RAJKOT MUNICIPAL CORPORATION
e - Tender No. RMC/ENGG/CZ/22-23/

Bid Documents For
PROVIDING AND LAYING PROP. SEWERAGE NETWORK TO EXISTING MADHAPAR SPS IN RMC AREA (PART-1) (SOUTH-WEST PORTION OF MADHAPAR JUNCTION) WITH ROAD RESTORATION WARD NO. 03 (FIFTH ATTEMPT)

Volume-II
Technical Specifications & Drawings

Milestone Dates for e-tendering is as under	
1. Downloading of e-Tender documents	23-11-2023 To 13-12-2023 upto 17.00 Hrs.
2. Pre-bid meeting in the O/o Add. City Engineer at **CENTRAL ZONE**	30-11-2023 at 16:00 hrs
3. Online submission of e - Tender	13-12-2023 upto 18.00 Hrs.
4. Physical submission of EMD, Tender fee and other documents required as per Financial and Experience criteria by Regd. Post. A.D. / Speed Post ONLY	15-12-2023 upto 18.00 Hrs.
5. Opening of online tender (Technical Bid)	16-12-2023 at 11.00 Hours onwards
6. Verification of submitted documents (EMD, e - Tender fee, etc.)	16-12-2023 at 18.30 Hours onwards
7. Agency to remain present in person along with original documents for verification	18-12-2023 between 16.00 to 17.00 Hours
8. Opening of Price Bid (If possible)	19-12-2023 at 11.00 Hours onwards
9. Bid Validity	180 Days
For further details, pre-qualification criteria etc. visit www.rmc.nprocure.com	

2023-24
CITY ENGINEER
RAJKOT MUNICIPAL CORPORATION
CENTRAL ZONE, DHEBAR ROAD,
Nr. S.T. STAND, RAJKOT - 360001 (GUJARAT)

TECHNICAL SPECIFICATIONS

CONTENT

:: TECHNICAL SPECIFICATIONS ::

A. GENERAL

1. SCOPE OF CONTRACT :

The work entitled comprise of excavation of trenches with shoring and strutting wherever required bailing out water wherever necessary, laying of pipes, jointing including supply of material and material required for jointing, testing as per specifications, Construction of appurtenances such as brick Masonry / RCC chambers etc. as per the type design specified entirely of the specification of various works stipulated in the e-Tender. The work includes supply of R C C N P - 3 pipes & Stoneware pipes ISI Marked and which shall have to be supplied at site or Municipal store by the contractor at specified and shown in schedule "B". Other material like cement etc shall have to supplied by the contractor from open market.

The scope of works comprises the following:

- ☐ Carrying out necessary topographical survey and geotechnical investigations
- ☐ Excavation of pipe trenches in soil, soft rock, hard rock, WBM and concrete roads, Dismantling of paver block including dewatering etc. complete.
- ☐ Providing, Supplying, lowering, Laying & jointing of RCC & Stoneware pipes as per Schedule – B along the route as per the network map
- ☐ Jointing of pipes with existing pipes (wherever required).
- ☐ Obtaining statutory approval from government bodies.
- ☐ Contractor shall plan and accordingly phase the supply of items according to his requirement to best utilize the available storage space at site.
- ☐ Construction of brick masonary sewer manholes as per Bill of Quantities and Specifications
- ☐ Providing pipe bedding as per the requirements.
- ☐ Backfilling of pipe trench with selected soil immediately after erection of pipe excluding pipe joints.
- ☐ Drilling of borehole for crossing, highway / Ring road as per Bill of Quantities and Site Conditions.
- ☐ Hydro testing of pipeline in segments.
- ☐ Reinstatement of WBM, Tar and Concrete Roads after laying and testing of pipeline.
- ☐ Demolishing old structures in the route of pipeline, if require
- ☐ Testing and commissioning.
- ☐ Preparation of as-built drawings.

2. e-TENDER PRICE:

The rates quoted in the bill of quantities shall cover everything necessary for the due and complete execution of the work according to the drawings

and other condition and stipulations of the contract including specifications of the evident, intend and meaning of all or either of them or according to customary usage and for periodical and final inspection and test and proof of the work in every respect and for measuring, numbering or weighing the same, including setting out and laying or fixing in position and the provision of all materials, power, tools, rammers, labour, tackle, platforms with impervious lapped joints for scaffolding, ranging roads, straight edged, cantering and boxing, wedges, moulds, templates, posts, straight rods, straight edged, cantering and boxing, wedges, moulds, templates, posts, straight rails, boning staves strutting, barriers, fencing lighting pumping apparatus, temporary arrangement for passage of traffic access to premises and continuance to drainage water supply and lighting (if interrupted by contractor's work) temporary sheds, painting, varnishing, polishing establishment for efficient supervision and stating arrangements for the efficient protective of life and property and all requisite plant and machinery of every kin

The contractor shall keep every portion of the work clear of accumulation from time to time and shall leave every portion of the work clean, clear, perfect and at the conclusion of whole, providing at their own cost all such material implement, appliances and labour as the Engineer in charge may require to prove if it to be so.

3. COMPLETION SCHEDULE:

The contract period shall be as prescribed in tender document, from the date of notice to proceed i.e Work Order. The Contractor shall submit his completion schedule and the program of works together with this e-Tender in conformity with completion schedule given in the documents.

4. Packing and Handling:

4.1. Necessary care shall be taken and required packing shall be provided to avoid damage to pipe barrels and the edges of the pipe ends in transit.

4.2. Where the goods are required to be dispatched at Railway risk, special packing as per IRCA rules are absolutely necessary, which would be payable by the contractor himself.

4.3. The contractor shall use proper handling equipment or follow suitable standard handling method for RCC & Stoneware pipes as approved by the Engineer-in- charge to unload the materials at the delivery site to prevent damage to the goods.

5. GENERAL TECHNICAL GUIDELINE:

5.1. All the items occurring in the work and as found necessary during actual execution shall be carried out in the best workman like manner as per specifications and the written order of the Engineer in charge

5.2. Extra Claim in respect of extra work shall be allowed only if such

work is ordered to be carried out in writing by the Engineer in charge

5.3. The contractor shall engage a qualified Engineer for the Execution of work who will remain present for all the time on site and will receive instructions and orders from the Engineer in charge or his authorized representative. The instruction and orders given to the contractor representative on site shall be considered as it given to the contractor himself.

5.4. The work order book as prescribed shall be maintained on the site of the work by the contactor and the contractor shall sign the orders given by the inspecting offers and shall carry out them properly.

5.5. Quantities specified in the e-Tender may vary at the time of actual execution and the contractor shall have no claim for compensation on account of such variation

5.6. Unexcavated lengths shall be left wherever required and so directed by the Engineer in charge during the currency of the contract and shall be tackle If required, before completion of work.

5.7. Diversion of road, if necessary, shall be provided and maintained during the currency of the contract by the contractor at his cost.

5.8. Figured Dimensions of drawing shall supersede measurements by scale, special dimensions or directions in the specifications shall supersede all other dimensions.

5.9. All levels are given on drawings and the contractor shall be responsible to take regular level on the approved alignment before actually starting the work. The levels shall be commence to the G.T.S. levels and shall be got approved from the Engineer in charge

5.10. If the arrangement of temporary drainage is required to be made during any work of this Contract, this shall be made by the Contractor without claiming any extra cost.

6. 5CLASSIFICATION OF STRATA:

6.1. All materials encountered in excavation will be classified in the following groups irrespective of mode of excavating the materials and the decision of the Engineer in charge in this regard shall be final and binding to the contractor.

6.2. Soils :
Soils of all sorts, silt, sand, gravel, soft murrum, stiff clay, kunkar and other soft excavation not covered in the items mentioned hereunder.

6.3. Hard Murrum :
Hard Materials comprising of all kinds of disintegrated rock or shale or indurate conglomerate interspersed with boulders, weathered and decomposed rock which could be removed with pick, bar, shove, wedges and hammers, though not without some difficulties.

6.4. Soft – Rock:
This shall include all materials which is rock but which does not need blasting and can be removed with a pick bar, wedges, pavement breakers, pneumatic tools etc.

6.5. Hard Rock:
This shall include rock accusing in mass or boulders which need blasting, this will also include rock to be removed by chiseling or any other method where blasting is not permissible.

7. The rates are inclusive of dewatering, if require

8. Regarding water supply for hydro testing, necessary water, power, labour, etc. required for necessary test shall be arranged by the contractor at his own cost.

9. During construction activity, proper care must be taken for labour safety and must follow the provisions of the Labour laws.

10. TMT bars of Fe-500 should be confirming to IS:1786. The approved makes shall be TATA, SAIL, Vizag, Gallent, Electrotherm or other equivalent make as approved by engineer-in-charge.

11. Cement shall be ordinary Portland cement conforming to IS:269, IS:8112 or IS:12269 for all the works as per the instructions of engineer-incharge. The approved makes shall be Ambuja, Ultratect, LOTUS, Siddhi, Sanghi, Hathi or as per IS confirming.

12. Minimum Cement content for the work should be as per attached circular No.RMC/C/Vigi.(Tech)/231 dt. 11/03/2022.

13. Testing of the materials like Brick, Sand, Aggregate, Reinforcement steel, etc. should have to be tested peridiocally as suggested by the Engineer-in-charge at Government approved material testing Laboratory and testing charges for the same has to be borne by the contractor.

14. In case of any ambiguity found in inspections / drawings etc, the decision of engineer-in-charge shall be final and binding to the contractor.

DETAILED SPECIFICATIONS OF 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 tract of oil and injurious alkalis, salts, organic mater and other deleterious materials which will either weaken the mortar or concrete or cause efflorescence in R.C.C.. The container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in I.S. 456-2000 (latest revision).

1.2 If required by the 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 I.S. 269-1976. Any indication of unsoundness, change in time of setting of 30 minutes either more or decrease of more than 10 percent 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 and also not too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or 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 for preparing or concrete.

M-2 CEMENT :

2.1 Cement shall be Sulphate Resistant Cement conforming to IS : 12330, Ordinary portland cement as per I.S. 269-1976 or Portland slag cement as per I.S.455-1976.

2.2 Testing of Cement : It should be specifically noted that the cement brought by the contractor at site of work shall be used after the same is tested at the approved laboratory as per the direction of the Engineer-in-charge. Such approved laboratory may be located at Ahmedaba All the charges for transport and testing of the samples shall have to be borne by the contractor. The frequency of testing of such materials shall be in accordance to the relevant Indian standard as directed by the Engineer-in-charge.

M-3 SAND :

3.1 Sand shall be natural sand, clean, well graded, hard strong, durable and gritty particles free from injurious of dust, clay, kankar nodules, soft or flaky particles shale, alkali salts, organic matter, loam, mica or other deleterious substances 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.

