowel bars in anchored condition.
4. Unit rate shall include cost of all materials, labour and equipments to complete the job.

Item No. 23

Cautionary Warning Sign :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-1977. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with retro reflectivesheeting as per latest M.O.S.T.Specifications; 3.1m long stand postand frame fabricated from suitable sizeiron angle of 35 x 35 x 3mm, 75 x75 x 6mm as required; painted with bestquality epoxy coatings in black andwhite bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge.(A) Engineer Grade(VR).....

Relevant specification of item No. 24 shall be followed. The fabrication of board & The details of symbol or inscription / numerals for board, shall be carried out as per the design of IRC / as per item description. **Payment shall be made on No. basis.**

Item No. 24

Village name/ Bump Ahead sign :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 60cms.rectangle as as per the design of IRC-67-1977 pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest M.O.S.T. Specifications; Letters and numerals should be as per IRC-30-1968, 3.1m long (2 nos) stand post and frame fabricated from suitable size iron angle of 50 x 50 x 5mm painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade(VR)...

1701. TRAFFIC SIGNS**1701.1. Scope**

The work covers supplying and installing traffic signs conforming to IRC67 complete in all respects in accordance with these Specifications and as approved by the Engineer.

1701.2. General

1701.2.1. The colour, configuration, size and location of all traffic signs for roads shall be in accordance with the Code of Practice for Road Signs, IRC:67, or as shown on the drawings. In the absence of any details or for any missing details, the same shall be provided as directed by the Engineer.

1701.2.2. The signs shall be semi-reflective, as shown on the drawings, fixed over mild steel sheeting duly stove enameled in white colour in front and grey colour on back, red engineering grade tape on borders and required message in non-reflective black sheeting of engineering grade tape as per Clause 1701.3.7 of these Specifications.

Road signs, in particular, the cautionary/warning signs and mandatory/regulatory signs in the approaches of level crossings or narrow bridges may be reflectorised using luminous paints or other similar reflective material.

1701.2.3. It is desirable that cautionary/warning and mandatory signs are fabricated through process of screen printing. In case the facility is not locally available in the region of work, these signs and informatory signs may have inscription/message having cut letters of non-reflective black sheeting which shall be bonded well or the base sheeting as directed by the Engineer.

1701.2.4. The sizes and dimensions of different categories of signs shall be in accordance with IRC:67.

1701.2.5. Language of inscription and font for informatory signs shall be in accordance with IRG67.

1701.2.6. The informatory signs shall have prescribed diamond type logo (600 mm x 600 mm) of Mukhya Mantri Gram Sadak Yojana on top of sign board as shown in Fig. 1700.1.

1701.2.7. Typical logo and informatory sign board : The

specifications and design of typical Informatory Sign Board shall be as given in *Annexure-1700.1* of these Specifications duly approved by the Engineer.

1701.3. Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:-

1701.3.1. Concrete : Concrete for footing shall be of the grade shown on the Contract drawings or of minimum M15 grade conforming to Section 801 of these Specifications.

1701.3.2. Reinforcing steel : Reinforcing steel shall conform to the requirement of IS:1786 unless otherwise shown on the drawing.

1701.3.3. Bolts, nuts, washers : High strength bolts shall conform to IS: 1367.

1701.3.4. ACP Sheets, Plates and supports : Plates and support sections for the sign posts shall conform to IS:2062 or any other relevant IS Specifications.

1701.3.5. Reflectorised paint: Reflectorised paint shall conform to IS:5 or the manufacturer's specifications in case of proprietary product and as approved by the Engineer.

1701.3.6. Non reflectorised paint : Non-reflectorised paint shall conform to IS: 164 and as approved by the Engineer.

1701.3.7. Engineering grade sheeting : This sheeting shall be enclosed lens type consisting of microscopic lens elements embedded beneath the surface of a smooth, flexible, transparent, water-proof plastic, resulting in a non-exposed lens optical reflecting system. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined in accordance with ASTM Standard) as indicated in Table 1700.1.

When totally wet, the sheeting shall not show less than 90 per cent of the values, of retro-reflection indicated in Table 1700.1. At the end of 5 years, the sheeting shall retain at least 50 per cent of its original retro-reflectance.