3.2 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 through sieve.
4.75 mm	100	600 Micron	30 - 100
2.36 mm	90 - 100	300 Micron	5 - 70
1.18 mm	70 - 100	150 Micron	0 - 50

3.3 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 through sieve	I. S. Sieve Designation	Percentage by weight passing through sieve.
4.75 mm	100	600 Micron	40 - 85
2.36 mm	100	300 Micron	5 - 50
1.18 mm	75 - 100	150 Micron	0 - 10

M-4 STONE GRIT :

4.1 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 proper adhesion of mortar. Grit shall for as possible flaky elongated pieces shall be avoide

It shall generally comply with the provisions of I. S. 383-1970. Unless special stone of particular quarried is mentione Grit special stone of particular quarries is mentione 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.

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

I. S. Sieve Designation	Percentage passing through sieve	I. S. Sieve Designation	Percentage Passing through sieve
12.50	100%	4.75	0.20%
10.00	85 - 100%	2.36	0.25%

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

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

M-5A STONE COARSE AGGREGATE FOR NOMINAL MIX CONCRETE :

5A.1 Coarse aggregate shall be of 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.

5A.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 approve 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	Percentage Passing for single sized aggregates of nominal size		
	40 mm	20 mm	16 mm		40 mm	20 mm	16 mm
80 mm	-	-	-	12.5 mm	-	-	-
63 mm	100	-	-	10.0 mm	0.5	0.20	0.30
40 mm	85-100	100	-	4.74 mm	-		0.50
0.50							
20 mm	0-20	85-100	100	2.35 mm	-		-
-							
16 mm	-	-	-	85-100	-	-	-

NOTE :- The percentage may be varied by the Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

5A.3 The grading test shall be taken in the beginning and at the charge of source of materials. The necessary tests indicated in I.S. 383-1970 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 inter mixed on different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

M-5B BLACK TRAP OR EQUIVALENT HARD STONE COARSE :

5B.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.

5B.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 approve Aggregate shall have no deleterious reaction with cement.

5B.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.

5B.4 If aggregate is covered with dust it shall be washed with water to make it clean.

M-6 CEMENT MORTAR:

6.1 Water shall conform to specification M-1. Cement shall confirm to specification M-2, sand shall confirm to M-3.

6.2 Proportion of Mix :

6.2.1 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 cum. The mortar may be hand mixed or machine mixed as directe

6.3 Preparation of Mortar:

6.3.1 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 obtaine 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 directe

6.3.2 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-7 BRICK BATS AGGREGATE :

7.1 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 underburnt of overburnt brick bats shall not be allowe

7.2 The brick bats shall be measured by volume by suitable boxes or as directe

M-8 BRICKS :

8.1 The bricks shall be hard or machine moulded and made from suitable soils and kiln burnt. They shall be free from cracks and flaws and nodules of free lime. The shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

The bricks shall be moulded 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.

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

8.3 The size of the conventional bricks shall be as under :

$$\left(9'' \times 4\tfrac{3}{4}'' \times 2\tfrac{3}{4}''\right) 225 \times 110 \times 75 \text{ mm.}$$

8.4 Only bricks of one standard size shall be used on one work. The following tolerance shall be permitted in the conventional size adopted in a particular work.
Length : = 1/8" (3.0 mm) Width : = 1/16" (1.50 mm)
Height : = 1/16" (1.50 mm)

8.5 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-8A FLY-ASH LIME BRICKS :

The fly ash lime bricks shall conform to Grade-1 or Grade-2 of IS-3812-1981. The frog of the 80 to 100 mm x 40 mm x 10 to 20 mm size.

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

The size of conventional brick shall be 225 mm x 110 mm x 75 mm.

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

Length : + 3 mm
Width : + 3 mm
Height : + 2 mm

The physical characteristic of bricks shall be as follows.

The minimum compressive strength of fly ash lime bricks shall not be less than 75 Kg/Sq.Cm. and the test shall be conform to IS-3495 (Part-I):1992.

The average drying shrinkage of the brick when tested by the method described in IS 4139-1989 being shall not exceed 0.15 percent.

The averages water absorption not more than 20 percentage by mass and the test shall conform to IS-3495 (Part-3):1992.

M-9 MILD STEEL BARS :

9.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be tested quality. It shall comply with relevant part of I.S.456-1978.

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

9.3 For the purpose of payment the bar shall be measured correct upto 10 mm length and weight payable worked out 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	3.35 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	7.31 Kg./Rmt.
7.	18 mm	2.00 Kg./Rmt.	14.	40 mm	9.86 Kg./Rmt.

M-10 TMT FE-500 STEEL BARS FOR REINFORCEMENT :

10.1 Reinforcement bars shall conform to IS-432, IS-226 or IS-1786 and welded wire fabrics to IS : 1566. Only TMT bars for reinforcement in RCC duct shall be used which shall be clean, free from pitting, oil, grease, paint, loose mill scale, rust, dirty dust or any other such substance that will destroy or reduce bon

It permitted by the Engineer-in-charge reinforcement shall be done in accordance with IS-2751 or IS-9147 as applicable.

10.2 Other provision and requirements shall conform to specification No. M-7 for mild steel bars.

M-11 MILD STEEL BINDING WIRE :

11.1 The mild steel wire size and quality shall conform to I.S. 280-1972.

11.2 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-12 STRUCTURAL STEEL :

12.1 All structural steel conform to I.S.226 - 1975. 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.

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

M-13 SHUTTERING :

13.1 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 ballies properly cross braced together so as to make the centering rigi In places of bullie props, brick pillar of adequate section built in mud mortar may be use

13.2 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.

13.3 If at any stage of work during or after placing concrete in the structure, the form 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.

13.4 The props shall consist of bullies having 100 mm minimum diameter measured at mid 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 of 0.10 Sq.m. laid on sufficiently hard base.

13.5 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.

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

13.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoide

13.8 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 manufacture 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 permitte

13.9 The shuttering for beams and slabs shall have camber of 4 mm per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset of 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-14 HARD DRAWN WIRE :

The Hard drawn steel wire should confirming to IS-432 (Part 2), Hard drawn steel wire shall be manufacture and its chemical composition should be as per para 3.0. The finished wire should be free from defects and finished in a workman like manner. Nominal sizes, Tolerances, Physical requirements are as per IS : 432 (Part-II) latest edition. Hard drawn steel wire should be tested as specified in IS : 432 (Part-II) latest edition.

DETAIL TECHNICAL SPECIFICATIONS

Excavation of Pipeline Trenches & Manhole

1.0 General

1.1 The excavation for trenches will generally, refers to open excavation for trenches in wet / dry conditions for pipe laying work.

2.0 Clearing of Sites:

2.1 The site on which the pipelines are to be laid and shown on plan and the area required for setting out and other operations shall be cleared and all obstruction loose stones and materials, rubbish of all kinds, stumps, brushwood as trees shall be removed as directed the roots shall be entirely grubbed up.

2.2 The products of the clearing to restacked in such a place and in such a manner, as directed by the engineer in charge.

2.3 All holes or hollows whether originally existing or produced by digging up roots, shall be carefully filled up with earth, well watered, well rammed leveled off, as may be directed.

2.4 The agency has to obtain necessary permission for diverting the traffic or public as per requirement from competent authority for carrying out the work.

3.0 Setting Out:

The center lines of all pipe trenches etc. shall be given by the Engineer-in-charge and it will be the responsibility of the contractor to install substantial reference marks, bench marks, etc. and maintain them as long as required true to line, level curve and slopes. The contractor shall assure full responsibility for alignment, and dimension of trench.
The labour materials etc. required for setting out and establishing benchmarks and other reference marks shall be arranged by the contractor at his own cost.

4.0 Excavation

4.1 The excavation for the pipe trenches shall also include removal of all materials of whatever nature and whether wet or dry condition necessary for laying of pipelines exactly in accordance with alignment, levels grades and curves shown on the plans or as directed by the Engineer-in-charge. Trenches shall be excavated to the exact width and depth according to the size of pipe and the sides shall be left vertical as far as possible or according to the angle of repose of various soils. Unless there is a specific extra provision in the contract for shoring and strutting or for cutting side slopes the contractor shall at his own cost do the necessary shoring and strutting or cutting of slopes to the angle of repose or both approved by the Engineer-in-charge. The contractor shall notify the Engineer before starting excavation to enable him to take cross sectional levels for purpose of measurements before the ground is disturbed. The bottom of the trenches shall be leveled both longitudinally and transversely or slopped as directed by the Engineer. The contractor shall at his own cost to remove such portions of boulders or rocks, as are rectified to make the bottom of the trench level. No filling shall be allowed to bring the trench to level. If by contractor's mistake excavation is made deeper than shown on the plans and if ordered by the Engineer the extra depth shall have to be made with selected excavated stuff only with watering, ramming etc. as directed, by the Engineer and at the cost of the contractor.

Other hard excavation shall be cleared of all sorts including loose materials and cut to firm surface, either level, stepped as directed by the Engineer. The Engineer may order such changes in the dimensions and alignment of pipe trench as may be deemed necessary to secure satisfactory cover over pipeline.

After each excavation is completed, the contractor shall notify the Engineer tothat effect and no laying of pipeline will be allowed to be laid until Engineer has approved the depth and dimensions of trenches, level and measurements.

Excavation by the Use of Explosives

Unless otherwise stated herein, I.S. Specification -IS: 4081: Safety Code for Blasting and related Drilling Operations‖ shall be followed. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation , precautions shall be taken to preserve the rock below and beyond the lines specified for the excavation, in the soundest possible condition. The quantity and strength of explosives used shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Employer's Representative, shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structures as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Employer's Representative at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

The contractor shall obtain a valid Blasting License from the authorities concerned. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done; and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as away as possible from the area to be blasted. Employer's Representative's prior approval shall be taken for the location proposed for the magazine.

In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old. Blasting for excavation in hard rock will only be allowed if permitted by competent authority otherwise shall be done with chiseling only.

For blasting operations, the following points shall be observed.

i) Contractor shall employ a competent and experienced supervisor and licensed blaster in-charge of each set of operation, which shall be held personally responsible to ensure that all safety regulations are carried out.

ii) Before any blasting is carried out, Contractor shall intimate Employer's Representative and obtain his approval in writing for resorting to such operation s. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.

iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within 200 m radius from the firing point, at least 15 minutes before firing time by sounding warning whistle. The area shall also be given a warning by sounding a distinguishing whistle.

iv) The blasting of rock near any existing buildings, equipments or any other property shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small

charges only and where directed by Employer's Representative; a trench shall have to be cut by chiseling prior to the blasting operation, separating the area under blasting from the existing structures.

v) The firing shall be supervised by a Supervisor and not more than 6 (six) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.

vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth, the balance of the hole shall be filled with stemming, which may consist of sand or stone dust or similar inert material.

vii) Contractor shall preferably detonate the explosives electrically.

viii) The explosives shall be exploded by means of a primer, which shall be fired by detonating a fuse instantaneous detonator (F.I.D) or other approved cables. The detonators with F.I.D. shall be connected by special nippers.

ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatin with detonator and fuse wire may be used. Underwater or for excavation in rock with substantial accumulated seepage electric detonation shall be used.

x) Holes for charging explosives shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.

xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level.

xii) Any rock excavation beyond an over break limit of 75 mm shall be filled up as instructed by Employer's Representative, with concrete of strength not less than M10. Stopping in rock excavation shall be done by hand trimming.

xiii) Contractor shall be responsible for any accident to workmen, public or Employer's property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of explosives, or any other Authority duly constituted under the State and / or Union Government as applicable at the place of excavation.

Stripping Loose Rock

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Employer's Representative, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion, which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Employer's Representative, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed.

Classification of Strata:

The decision regarding, classification of strata shall rest with the Engineer in charge and his decision shall be final and binding to the contractor.

All the materials encountered in the excavation shall be classified as under :-

Ordinary soil and soft murrum:

These will include all materials of an earthy or sandy nature, which can be easily ploughed or small shingle, and gravel, which can be easily removed.

Hard murrum:

This shall include all kinds of disintegrated rock or shale or inundated clay which can be removed with a shovel without difficulty and which do not require blasting.

Soft rock:
This shall includes all materials which is rock or hard conglomerate, all decomposed and weathered rock, highly fissured rock old masonry and also soft rock boulders bigger than 1/2 cubic meter and other varieties of rock. Which do not require blasting and which can be removed with the pie crowbars wedges and hammer.

Hard rock:
This shall include rocks, occurring in masses, which could best be removed by chiseling.

5.0 Protection

5.1 The trenches shall be strongly fenced and red light signal shall be kept at night and arrangement of watchman to prevent accidents should be done. Sufficient care and protective measure shall be taken to see that the excavation shall not affect or damage the adjoining structure. The contractor shall be entirely responsible for any injury to life and damage to the properties etc. Necessary protection work such as guide ropes, crossing places, barricades, caution boards etc. shall be provided by the contractor.

6.0 The excavation in all sorts of soil, hard murram, soft rock or hard rock or any type of soil shall have to be carried out up to the required depth by the agency

7.0 Disposal of Excavated Stuff

7.1 No excavated stuff from trench are to be placed even temporarily nearer than 1.5 meter or greater distance up to 90 meter or as prescribed by the Engineer from the outer edge of trench. All excavated material will be the property of the owner. The rate of excavation includes sorting out of useful materials and stacking them separately as directed within specified lead. The excavated stuff suitable and useful for refilling or for other use shall be stacked at convenient places. The materials not useful in any way shall be disposed off as directed by the Engineer from the outer edge of trench.

7.2 The site should be cleared off on completion of work.

8.0 Additional Requirements

8.1 At the joints of pipes, the trench shall be excavated to an additional depth of 15 cm. and width of 30 cm. And length of 15 cm. beyond the edge of collar on both the sides or as directed. The rate include for such extra excavation made at the joints. The trenches shall be excavated perfectly in straight line. The bottom of the trench shall be kept as per invert level or as directed. To maintain the proper slope the usual method of site rails and boning rods shall be adopted. The contractor shall have to provide and fix and maintain sight rails and boning rods without any extra cost**.**

If the contractor fails or makes delay to give hydraulic test of the pipe line laid in any of the section, without any genuine reason, he shall be responsible to get any part of the length trenches refill in such case (i.e. before testing) for safety of pedestrian and/or vehicular traffic as found necessary by the engineer-in-charge without any extra cost. If found necessary and directed by

the Engineer-in-charge, the contractor shall have to excavate the refilled trenches, during hydraulic test without any extra cost.

At all road crossings, trenches shall be excavated only for half width of the road and pipe shall be laid. The other half shall be excavated only after back filling over the laid pipeline is done so as to make it suitable for the traffic. The contractor shall provide diversion when the pipeline is to be laid along the road as required and shall maintain the diversion or any part of it, without any extra cost. At all road crossings, the pipe shall be laid below the crest of road

8.2 The contractor shall break the road surface by chiseling to the exact width and length as shown on the drawing or as directed by the Engineer-in-charge.
The excavated stuff shall be deposited in uniform layers to avoid mixing with other kind of materials at non-objectionable place or as directed by the Engineer-in-charge.

9.0 Measurement and Payment

9.1 Payment shall be made as per actual work done.

9.2 The rate for the item of excavation shall include the following unless and otherwise mentioned

(a) Clearing of site
(b) Setting out work including all materials and labour.
(c) Providing and subsequently removing, shoring and strutting outing slopes etc..
(d) Excavation and removal and staking of all excavated stuff as directed.
(e) Necessary protection including labour materials equipment etc. to ensure safety and protection against risk or accident.
(f) Providing facilities for inspection and damage to property if caused during progress of work.
(g) Compensation for injury to life and damage to property if caused during progress of work.
(h) Restoring of water supply connections, sewer connections, telephone lines, khalkuva soak pits etc. if damaged by contractor without extra payment.
(j) Clearing the site on completion of works directed by the Engineer.

Measurement and Payment

Payment shall be made on cubic meter basis of excavation for single time only.

GRANULAR /CEMENT CONCRETE BEDDING

(A) PROVIDING BEDDING INCL. RAMMING, WATERING, CONSOLIDATING ETC. FILLING IN TRENCH WITH AVAILABLE SAND

WORKMANSHIP

The sand / granular material to be use for bedding shall be free from salts, organic or other foreign matter. All clods of sand shall be broken.

As soon as the work in trench has been completed and measured the site of trench shall be cleared of all debris, brick bats, mortar dropping etc. sand filled with sand in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The sand shall be rammed with iron rammers where feasible and with the butt ends of crowbars, where rammer cannot be used.

The finished level of bedding shall be kept to shape intended to be given to excavation .

The consolidation may be done by hand rammers, where so specified. The extent of consolidation required shall also be as specified.

The sand /granular material shall be allowed to be used in bedding the trenches. Under no circumstances black cotton soil be used for bedding.

MODE OF MEASUREMENTS & PAYMENT :

The payment shall be made for bedding the granular material as per drawings. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

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

(b) Providing and casting situ cement concrete (1:2:4) bedding using granite quartizite trap metal of size 25 mm to 40 mm including consolidation, curing etc. complete.

The concrete bedding of proportion (1:2:4) shall be according to specification of Item of concrete works.

MODE OF MEASUREMENTS & PAYMENT :

The payment shall be made for concrete bedding as per drawings. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

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

REINFORCED CEMENT CONCRETE PIPES SOCKET & SPIGOT

SCOPE

This specification covers the requirements for manufacturing, testing, supplying, jointing and testing at work sites of Reinforced Cement Concrete (RCC) pipes, of both pressure and non pressure varieties used for pumping mains and gravity, sewers and storm water drains. Laying of pipes and fittings/specials are covered in another para. The two parts are complementary and are to be read together for a correct interpretation of the provisions of this specification.
APPLICABLE CODES

The manufacturing, testing, supplying, jointing and testing at work sites of RCC pipes shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the codes shall be referred to. If requirements of this specification conflict with the requirements of the codes and standards, this specification shall govern.

MATERIALS

a) IS: 458 - Specification for precast concrete pipes (with and without reinf.)-2021
b) IS: 3597 - Method of tests for concrete pipes.
c) IS: 5382 - Specification for rubber sealing rings for gas mains, water mains and sewers.
d) IS: 516 - Method of test for strength of concrete.

CODE OF PRACTICE

a) IS: 456 - Code of practice for plain and reinforced concrete
b) IS: 783 - Code of practice for laying of concrete pipes

DESIGN

Design of RCC pipes including reinforcement details and the ends of pipes shall be in accordance with the relevant clauses of IS: 458-2021.

MANUFACTURING

GENERAL :

Pipe should be with ISI mark confirming to IS-458-2021. Pipe can be manufactured by spinning process or by vibrated casting process.

The method of manufacture shall be such that the form and the dimensions of the finished pipes are accurate within the limits specified in relevant clause of IS: 458. The surfaces and edges of the pipes shall be well defined and true, and their ends shall be square with the longitudinal axis. The ends of the pipes shall be further reinforced by an extra ring of reinforcement to avoid breakage during transportation.

The RCC pipes and rubber rings shall be systematically checked for any manufacturing defects by experienced supervisors so as to maintain a high standard of quality.

Owner/Engineer shall at all reasonable times have free access to the place where the pipes and collars/rubber rings are manufactured for the purpose of examining and testing the pipes and collars/rubber rings and of witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards shall be performed by the supplier/contractor at his own cost and in presence of Owner/Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Owner/Engineer.

If the test is found unsatisfactory, Owner/Engineer may reject any or all pipes of that lot. The decision of Owner/Engineer in this matter shall be final and binding on Contractor and not subject to any arbitration or appeal.

MATERIALS

Cement

Cement used for the manufacture of RCC pipes should be OPC/SRC and shall confirm to relevant IS codes.

Aggregates

Aggregates used for the manufacture of RCC pipes shall conform to IS:383. The maximum size of aggregate should not exceed one-third the thickness of the pipe or 20 mm, whichever is smaller.

Mixing and Curing Water

Water shall be clean, colorless and free from objectionable quantities of organic matter, alkali, acid, salts or other impurities that might reduce the strength, durability or other desirable qualities of concrete and mortar.

Reinforcement

Reinforcement used for the manufacture of the RCC pipes shall be mild steel Grade I or medium tensile steel bars conforming to IS: 432 (Part-I) or hard-drawn steel wire conforming to IS: 421 (Part-2). Reinforcement cages for pipes shall be as per relevant requirements of IS: 458.

Concrete

Concrete used for the manufacture of RCC pipes shall conform to IS: 456. The minimum cement content and minimum compressive strength of concrete shall be as per relevant requirements of IS:458 (Latest Edition). Compressive strength tests shall be conducted on 15 cm cubes in accordance with the relevant requirements of IS: 456 and IS: 516.

Rubber Ring

Rubber ring chords used in pipe joints shall be EPDM rubbering as per IS 5382 : 1985.

CURING

Pipes manufactured in compliance with IS:458 (Latest Edition) shall be either water cured or steam cured for minimum stipulated curing period in accordance with relevant requirements of the latest revised IS:458 (Latest Edition).

DIMENSIONS

The internal diameter, wall thickness and length of barrel and collar of pipes, reinforcement (longitudinal and spiral), type of ends and minimum clear cover to reinforcement and strength test requirements shall be as per the relevant clauses/tables of IS: 458 for different classes of pipes.