TABLE 1700.1 : ACCEPTABLE MINIMUM COEFFICIENT OF RETRO-REFLECTION FOR ENGINEERING GRADE SHEETING (CANDEL AS PER LUX PER SQUARE METRE)

Observation angle in degree	Entrance angle in degree	White	Yellow	Orange	Green	Red	Blue
0.2	-4	70	50	25	9.0	14.5	4.0
0.2	+30	30	22	7.0	3.5	6.0	1.7
0.5	-4	30	25	13.5	4.5	7.5	2.0
0.5	+30	15	13	4.0	2.2	3.0	0.8

1701.3.8. Signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick. All others shall be at least 2 mm thick. The thickness of the sheet shall be related to the size of the sign board and its support and shall be such that it does not bend or deform under the prevailing wind and other loads.

1701.3.9. In respect of sign sizes not covered by IRC:67, the structural details (thickness, etc.) shall be as per the approved drawings.

1701.4. Installation

1701.4.1. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally signs with an area upto 0.9 sq.m can be mounted on a single post and for greater area two or more supports shall be provided. Sign supports may be of mild steel, reinforced concrete or Galvanised Iron (G.I.) posts and should be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1701.4.2. All components of signs and supports, other than the reflective portion and G.I. posts shall be thoroughly de-scaled, cleaned, primed and painted with two coats of epoxy paint. Any part of mild steel (M.S.) post below ground shall be painted with three coats of red lead paint.

1701.4.3. The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or G.I. posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1701.4.4. Mild steel sheets of sign boards shall be stove enameled on both sides in furnace at required temperature, the lettering, borders shall be painted with ready mix

synthetic enamel paint of superior quality in required shade and colour as specified.

1701.5. Measurements for Payment

The measurement of standard cautionary, mandatory and facility information signs **shall be in numbers** of different types of signs supplied and fixed.

1701.6. Rate

The Contract unit rate shall be payment in full for the cost of making the road sign including all materials and installing it at the site and incidentals to complete the work to the Specifications.

Annexure-1700.1

SPECIFICATIONS FOR INFORMATORY SIGN BOARD

A typical design of Informatory Sign Board shall be as directed. The specification and installation details of the typical sign board are given below:

(i) The board will be a composite unit consisting of two ACP Plates of 3 mm thickness. The size plate will be 900 mm x 750 mm size, welded / riveted over M.S. flat iron frame of 25 mm x 5 mm size on back on edges. Welding of all the sheets over angle and flat iron frame will be done neatly to have plain surface on one side. The angle iron frame of the lower most plate and flat iron frame of the middle plate will be welded to two nos. 75 mm x 75 mm (12 SWG) sheet tubes posts placed at 1125 mm apart centre to centre. The top of the middle plate will be flushed with the top of 75 mm dia medium steel tube posts and these posts will be embedded in cement concrete M15 grade blocks of 600 mm x 600 mm x 750 mm below ground level. The height of bottom of the lower most plate will be 1200 mm from normal ground level

(ii) All ACP plates will be of approved quality, the lettering and borders, etc. of middle and bottom plate, logo on top plate and back of all steel plates will be painted with ready mixed synthetic enamel paints of superior quality in required shade and colour as specified. All the sections for frame and posts will be painted with primer and two coats of Epoxy paint. The steel tube below ground level will be painted with three coats of Epoxy paint. The design, painting and lettering will be done as per approved drawing.

Item No. 25

Place identification sign :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 150 x 90cms. rectangle as as per the design of IRC-67-1977 pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest M.O.S.T. Specifications; Letters and numerals should be as per IRC-30-1968, 3.1m long (2 nos) stand post and frame fabricated from suitable size iron angle of 50x50x5mm 75x75x6mm as required; painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade(VR)...

Relevant specification of item No. 24 shall be followed. The fabrication of board & The details of symbol or inscription / numerals for board, shall be carried out as per the design of IRC / as per item description. **Payment shall be made on No. basis.**

Item No. 26

Citizen' s information Board- Providing and fixing of typical MMGSY information board as per instruction. Two ACP sheets of 3 mm thick, of 900 mm x 750mm size fixed at top & bottom duly rivetted with MS angles of 25 x 25 x 5 mm thick M.S angle shall be welded by two vertical M.S angle of 5 mm thick to 75 mm x 75 mm of 12 SWG square tubes posts duly embedded in cement concrete M-15 grade blocks of 600mm x 600mm x 75mm, below ground level. The letters & figure of any shade reflectorised with High Intensity Prismatic Grade Retro Reflective Sheeting of Type-4 as per ASTM D-4956 and latest MORD specifications; All sections of framed posts and steel tube will be painted with primer and two coats of epoxy paints as per drawing Clause 1701 and Annexure 1700.1 (10.16). (A) Class-B High intensity Grade Retro Reflective sheeting.