Table – 3 of IS-458-2021

Design and Strength Test Requirements of Concrete Pipes of Class NP3 Reinforced Concrete, Medium Duty, Non-Pressure Pipes made by spinning process

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2 and 8.1 and Table 20)

Internal Diameter of Pipes in mm	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Draws Steel	Load to Produce 0.25 mm Crack kN/linear metre	Ultimate Load
		Minimum number	Kg/linear metre	Kg/linear metre		kN/linear metre
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	40	8	0.78	1.53	15.50	23.25
400	75	8	0.78	1.6	19.16	28.74
450	75	8	0.78	1.9	21.56	32.34
600	85	8 or 6+6	1.18	2.82	28.74	43.11
800	95	8 or 6+6	2.66	6.87	38.32	57.48
900	100	6 + 6	2.66	11.55	43.11	64.67
1000	115	6 + 6	2.66	15.70	47.90	71.85
1200	120	8 + 8	3.55	24.74	57.48	86.22
1400	135	8 + 8	3.55	46.21	67.06	100.60
1600	140	8 + 8	3.55	65.40	76.64	114.96
1800	150	12 + 12	9.36	87.10	86.22	129.33
2000	170	12 + 12	9.36	97.90	95.80	143.70
2200	185	12 + 12	9.36	133.30	105.38	158.07

Note :

a. If mild steel is used for spiral reinforcement, the weight specified under col.5 shall be increased to 140/125.
b. The longitudinal reinforcement given in this table is valid for pipes upto 2.5 m. effective length for internal diameter of pipe upto 250 mm and upto 3 m. effective length for higher diameter pipes.
c. Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col.4 by the length of the pipe and then deducting for the cover length provided at the two ends.
d. Concrete for pipes shall have a minimum compressive strength of 35 N/mm2 at 28 days.

Table – 5 of IS- 458-2021

Design and Strength Test Requirements of Concrete Pipes of Class NP3 Reinforced Concrete, Medium Duty, Non-Pressure Pipes Made by Vibrated Casting Process

(Clauses 5.5.1, 6.1.1, 6.1.2.1, 6.1,3, 6.2.2, 7.3,2 and 8.1 ; and Table 20)

Internal Diameter of Pipes in mm	Minimum Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Draws Steel	Load to Produce 0.25 mm Crack kN/linear metre	Ultimate Load kN/linear metre
		Minimum number	Kg/linear metre	Kg/linear metre		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	50	8	0.78	1.53	15.5	23.25
400	60	8	0.78	1.6	19.16	28.74
450	65	8	0.78	1.9	21.56	32.34
600	75	8 or 6 +6	1.18	2.2	28.74	43.11
800	95	8 or 6 +6	2.66	6.87	38.32	57.48
900	100	6 + 6	2.66	11.55	43.11	64.67
1000	115	6 + 6	2.66	15.7	47.9	71.85
1200	125	8 + 8	3.55	21.25	57.48	86.22
1400	140	8 + 8	3.55	30	67.06	100.6
1600	165	8 + 8	3.55	50.63	76.64	114.96
1800	180	12 + 12	9.36	64.19	86.22	129.33
2000	190	12 + 12	9.36	83.12	95.8	143.7
2200	210	12 + 12	9.36	105.53	105.4	158.07

Note : Concrete for pipes shall have a minimum compressive strength of 35 N/mm^2 at 28 days

Table – 6 of IS-458-2021

Design and Strength Test Requirements of Concrete Pipes of Class NP4 Reinforced Concrete, Heavy Duty, Non-Pressure Pipes

(Clauses 6.1.1, 6.1.2.1, 6.1,3, 6.2.2, 7.3,2 and 8.1 ; and Table 20)

Internal Diameter of Pipes in mm	Minimum Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Draws Steel	Load to Produce 0.25 mm Crack kN/linear metre	Ultimate Load kN/linear metre
		Minimum number	Kg/linear metre	Kg/linear metre		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	40	8	0.78	1.53	26.4	39.6
400	75	8	0.78	1.97	33.9	50.9
450	75	8	0.78	3.36	36.9	55.3
600	85	8 or 6 + 6	2.34	8.5	46.3	69.4
800	95	8 or 6 + 6	3.44	16.72	59.3	89.1
900	100	6 + 6	3.44	20.92	66.3	99.4
1000	115	8 + 8	6.04	26.7	72.6	108.9
1200	120	8 + 8	6.04	46.25	88.3	132.4
1400	135	8 + 8	9.36	59.2	99.1	148.65
1600	140	12 + 12	9.36	86.6	109.90	164.85
1800	150	12 + 12	14.88	103.3	120.7	181.05
2000	170	12 + 12	14.88	125.28	131.5	197.25
2200	185	12 + 12	14.88	154.94	142.2	213.3

Note :

1. If mild steel is used for spiral reinforcement, the weight specified under col.5 shall be increased to 140/125.
2. The longitudinal reinforcement given in this table is valid for pipes upto 2.5 m. effective length for internal diameter of pipe upto 250 mm and 3 m. effective length for higher diameter pipes.
3. Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col.4 by the length of the pipe and then deducting for the cover length provided at the two ends.
4. Concrete for pipes shall have a minimum compressive strength of 35 N/mm2 at 28 days.

Table – 8 of IS-458-2021

Design and Strength Test Requirements of Concrete Pipes of Class NP4 Reinforced Concrete, Heavy Duty, Non-Pressure Pipes made by Vibrated casting process

(Clauses 5.5.1, 6.1.1, 6.1.2.1, 6.1,3, 6.2.2, 7.3,2 and 8.1 ; and Table 20)

Internal Diameter of Pipes in mm	Minimum Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Draws Steel	Load to Produce 0.25 mm Crack kN/linear metre	Ultimate Load kN/linear metre
		Minimum number	Kg/linear metre	Kg/linear metre		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	50	8	0.78	1.53	26.4	38.6
400	60	8	0.78	1.97	33.9	50.9
450	65	8	0.78	3.36	36.9	55.3
600	75	8 or 6 + 6	2.34	8.50	46.3	69.4
800	95	8 or 6 + 6	3.44	16.72	59.3	89.1
900	100	6 + 6	3.44	20.92	66.3	99.4
1000	115	8 + 8	6.04	26.70	72.6	108.9
1200	125	8 + 8	6.04	42.42	88.3	132.4
1400	140	8 + 8	9.36	51.39	99.10	148.65
1600	165	12 + 12	9.36	61.81	109.9	164.85
1800	180	12 + 12	14.88	78.03	120.70	181.05
2000	190	12 + 12	14.88	103.5	131.5	197.25

Note : Concrete for pipes shall have a minimum compressive strength of 35 N/mm^2 at 28 days.

The tolerances regarding overall length, internal diameter of pipes or sockets and barrel wall thickens shall be as per relevant clause of IS: 458.

WORKMANSHIP AND FINISH

Pipes shall be straight and free from cracks except that craze cracks may be permitted. The ends of the pipes shall be square with their longitudinal axis so that when placed in a straight line in the trench no opening between ends in contact shall exceed 3 mm in pipes up to 600 mm diameter (inclusive), and 6 mm in pipes larger than 600 mm diameter.

The outside and inside surfaces of the pipes shall be smooth, dense and hard, and shall not be coated with cement wash or other preparation unless otherwise agreed to between Owner/Engineer and the manufacturer or supplier.

The pipes shall be free from defects resulting from imperfect grading of the aggregate, mixing or moulding.

The pipes shall be free from local dents or bulges greater than 3 mm in depth and extending over a length in any direction greater than twice the thickness of barrel.

The deviation from straight in any pipe throughout its effective length, tested by means of a rigid straight edge parallel to the longitudinal axis of the pipe shall not exceed, for all diameters 3 mm forever meter run.

TESTING

All pipes for testing purposes shall be selected at random from the stock of the manufacturer and shall be such as would not otherwise be rejected under the criteria of tolerances as mentioned in IS:458 (Latest Edition).

During manufacture, tests on concrete shall be carried out as per IS:456. The manufacturer shall supply, when required to do so by Owner/Engineer the results of compressive tests of concrete cubes and split tensile tests of concrete cylinders made from the concrete used for the pipes. The manufacturer shall supply cylinders or cubes for test purposes required by the Owner/Engineer and such cylinders or cubes shall withstand the tests prescribed by the manufacturer for the hydrostatic test pressure. For non-pressure pipes, 2 percent of the pipes shall be tested for hydrostatic test pressure.

The specimen of pipes for the following tests shall be selected in accordance with relevant Clause of IS:458 (Latest Edition)and tests in accordance with the methods described in IS:3597.

i) Hydrostatic test
ii) Three edge bearing test
iii) Absorption test

Note: Three edge bearing strength to produce 0.25 mm crack in case of special design of pipes shall be as per IS:458:2003.

For Inspection at manufacturing site 24 hrs. access shall be provided to RMC Engineers as well as engineer appointed by PMC/TPI agency. Apart from this RMC will establish its own pipe testing facility where pipes will be randomly tested. The cost of transporting the pipe to the testing facility & testing charges shall be borne by the contractor.

SAMPLING AND INSPECTION

In any consignment, all the pipes of same class and size and manufactured under similar conditions of production shall be grouped together to constitute a lot. The conformity of a lot to the requirements of this specification shall be ascertained on the basis of tests on pipes selected from it.

The number of pipes to be selected from the lot for testing shall be in accordance with Table 15 of IS:458 (Latest Edition).

Pipes shall be selected at random. In order to ensure randomness, all the pipes in the lot may be arranged in a serial order and starting from any pipe, every 'n'th pipe be selected till the requisite number is obtained, n being the integral part of N/n, where N is the lot size and n is the sample size.

All pipes selected as per IS : 458 shall be inspected for dimensional requirements, finish and deviation from straight. A pipe failing to satisfy one or more of these requirements shall be considered as defective.

The number of pipes to be tested for tests under IS : 458 shall be in accordance with column 4 of Table 15 of IS:458 (Latest Edition). These pipes shall be selected from pipes that have satisfied the requirements mentioned in Clause above.

A lot shall be considered as conforming to the requirements of IS:458 (Latest Edition) of the following conditions are satisfied.

a) The number of defective pipes shall not be more than the permissible number given in column 3 of Table 15 of IS:458 (Latest Edition).

b) All the pipes tested for various tests as per IS-458 shall satisfy corresponding requirements of the tests.
c) In case the number of pipes not satisfying requirements of any one or more tests, one or two further samples of same size shall be selected and tested for the test or tests in which failure has occurred. All these pipes shall satisfy the corresponding requirements of the test.

MARKING

The following information shall be clearly marked on each pipe :

a) For RMC USE
b) Internal diameter of pipe
c) Class of pipe
d) Date of manufacture, and
e) Name of manufacturer or his registered trademark or both.

LAYING OF PIPES

The laying of RCC pipes shall conform to Technical Specifications

JOINTING

GENERAL

Jointing of RCC pipes shall be done with SRC cement only and as per the requirements of following specifications and as per the relevant IS. The type of joints shall be as below. After jointing, extraneous material, if any, shall be removed from the inside of the pipe and the newly made joints shall be thoroughly cured. In case, rubber-sealing rings are used for jointing, these shall conform to IS 5382 and shall be of such type as mentioned in IS-458:2003.

FLUSH JOINT (INTERNAL)

This joint shall be generally used for culvert pipes of 900-mm diameter and over. The ends of the pipes are specially shaped to form a self-centering joint with an internal jointing space 13-mm wide. The finished joint is flush with both inside and outside with the pipe wall. The jointing space is filled with cement mortar in the proportion as specified in IS-458-2003, mixed sufficiently dry to remain in position when forced with a trowel or rammed.

FLUSH JOINT (EXTERNAL)

This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends. Each end shall be butted against each other and adjusted in correct position. The jointing space shall then be filled with cement mortar as specified in IS-458-2003, sufficiently dry and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

SPIGOT AND SOCKET JOINT (FLEXIBLE)

The RCC pipe with the rubber ring accurately positioned on the spigot shall be pushed well home into the socket of the previously laid pipe by means of uniformly applied pressure with the aid of a jack or similar appliance. The RCC pipes shall be of spigot and socket type and rubber rings as specified in IS-458-2003, shall be used, and the manufacturers instructions shall be deemed to form a part of these specifications. The rubber rings shall be lubricated before making the joint and the lubricant shall be soft soap water or an approved lubricant supplied by the manufacturer.

Socket & Spigot NP3 & NP4 pipe with rubber ring roll on joint for diameter upto 900 mm should be provided as per table 14 pf IS 458 : 2003.

Socket & spigot NP3 & NP4 pipe with rubber ring confined joint for diameter 1000 mm to 2200 mm should be provided as per Table -17 of IS 458:2003.

CLEANING OF PIPES

As soon as a stretch of RCC pipes has been laid complete from Machinehole to Machinehole or for a stretch as directed by Owner/Engineer, contractor shall run through the pipes both backwards and forwards a double disc or solid or closed cylinder 75 mm less in diameter than the internal diameter of pipes. The open end of the incomplete stretch of pipeline shall be securely closed as may be directed by Owner/Engineer to prevent entry of mud or silt etc.

If as a result of the removal of any obstructions Owner/Engineer considers that damages may have been caused to the pipelines, he shall be entitled to order the stretch to be tested immediately. Should such test prove unsatisfactory, contractor shall amend the work and carry out such further tests as are required by Owner/Engineer.

It shall also be ascertained by contractor that each stretch from Machinehole to Machinehole or the stretch as directed by Engineer is absolutely clear and without any obstruction by means of visual examination of the interior of the pipeline suitably enlightened by projected sunlight or otherwise.

TESTING AT WORK SITE

After laying and jointing of RCC pipes is completed the pipeline shall be tested at work site as per the following specifications and as directed by Owner/Engineer. All equipment for testing at work site shall be supplied and erected by contractor. Water for testing of pipes shall be arranged by him. Damage during testing shall be contractor's responsibility and shall be rectified by him to the full satisfaction of Owner/Engineer. Water used for test shall be removed from pipes and not released to the excavated trenches.

After the joints have thoroughly set and have been checked by Owner/Engineer and before backfilling the trenches, the entire section of the sewer or storm water drain shall be proved by contractor to be water tight by filling in pipes with water to the level of 1.50 m above the top of the highest pipe in the stretch and heading the water up for the period of one hour. The apparatus used for the purpose of testing shall be approved by Owner/Engineer. Contractor if required by Owner/Engineer shall dewater the excavated pit and keep it dry during the period of testing. The loss of water over a period of 30 minutes should be measured by adding water from a measuring vessel at regular 10 minutes intervals and noting the quantity required to maintain the original water level. For the approval of this test the average quantity added should not exceed 1 litre/hour/100 linear metres/10 mm of nominal internal diameter. Any leakage including excessive sweating which causes a drop in the test water level will be visible and the defective part of the work should be removed and made good.

In case of pressure pipeline the completed stretch of pipeline shall be tested for site test pressure as specified in IS-458-2003. The site test pressure should not be less than the maximum operating pressure plus the calculated surge pressure, but in no case should it exceed the hydrostatic test pressure as specified in IS:458 (Latest Edition).

MEASUREMENT

All RCC pipes shall be measured according to the work actually done and no allowance will be made for any waste in cutting to the exact length required. The measurement

for pipes shall be in running meter nearest to a cm. of length along the centre line of pipe as actually laid at work sites.

The rate for providing, laying and jointing of RCC pipes shall be deemed to include the cost of rubber rings, jointing material, testing and extra excavation required for ordinary bedding of pipes and also for pipe sockets, if any.

NOTES

- If any damage is caused to the pipeline during the execution of work or while cleaning/testing the pipeline as specified. Contractor shall be held responsible for the same and shall replace the damaged pipeline and retest the same at his own cost to the full satisfaction of Engineer.

- Water for testing of pipeline shall be arranged by Contractor at his own cost.

- Pipes shall be brought on site proportionate to the required progress for Thirty days only.

LAYING OF PIPES AND FITTINGS/SPECIALS

The laying of RCC pipes shall be as under :

JOINTING

GENERAL

Jointing of RCC pipes shall be done with cement only and as per the requirements of following specifications and as per the relevant IS. The type of joints shall be as below. After jointing, extraneous material, if any, shall be removed from the inside of the pipe and the newly made joints shall be thoroughly cured.

FLUSH JOINT (INTERNAL)

This joint shall be generally used for culvert pipes of 900-mm diameter and over. The ends of the pipes are specially shaped to form a self-centering joint with an internal jointing space 13-mm wide. The finished joint is flush with both inside and outside with the pipe wall. The jointing space is filled with cement mortar in the proportion as specified in IS-458-2003, mixed sufficiently dry to remain in position when forced with a trowel or rammed.

FLUSH JOINT (EXTERNAL)

This joint is suitable for pipes which are too small for jointing from inside. This joint is composed of specially shaped pipe ends. Each end shall be butted against each other and adjusted in correct position. The jointing space shall then be filled with cement mortar as specified in IS-458-2003, sufficiently dry and finished off flush. Great care shall be taken to ensure that the projecting ends are not damaged as no repairs can be readily affected from inside the pipe.

SPIGOT AND SOCKET JOINT (FLEXIBLE)

The RCC pipe with the rubber ring accurately positioned on the spigot shall be pushed well home into the socket of the previously laid pipe by means of uniformly applied pressure with the aid of a jack or similar appliance. The RCC pipes shall be of spigot and socket type and rubber rings as specified in IS-458-2003, shall be used, and the manufacturers instructions shall be deemed to form a part of these specifications. The rubber rings shall be lubricated before making the joint and the lubricant shall be soft soap water or an approved lubricant supplied by the manufacturer.

Socket & Spigot NP3 & NP4 pipe with rubber ring roll on joint for diameter upto 900 mm should be provided as per table 14 pf IS 458 : 2003.

Socket & spigot NP3 & NP4 pipe with rubber ring confined joint for diameter 1000 mm to 2200 mm should be provided as per Table -17 of IS 458:2003.

COLLAR JOINT (RIGID)

After laying the RCC pipes at proper alignment and gradient their abutting faces shall be coated with hot bitumen in liquid condition by means of a brush. The wedge-shaped groove in the end of the pipe shall then be filled with a tarred gasket in one length for each joint. The collar shall then be slipped over the end of the pipe and the next pipe butted well against the tarred gasket by suitable appliances approved by Owner/Engineer so as to thoroughly compress the tarred gasket into the grooves, care being taken that the concentricity of the pipes and levels are not disturbed during this operation. The collar shall then be placed symmetrically over the end of the two pipes and the space between the inside of the collar and the outside of the pipe filled with a mixture of cement and sand as specified in Data Sheet-A, tempered with just sufficient water to have a consistency of the semi-dry conditions, well packed and thoroughly

rammed with caulking tools. The joints shall be finished off with a fillet sloping at 45(to the side of the pipe. The finished joints shall be protected and cured thoroughly as directed by Owner/Engineer. Any plastic solution or cement mortar that may have been squeezed into the inside of the pipe shall be removed so as to leave the inside of the pipe perfectly clean.

COLLAR JOINT (SEMI-FLEXIBLE)

This joint is made up of a loose collar, which covers two specially shaped pipe ends. Each end shall be fitted with a rubber ring as specified in Data Sheet-a which when compressed between the spigot and collar, seals the joint. Stiff mixture of cement mortar as specified in Data Sheet-a shall then be filled into the remaining annular space and rammed with a caulking tool.

CLEANING OF PIPES

As soon as a stretch of RCC pipes has been laid complete from manhole to manhole or for a stretch as directed by Owner/Engineer, contractor shall run through the pipes both backwards and forwards a double disc or solid or closed cylinder 75 mm less in diameter than the internal diameter of pipes. The open end of the incomplete stretch of pipeline shall be securely closed as may be directed by Owner/Engineer to prevent entry of mud or silt etc.

If as a result of the removal of any obstructions Owner/Engineer considers that damages may have been caused to the pipelines, he shall be entitled to order the stretch to be tested immediately. Should such test prove unsatisfactory, contractor shall amend the work and carry out such further tests as are required by Owner/Engineer.

It shall also be ascertained by contractor that each stretch from manhole to manhole or the stretch as directed by Engineer is absolutely clear and without any obstruction by means of visual examination of the interior of the pipeline suitably enlightened by projected sunlight or otherwise.

TESTING AT WORK SITE

After laying and jointing of RCC pipes is completed the pipeline shall be tested at work site as per the following specifications and as directed by Owner/Engineer. All equipment for testing at work site shall be supplied and erected by contractor. Water for testing of pipes shall be arranged by him. Damage during testing shall be contractor's responsibility and shall be rectified by him to the full satisfaction of Owner/Engineer. Water used for test shall be removed from pipes and not released to the excavated trenches.

After the joints have thoroughly set and have been checked by Owner/Engineer and before backfilling the trenches, the entire section of the sewer or storm water drain shall be proved by contractor to be water tight by filling in pipes with water to the level of 1.50 m above the top of the highest pipe in the stretch and heading the water up for the period of one hour. The apparatus used for the purpose of testing shall be approved by Owner/Engineer. Contractor if required by Owner/Engineer shall dewater the excavated pit and keep it dry during the period of testing. The loss of water over a period of 30 minutes should be measured by adding water from a measuring vessel at regular 10 minutes intervals and noting the quantity required to maintain the original water level. For the approval of this test the average quantity added should not exceed 1 litre/hour/100 linear metres/10 mm of nominal internal diameter. Any leakage including excessive sweating which causes a drop in the test water level will be visible and the defective part of the work should be removed and made good.

In case of pressure pipeline the completed stretch of pipeline shall be tested for site test pressure as specified in IS-458-2003. The site test pressure should not be less

than the maximum operating pressure plus the calculated surge pressure, but in no case should it exceed the hydrostatic test pressure as specified in IS:458 (Latest Edition).

MEASUREMENT

All RCC pipes shall be measured according to the work actually done and no allowance will be made for any waste in cutting to the exact length required. The measurement for pipes shall be in running meter nearest to a cm. of length along the centre line of pipe as actually laid at work sites.

The rate for providing, laying and jointing of RCC pipes shall be deemed to include the cost of rubber ring, jointing material, testing and extra excavation required for pipe sockets, if any.

NOTES

- If any damage is caused to the pipeline during the execution of work or while cleaning/testing the pipeline as specified. Contractor shall be held responsible for the same and shall replace the damaged pipeline and retest the same at his own cost to the full satisfaction of Engineer.

- Water for testing of pipeline shall be arranged by Contractor at his own cost.

- Pipes shall be brought on site proportionate to the required progress for Thirty days only.