Relevant specification of item No. 24 shall be followed. The fabrication of board & The details of symbol or inscription / numerals for board, shall be carried out as per the design of IRC / as per item description. **Payment shall be made on No. basis**

Item No. 27

Providing and fixing logo board of MMGSY as per National Rural Road Development Agency diamond size, 600 x 600 mm, 1.50 mm thick Plate & board plate size, 900 x 250 mm, 1.5 mm thick M.S. plate and 2.40 meter deep length single angle 75 x 75 x 6 mm size including fitting and painting , lettering with luminous colour as per drawing including fixing in CC 1:3:6 etc compete.

Relevant specification of item No. 24 shall be followed. The fabrication of board & The details of symbol or inscription / numerals for board, shall be carried out as per the design of IRC / as per item description. **Payment shall be made on No. basis.**

Item No. 28

Hazard Marker Sign :-Providing and fixing sing boards made out of 2mm aluminium sheet; size 90 x 30cms. rectangle as as per the design/drawing attached (IRC) pretreated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro refiective sheeting as per latest M.O.S.T. Specifications; 3.1m long stand post and frame fabricated from suitable size iron angle of 35 x 35 x 3mm & 50 x 50 x 5mm painted with best quality epoxy coatings The fixing at site shall be in 1:2:4 CC block of size 45x45x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.(A) Engineer Grade(VR)...

Relevant specification of item No. 24 shall be followed. The fabrication of board & The details of symbol or inscription / numerals for board, shall be carried out as per the design of IRC / as per item description. **Payment shall be made on No. basis**

Item No. 29

Chevron sign Project Information Board: Providing and fixing of typical Project informatory sign boardwith Logo as per 1700 of MORD specifications and drawing. The board will be a composite unit consisting ofThree Plates ACM (Aluminum Composite Material), material specificalitons as per clause 17001.3. The topmost plate will be of 3mm ACM in diamond shape of 600x600mm size, riveted with MS angle iron frame of25mmx25mmx5mm size on back on edges. The middle 4mm ACM plate of will be 1200x150mm size rivetedwith MS angle iron frame of 25mmx25mmx5mm size on back on edges. The main 4mm ACM lower mostplate will be 1500mmx600mm size, riveted with MS angle iron frame of 25mmx25mmx5mm size. Riveting ofall the sheets over angle and flat iron frame will be done neatly to have plain surface on one side. The angleiron frame of lower most plate and flat iron frame of the middle plate will be welded to two nos 75mmx75mm (12 SWG) sheet tubes posts placed at 1125mm apart centre to centre. the top of the middle platewill be flushed with the top of 75mm dia medium steel tube posts and these posts will be embeded in cementconcrete M15 grade block of 450x450x600mm below ground level. The height of the bottom of the lowerplate will be 1200mm from normal ground level and the bottom of the middle plate will be 100mm above thetop level of the lower most plate. the diamond shaped plate mounted over flat angle iron frame will beconnected to middle plate by square steel section of 47mmx47mm, thickness 12SWG having a spacing of100mm between the diamond shaped plate and middle plate and this square section will be riveted to thebottom point of the diamond shaped plate. logo, letters and numerals on the ACM should be madeup of Retro Reflective sheeting of Type-1 AEGP Class-A grade as per the latest MORD section 1700 andIRC 67-2012 specifications. Al the section of the frame and posts shall be painted with primer and two coatsof epoxy paint. The design, painting and lettering shall be done as per the Signage Guide and asdirected by

Engineer-In-charge. . A warranty for 5 years for the Retro reflective sheeting for Class-A

Relevant specification of item No. 24 shall be followed. The fabrication of board & The details of symbol or inscription / numerals for board, shall be carried out as per the design of IRC / as per item description. **Payment shall be made on No. basis.**

Signature of contractor

**Deputy Executive Engineer
Panchayat R. & B Sub. Division
Danta**

**Executive Engineer
Panchayat R. & B. Division
Palanpur**