SCOPE

The specification covers the requirements for laying of pipes and fittings/specials below ground. The two parts are complementary and are to be read together for a correct interpretation of the provisions of this specification.

APPLICABLE CODES

The laying of pipes and fittings/specials shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred to. In all cases, the latest revision of the standards/codes shall be referred to. If requirements of this specification conflict with the requirements of the standards/codes, these specifications shall govern.

CODES OF PRACTICE

a) IS: 783 -Code of practice for laying of concrete pipes
b) IS: 3114 -Code of practice for laying of cast iron pipes
c) IS: 3764 -Excavation work - Code of Safety
d) IS: 4127 -Code of practice for laying of glazed stoneware pipes
e) IS: 5822 -Code of practice for laying of electrically welded steel pipes for water supply
f) IS: 6530 -Code of practice for laying of asbestos cement pressure pipes

CARTING AND HANDLING

Pipes and fittings/specials shall be transported from the factory to the work sites at places along the alignment of pipeline as directed by Owner/ Engineer. Contractor shall be responsible for the safety of pipes and fittings/specials in transit, loading/unloading. Every care shall be exercised in handling pipes and fittings/specials to avoid damage. While unloading, the pipes and fittings/specials shall not be thrown down from the truck on to hard surfaces. They should be unloaded on timber skids with steadying ropes or by any other approved means. Padding shall be provided any

other approved means. Padding shall be provided between coated pipes, fittings/ specials and timber skids to avoid damage to the coating. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. In case of spigot socket pipes, care should be taken regarding orientation of pipes while unloading. As far as possible pipes shall be unloaded on one side of the trench only. The pipes shall be checked for any visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for reclamation. Any pipe, which shows sufficient damage to preclude it from being used, shall be discarded. Dragging of pipes and fittings/specials along concrete and similar pavement with hard surfaces shall be prohibited. Pipes can be brought to site only after the mandatory tests i.e. are completed and pipe lots accepted. i.e. Cube tests, T.E.B., Hydrostatic, water absorption test.

STORAGE

Each stack of pipes shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible. Storage shall be done on firm level and clean ground and wedges shall be provided at the bottom layer to keep the stack stable. The stack shall be in pyramid shape or the pipes laid length-wise and crosswise in alternate layers. The pyramid stack shall be made for smaller diameter pipes for conserving space in storing them. The height of the stock shall not exceed 1.5m. Fittings/specials shall be stacked under cover and separated from pipes.

Rubber rings shall be stored in a clean, cool store away from windows, boiler, electrical equipment and petrol, oils or other chemicals. Particularly in the field where the rubber rings are being used it is desirable that they are not left out on the ground in the sun or overnight under heavy frost or snow conditions.

LAYING

EXCAVATION

Before excavating the trench the alignment of pipeline shall be approved by Owner/Engineer. The excavation of trenches and pits for manholes/ chambers shall be carried out in accordance with the Technical Specification: Section-D1 and shall be done such that it does note get far ahead of the laying operating as approved by Owner/Engineer.

To protect persons from injury and to avoid damage to property, adequate barricades, construction signs, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian Standards and the rules and regulations of local authorities in regards to safety provisions shall be observed.

Suitable barricading shall be provided along the sides of trenches and pits. The posts of fencing shall be of timber securely fixed in the ground not more than 3 m apart and they shall not be less than 75 mm in diameter or less than 1.2m above surface of the ground. There shall be two rails, one near the top of the post and the other about 450mm above the ground and each shall be from 50 mm to 70mm in diameter and sufficiently long to run from post to post to which they shall be bound with strong rope. The method of projecting rails beyond the post and trying them together where they meet will not be allowed on any account. All along the edges of the excavation trenches a bank of earth about 1.2m high shall be formed where required by owner/ engineer for further protection.

The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Owner/Engineer.

During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants, sluice valves, manholes covers etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organisations or otherwise as Owner/engineer may direct.

Contractor shall take into account additional excavation if any as Owner/ Engineer may require in order to locate the position of water pipes, drains, sewers etc. or any other works which may be met with, in or about the excavation of trenches/pits while quoting the rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Owner/Engineer may direct, and shall be protected by the Contractor from damage during the progress of the work. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas, sewage etc.

If the work for which the excavation has been made is not completed by the expected date of the setting of monsoon as stipulated in "Data Sheet -A" or the setting in of rain whichever is earlier, or before the day fixed by Owner/ Engineer for filling in any excavation on account of any festival or special occasion. Contractor shall backfill such excavation and consolidates the filling.

Utmost care shall be taken to see that the width of the trench at the top of pipe is not more than that specified in drawing. In case additional width is required it shall be provided only in the top portion from the ground level up to 300-mm above the top of pipe. If any extra width is provided in the area below this portion, Contractor shall have to provide remedial measures in the form of lime concrete or rubble masonry otherwise at the discretion and to the satisfaction of Owner/Engineer. If rock is met with, it shall be removed to 15 cm below the bottom of pipes and fittings/specials and the space resulting shall be refilled with granular materials and properly consolidated. Bottom of trenches/pits shall be saturated with water well rammed wherever Owner/ Engineer may consider it necessary to do so.

Wherever a socket or collar of pipe or fitting/special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all around the socket in order to make the joint and the grip shall be maintained clear until the joint has been approved by Owner/Engineer.

When welding is to be carried out with the pipes and specials in the trench, additional excavation of not more than 60 cm in depth and 90 cm in length shall be made at joints in order to facilitate welding.

The excess excavated material shall be carried away from site of works to a place up to a distance as directed by Owner/Engineer. This shall be done immediately so as not to cause any inconvenience to the public or traffic. If the instructions from Engineer are not implemented within seven days from the date of instructions to cart the materials and to clear the site, the same shall be carried out by Owner/Engineer and any claim or dispute shall not be entertained in this respect.

DEWATERING

During the excavation, if subsoil water is met with Contractor shall have to provide necessary equipment and labourers for dewatering the trenches/pits by bailing out water or water mixed with clay; if pumping out subsoil water is found to be necessary, Contractor shall provide sufficient number of pumps for the same. In both the above

cases the excavation shall be done to the required level and the pipes shall be laid to proper alignment and gradient. Contractor shall also make necessary arrangement for the disposal of drained water to nearby storm water drain or in a pit if allowed by Owner/Engineer. In no case the water shall be allowed to spread over the adjoining area. Before discharging this water into public sewer/drain, Contractor shall take necessary permission from the local authorities.

SPECIAL FOUNDATION IN POOR SOIL

Where the bottom of the trench and sub-grade is found to consist of material which is unstable to such a degree that in the opinion of Owner/Engineer, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipes, consisting of piling, timbers or other materials, in accordance with relevant drawings and as instructed by Owner/Engineer shall be constructed.

WOODEN SHORING

Contractor shall suitably design polling bards, walling and struts to meet different soil conditions that might be encountered in excavating trenches/ pits. The horizontal and vertical spacing of struts shall be such that not only the sides of trenches shall be prevented from collapse but also easy lowering of pipe in trenches shall be ensured without creating undue obstructions for the excavation of the work. Any inconvenience and/or delay that might be caused in lowering pipes in trenches as a result of adopting improper spacing of struts by Contractor shall be his sole responsibility. No part of shoring shall be at any time be removed by Contractor without obtaining permission from Owner/Engineer. While taking out shoring planks the hollows of any form must simultaneously be filled in with soft earth well rammed with rammers and with water.

Owner/Engineer may order portions of shoring to be left in the trenches/pits at such places, where it is found absolutely necessary to do so to avoid any damage, which may be caused to buildings, cables, gas-mains, water mains, sewers etc. in close proximity of the excavation, by pulling out the shoring from the excavations. Contractor shall not claim, on any reason whatsoever, for the shoring which may have been left in by him at his won discretion.

STEEL PLATE SHORING

Where the subsoil conditions are expected to be of a soft and unstable character in trench/pit excavation, the normal method of timbering may prove insufficient to avoid subsidence of the adjoining road surfaces and other services. In such circumstances Contractor will be required to use steel trench sheeting or sheet piling adequately supported by timber struts, walling etc., as per the instructions, manner and method directed by Owner/ Engineer. Contractor shall supply, pitch, drive and subsequently remove trench sheeting or piling in accordance with other items of the specification.

BONING STAVES AND SIGHT RAILS

In laying the pipes and fittings/specials the centre for each manhole/chamber or pipeline shall be marked by a peg. Contractor shall dig holes for and set up two posts (about 100 x 100 x 1800 mm) at each manhole/chamber or junction of pipelines at nearly equal distance from the peg and at sufficient distances there from to be well clear of all intended excavation, so arranged that a sight rail when fixed at a certain level against the post shall cross the centre line of the manhole/chamber or pipelines. The sight rail shall not in any case be more than 30m apart. intermediate rails shall be put up if directed by Owner/Engineer.

Boning staves of 75mm x 50 mm size shall be prepared by Contractor in various lengths, each length being of a certain whole number of meters and with a fixed tee

head and fixed intermediate cross pieces, each about 300 mm long. The top-edge of the cross piece must be fixed below the top-edge of the cross piece must be fixed below the top-edge of the tee-head at a distance equal to the outside diameter of the pipe or the thickness of the concrete bed to be laid as the case may be. The top of cross pieces shall indicate different levels such as excavation for pipeline, top of concrete bed, top of pipe etc. as the case may be.

The sight rail of size 250-mm x 40 mm shall be screwed with the top edge resting against the level marks. The centre line of the pipe shall be marked on the rail and this mark shall denote also the meeting point of the centre lines of any converging pipes. A line drawn from the top edge of one rail to the top edge of the next rail shall be vertically parallel with the bed of the pipe, and the depth of the bed of pipe at any intermediate point may be determined by letting down the selected boning staff until the tee head comes in the line of sight from rail to rail.

The post and rails shall be perfectly square and planned smooth on all sides and edges. The rails shall be painted white on both sides and the tee-heads and crosspiece of the boning staves shall be painted black.

For the pipes converging to a manhole/chamber at various levels, there shall be a rail fixed for every different level. When a rail comes within 0.60 M of the surface of the ground, a higher sight-rail shall be fixed for use with the rail over the next point.

The posts and rails shall in no case be removed until the trench is excavated, the pipes are laid and Owner/Engineer gives permission to proceed with the backfilling.

LAYING OF PIPES AND FITTINGS/SPECIALS

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas, sewage etc. After excavation of trenches, pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Owner/Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fitting/specials shall be made by Contractor. In no case pipes and fittings/specials shall be dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipes and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and is rung with slight hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene /dye on the inside of the pipe at the suspected spot. No sign of kerosene/dyke should appear on the outside surface. Pipes and fittings/specials damaged during lowering or aligning shall be rejected by Owner/Engineer.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings/specials, which do not allow a sufficient and uniform space for joints, shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Owner/Engineer. During the period that the plug is on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where

long radius curves are permitted the deflection allowed at joints shall not exceed 2½%. In case of pipes, with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. The pipes shall be laid such that the marking on pipes appears at the top of the pipes.

The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe-cutting machine shall be used.

JOINTING

Jointing for pipes and fittings/specials shall be as per IS-783 (latest revision) done in accordance with the relevant specifications depending upon the type of pipes being used.

Basic requirements for jointing the pipes are

a) Cleanliness of all parts , particularly joint surface.
b) Correct location of components.
c) Centralization of spigot within socket.
d) Provision of the correct gap between the end of the spigot and the back of the socket to ensure flexibility at each joint.
e) Any lubricant used shall be approved as to composition and method of application.

TESTING AND COMMISSIONING

Testing and commissioning of pipes shall be as per IS-783 (latest Revision) clause 15.5 done in accordance with the relevant specifications.

SEWER MANHOLES

MATERIALS :

Material used for construction of sewer manholes shall conform to material specification given in the tender.

Manhole cover with frame of required size and weight shall be procured by the contractor.

WORKMANSHIP :

The manhole of different types and sizes as specified shall be constructed in sewer line at such place and to such levels and dimension as shown in drawing or as directed.

Excavation :- The excavation for construction of manhole including dismantling of all types of roads surface guarding, barricading, lightening the trenches, dewatering if required, removing and replacing, shifting of telephone/electric cables, pipe line etc. and all other safety provisions like shoring and strutting etc. till refilling of trenches and completion of manhole construction, stacking of excavated stuff within the specified lead, back filling of selected excavated earth, watering and consideration etc. complete shall be carried out as per relevant specification of Excavation.

Concrete work :- The bed concrete in P.C.C. (1:4:8), benching concrete for channel in C.C. (1:2:4) and RCC slab in (1:2:4) by volume with necessary centering and shuttering work shall be provided. It should be placed deemed and or vibrated and cured as directed by engineer in charge.

REINFORCEMENT :

All the 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 No. 1 binding wire not less than 1 mm is size and by using stay block ornnetal chair spacers, metal hangers, supporting wires or other approved devices it sufficiently close intervals. Bars shall not be allowed to bag between supports nor displaced during concrete of any other operation of the work. Reinforcement after being 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.

Bars shall be bend cold to specified shape and dismensions or as directed, attain proper raduis of bends, Bars shall not be bent or staightened in a manner that will injure the materials. Bars bend during transport of handling shall be straightened before being used on the work. Unless otherwise specified for mild steel a `U' type hook at the end of each bar shall inveriably be provided to main reinforcement.

In case 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 cold twisted steel bars shall be used or without hooks at the ends. Deformed bars without hooks shall however, comply with relevant enchorage requirements.

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

As far as possible bars of full length shall be used. In case this not possible overlapping of bars shall be done as directed. The overlaps shall be staggered for

different bars and located at points along the span where shear not bending moment is maximum.

When permitted or specified on the drawings joints of reinforcement bars shall butt welded so as to transmit their full stresses. Welded joints shall preferably located at points when steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the rods are welded. It shall be ensured that no viods are left in welding and when welding is done in two or three stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work.

BRICK MASONARY WORK :

Before masonary is to be laid on concrete footing the top of concrete shall be cleaned and moistened. The contractor shall obtain the Engineer's approval for one foundation, bed, before foundation masonary is started.

Wetting of Bricks : The brick required for masonary shall be theroughly wetted with clean water for amount two hours before use or as directed. The cassation of bubbles, when the bricks are wetted with water is an indication of through wetting of bricks.

Brick shall be laid in English bond unless directed otherwise. Half or out bricks shall not be used except when necessary to complete to bond. Closers in such case shall be cut to required size and used bear the ends of walls.

A layer of mortar shall be spread on full width for suitable length of the lower course, each brick shall first be properly bedded and set home by gently tamping with handle of trowel of wooden mallet. Its inside face shall be flushed with mortar the next brick is laid and pressed again it. On completion of course, the vertical joints shall be fully silled from the top with mortar.

The wall shall be taken up truly in plumb. All corners shall be laid truly horizontal and all vertical joint shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of brick course shall be kept uniform.

The brick shall be laid with from up wards. A set of tools comprising of wooden straight edges, monsoon spirit level, square half meter rub, and pins string and plumb shall be kept on the site of work for frequent checking during the progress of work.

Both the faces of walls of thickness greater than 23 cms. shall be kept in proper place. All the connected brick work shall be kept not more than one meter over the rest of the work. Where this is not possible the work shall be raked back according to bond (and not left toothed) at an angle not stoper than 45 degrees.

All fixtures like pipe inlet and outlet, PVC steps, manhole cover and frame etc. which are required to be built in wall shall be embeded in cement mortar.

Brick shall be so laid that all joints shall not exposed 12 mm. The face joints shall be raked out as directed by raking tool daily during the progress of work, when the mortar in still green so as to provided key for plaster or ponting to be done.

For the face of brick work, plastering is to be done joints shall be racked out to a depth not less than thickness of joints. The face of brick work shall be cleaned and mortar dropping removed on very same day that brick work is laid.

PLASTER WORK :

The surface shall be cleaned of all dust, loose mortar droppings, traces of algae afflorseence and other foreign mortar by water or by brushing. Smooth surface shall be roughened by wire brushing of it is not hard any by backing if it is har. In case of concrete surface, if a chemical retarder has been applied to the form work. The surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that done of the reerarders is left on the surface. Trimming of projections on brick/concrete surface where necessary shall be carried out to get an even surface.

The work shall be soaked but only damped evenly before applying the plaster. If the surface become dry, such areas shall be moistened again.

The plaster about 15 x 15 cms. shall be first applied horizontally and vertically at not more than 2 meters intervals over the entire surface to serve as gauge. The surface of these gauges shall be truly in plane of the finished plastered surface. The mortarshall than be applied in uniform surface slightly more than the specified thickness, then brought to a true surface be working a wooden straight edge reaching acress the gauges with small upward and sideways movements at a time. Finally, the surface shall be finished off true with a trowel of wooden float accordingly excessive trowelling of over working the float shall be avoided. All corners arrises angles and junctions shall be truly vertical of horizontal as the case may be and shall be carefully finished. Rounding or chambering conners, arrises junctions etc. shall be carried out with proper templates the size required.

Cement mortar for plaster shall be used within half an hour after addition of water. And mortar for plaster which is partially set shall be rejected and removed forthwith from the site.

In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically, when recommending the plaster the edge of the old work shall be scraped clear and wetted with cement putty before plaster is applied to the adjustment areas to enable the two to properly together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15 cm. to any corners of arises. It shall not be closed on the body of features such as plaster bends and cornices not at the corners or arises. Horizontal joints in plaster work shall not also occure on walls and copings these invariably leads to leakage. No portion of the surface shall be deft out initially to be packed up latter on.

FIXING OF POLY PROPYLENE STEPS AND MANHOLE COVER :

During the construction of masonary wall of the manhole the cement mortar of required proportion shall be used for embedding the Poly propylene steps in the wall masonary. The spacing of steps in the masonary shall be 300 mm centre to centre in the staggered position in the vertical direction with two staggered raws at 385 mm centre to centre in the horizontal direction the top of the manhole shall not be more than 300 mm above the benching and the centre line of two staggered raws shall be the centre line of the shorter side of manhole frame in the roof of chamber.

The detailed specifications for the "Poly propylene steps as below:

The Polypropylene conforming to an ASTM D-4101, injection molded around a 12 mm dia. IS 1786 grade Fe-500 steel reinforcing bar and should meet the load required 225 Kg. as per IS-5455. The measurement should be as per attached drawing. The tolerance in the length and width is +/- 5 mm and +/- 1 mm in thickness. The weight of the steps should not be less than 0.900 Kg.

Unchequered portion of the step shall be inserted with the risk cement mortar during the couse of masonary work so constructed around the steps as to keep the step on its right position. The non-slip grap chequered portion of the steps shall be well kept outside the masonary.

During fixing of the steps, the wall should not be demaged and shall not vibrate or shall not shake during ascents and decents otherwise they shall have to be refixed correctly as per the drawings or as mentioned above.

Manhole frame shall be firmly and securely laid on top of shafts of conical tops in 25 mm thick cement mortar and shall be embeded in 200 mm the cement concrete of proportion 1:2:4 (1 Cement : 2 coarse sand : 4 Kapchi as aggregate of 20 mm nominal size) in such a way that the top of M.H. frame shall be flush with concrete surface and top surface neatly finished 25 mm thick with cement mortar 1:3 in confirmity with ground or road levels.

OTHER REQUIREMENTS :

As per line and level and size of the manhole pit shall be excavated as per drawing or as ordered by the Engineer.

The foundation concrete 1:4:8 with required thickness as per drawing or as directed shall be laid after compacting the bottom of the pit. The cement concrete shall conform to specified specification of Cement Concrete.

The clear inside chamber size of opening shall be as per the drawing or as directed by the Engineer-in-charge.

The masonary wall shall be plastered inside with 20 mm thick 1:3 cement mortar and outside 15 mm thick in C.M. (1:3) above coping level. The off set for the concrete foundation shall be 300 mm on all sides beyond walls of chamber.

Whenever pipes enter or leave the masonary chamber bricks on edge must be so laid around the upper half of the pipes so as to form the arch to prevent the weight of the masonary chamber over it.

On the top of masonary walls 1:5 cement mortar shall be laid and then R.C.C. slab of grade 1:2:4 necessary and as directed by the Engineer with coarse aggregate of trap metal of 20 mm nominal shall be laid necessary from work and centering shall have to be provided by the contractor at his own cost as per relevant specification of cement concrete.

In the bottom of manhole the channel and benching shall be done in C.C. 1:2:4 (1 Cement : 2 Coarse sand : 4 graded stone aggregate of 20 mm nominal size) rising at a step in line from edge of the channel, the channel of the bottom of the chamber shall be plastered 20 mm thick in c.m. 1:3 (1 Cement : 3 fine sand) and steel trowel smooth.

Channels shall be in semi circular in the bottom half and a diameter equal to the sewer. Above the horizontal diameter, the side shall be extended vertically to the same level as the crown of the out going pipe and the top edge shall be suitably rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junctions with the main channel an appropriate fall suitably rounded off in the direction of flow in the main channel shall be given.

For conical shaft of manhole necessary conical portion shall be treated from 750 mm below the bottom of concrete of slab for fixing of manhole cover and frame.

The item includes curing of all the cement work for 14 days.

MODE OF MEASUREMENTS & PAYMENTS :

Payment shall be made on the basis as per number of masonary manholes chamber Constructed with all constructing materials labours, excavation refilling curing, finishing providing and fixing PVC steps constructing laying half round gutter fixing R.C.C. manhole cover etc. complete in all respect.

The item will be paid per No. of construction of complete masonary manhole chamber as shown in the drawing upto the depth specified and shown in the type design drawing.

The measurements shall be made for such number of chambers construction. The surplus excavated stuff shall be disposed of as directed by Engineer-in-charge.

The depth of manholes shall be the distance between the top of manhole and the invert level of the main drain. The rate includes all labours, materials, tools and plant etc. required for satisfactory completion of this item as directed above.

The item includes :-

(i) Excavation for manhole
(ii) Bed concrete slab concrete and copping with necessary reinforcement.
(iii) Necessary brick work with cement plaster inside and outside.
(iv) Providing and fixing polyproplene steps.
(v) Carting, conveying and fixing of manhole frame cover with necessary concrete and finishing.
(vi) Refilling with necessary watering and consolidation.
(vii) Curing for 14 days.

PRECAST RCC MANHOLE FRAME AND COVER

1.0 GENERAL

1.1 Precast RCC Manhole Frame & cover shall be as per IS: 12592 (part – I & II). The M.H. Frame & Cover shall be of Heavy duty of Grade designation HD-20 – Rectangular in shape with clear opening of Man Hole.

2.0 MATERIALS

2.1 Materials such as cement, aggregate, water, reinforcement shall be of standard as prescribed in the material part. Other materials to be used for Frame & Cover shall be as under:

2.2 CONCRETE:

The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing, etc. (IS: 456 – 1978). The minimum cement content in the concrete shall be 360 Kg/m3 with a maximum water content ratio of 0.45. Concrete weaker than grade M 30 shall not be used. Compaction of concrete shall be done by table machine vibration.

3.0 STEEL FIBERS:

The diameter/equivalent diameter of steel fibers shall not be greater than 0.75 mm. The aspect ratio of the fibers shall be in the range of 50 to 80. The minimum volume of fibers, where used, shall be 0.5 percent of the volume of the concrete.

4.0 ADDITIVES OR ADMIXTURES:

Additives or admixtures may be added either as additives to the cement during manufacture, or as admixtures to the concrete mix. Additives or admixtures used for covers may be:

a) Accelerating, water-reducing and air-entertaining admixtures confirming to IS: 9103- 1979.

b) Coloring pigments

c) Fly ash confirming to IS: 3812-1981

d) Water proofing agents conforming to IS: 2645-1975.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Length, breadth and diameter of precast concrete manhole covers shall be such that the maximum clearance at top between the cover & frame of corresponding grade and shape shall be 5 mm. The top surface of frame & cover is in level within a tolerance of ± 5 mm.

6.0 MANUFACTURE:

6.1 MIXING

Concrete shall be mixed in a mechanical mixer. Mixing shall be continued until there is a uniform distribution of the material and the mass is uniform in colour and consistency.

6.2 Placing of reinforcement, compaction of concrete, curing, edge protection and finishing shall be attended as per IS: 12592. Edge Protection & Finishing shall be provided as per relevant IS.

7.0 LIFTING HOOKS:

7.1 The minimum diameter of mild steel rod used as lifting device shall be 16 mm for heavy duty covers. The lifting device shall be protected from corrosion by hot dip galvanizing or any other suitable means approved by the purchaser or shall be made of naturally corrosion resistant metal rods.

8.0 PHYSICAL REQUIREMENTS:

8.1 All the frame & covers shall be sound and shall be free from cracks & other defects, which interferes with the proper placing of the units or impair the strength or performance of the units. Minor chippings resulting from the customary methods of handling and transportation shall not be deemed ground for rejection.

9.0 MARKING:

Each Cover shall have following marking:

a) Date of manufacture
b) Grade Designation
c) ISI mark
d) as specified - Identification mark

10.0 TESTING

Frame & covers will be tested at factory by owner / consultant & accepted goods shall be procured on site of work.

11.0 PAYEMENT

The rate shall be paid on number basis for set of Frame & Cover.

REFILLING OF PIPELINE TRENCHES

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipe and drains have been tested and passed. The backfilling material shall be properly consolidated taking due care so that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with fine materials such as earth, murrum, etc. The filling up to the level of the centerline of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the centerline of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

Measurement and Payment

Payment shall be made on cubic meter basis of actual refilling done.

CONCRETE WORK

SCOPE

This Specification covers the general requirements for concrete using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing, transporting, placing, curing, protecting, repairing, finishing and testing of concrete; form work; requirements in regard to the quality, storage, bending and fixing of reinforcement; grouting as well as mode of measurement and payment for complete works.

It shall be very clearly understood that the specifications given herein are brief and do not cover minute details. However, all work shall have to be carried out in accordance with the relevant standards and codes of practices or in their absence in accordance with the best accepted current engineering practices or as directed by Engineer from time to time. The decision of Engineer as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on Contractor and no claim whatsoever will be entertained on this account.

APPLICABLE CODES AND SPECIFICATIONS

The following specifications, standards and codes, including all official amendments / revisions and other specifications and codes referred to therein, should be considered a part of this specification. In all cases the latest issue / edition / revision shall apply. In case of discrepancy between this specification and those referred to herein below or other specifications forming a part of this bid document, this specification shall govern.

Code for Materials

1.	IS : 269	-	Specification for 33 grade ordinary portland cement
2.	IS : 455	-	Specification for portland slag cement
3.	IS : 1489 (Part 1 and	-	Specification for portland pozzolana cement
4.	IS : 8112	-	Specification for 43 grade ordinary portland cement.
5.	IS : 12330	-	Specification for sulphate resisting portland cement
6.	IS : 383	-	Specification for coarse and fine aggregates from natural sources for concrete.
7.	IS : 432 (Part 1 and	-	Specification for mild steel and medium tensile steel bars and hard drawn steel wires for concrete reinforcement.
8.	IS : 1786	-	Specification for high strength deformed steel bars and wires for concrete reinforcement.
9.	IS : 1566	-	Specification for hard drawn steel wire fabric for concrete reinforcement.
10.	IS : 9103	-	Specification for admixtures for concrete.
11.	IS : 2645	-	Specification for integral cement water proofing compounds.
12.	IS : 4990	-	Specification for plywood for concrete shuttering work.
13.	IS : 12269	-	Specification for 53 grade ordinary portland cement.

Code for Material Testing

1.	IS : 4031 (Parts 1 to 15)	-	Methods of physical tests for hydraulic cement.
2.	IS : 4032	-	Methods of chemical analysis of hydraulic cement.
3.	IS : 650	-	Specifications for standard sand for testing of cement.
4.	IS : 2430	-	Methods for sampling of aggregates for concrete.
5.	IS : 2386 (Parts 1 to 8)	-	Methods of test for aggregates for concrete.
6.	IS : 3025	-	Methods of sampling and test (physical and chemical) water used in industry.
7.	IS : 6925	-	Methods of test for determination of water soluble chlorides in concrete admixtures.

Code for Materials Storage

1.	IS : 4082	-	Recommendations on stacking and storing of construction materials at site.

Code for Concrete Mix Design

1.	IS : 10262	-	Recommended guidelines for concrete mix design.
2.	SP : 23 (S&T)	-	Handbook on Concrete Mixes.

Code for Concrete Testing

1.	IS : 1199	-	Method of sampling and analysis of concrete.
2.	IS : 516	-	Method of test for strength of concrete
3.	IS : 9013	-	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
4.	IS : 8142	-	Method of test for determining setting time of concrete by penetration resistance.
5.	IS : 9284	-	Method of test for abrasion resistance of concrete.
6.	IS : 2770	-	Methods of testing bond in reinforced concrete.

Code for Equipment

1.	IS : 1791	-	Specification for batch type concrete mixers.
2.	IS : 2438	-	Specification for roller pan mixer.
3.	IS : 4925	-	Specification for concrete batching and mixing plant.
4.	IS : 5892	-	Specification for concrete transit mixer and agitator.
5.	IS : 7242	-	Specification for concrete spreaders.
6.	IS : 2505	-	General Requirements for concrete vibrators : Immersion type.
7.	IS : 2506	-	General Requirements for screed board concrete vibrators.
8.	IS : 2514	-	Specification for concrete vibrating tables.
9.	IS : 3366	-	Specification for pan vibrators.
10.	IS : 4656	-	Specification for form vibrators for concrete.
11.	IS: 11993		Code of practice for use of screed board concrete vibrators.
12.	IS : 7251	-	Specification for concrete finishers.
13.	IS : 2722	-	Specification for portable swing weigh batchers for concrete (single and double bucket type).
14.	IS : 2750	-	Specification for steel scaffoldings.

Codes of Practice

1.	IS : 456	-	Code of practice for plain and reinforced concrete.
2.	IS : 457	-	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
3.	IS : 3370 (Parts 1 to)	-	Code of practice for concrete structures for storage of liquids.
4.	IS : 3935	-	Code of practice for composite construction.
5.	IS : 2204	-	Code of practice for construction of reinforced concrete shell roof.
6.	IS : 2210	-	Criteria for the design of reinforced concrete shell structures and folded plates.
7.	IS : 2502	-	Code of practice for bending and fixing of bars for concrete reinforcement.
8.	IS : 5525	-	Recommendation for detailing of reinforcement in reinforced concrete works.
9.	IS : 2751	-	Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
10.	IS : 9417	-	Specification for welding cold worked bars for reinforced concrete construction.
11.	IS : 3558	-	Code of practice for use of immersion vibrators for consolidating concrete.
12.	IS : 3414	-	Code of practice for design and installation of joints in buildings.
13.	IS : 4326	-	Code of practice for earthquake resistant design and construction of building.
14.	IS : 4014 (Part 1 a	-	Code of practice for steel tubular scaffolding.
15.	IS : 2571	-	Code of practice for laying in-situ cement concrete flooring.
16.	IS : 7861	-	Code of practice for extreme weather concreting.
	(Part – 1)	-	Recommended practice for hot weather concreting.
	(Part – 2)	-	Recommended practice for cold weather concreting.

Code for Construction safety

1.	IS : 3696 (Parts I and III)	-	Safety code for scaffolds and ladders.
2.	IS : 7969	-	Safety code for handling and storage of building materials.
3.	IS : 8989	-	Safety code for erection of concrete framed structures.

Code for Measurement

1.	IS : 1200 (Part 1 to 28)	-	Method of measurement of building and engineering works.
2.	IS : 3385	-	Code of practice for measurement of Civil Engineering works.

GENERAL

Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work. This shall, however, not relieve Contractor of any of his responsibilities. All materials which doe not conform to this specification shall be rejected.

Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes / standards shall generally be used, other materials

may be used after approval of the Engineer and after establishing their performance suitability based on previous data, experience or tests.

MATERIALS

Cement

Unless otherwise specified or called for by the Engineer, cement shall be Sulphate resistant cement to IS
Where Portland pozzolana or slag cement are used, it shall be ensured that consistency of quality is maintained, there will be no adverse interactions between the materials and the finish specified is not marred.

Only one type of cement shall be used in any one mix. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from Engineer.

Cement which is not used within 90 days from its date of manufacture shall be tested at a laboratory approved by Engineer and until the results of such tests are found satisfactory, it shall not be used in any work.

Aggregates (General)

General

"Aggregate" in general designates both find and coarse inert materials used in the manufacture of concrete (vide BIS 456 & BIS 383) and conforming to tests as per BIS 2386 (Part I to VI).

"Coarse Aggregate" is aggregate most of which is retained when passed through on 4.75 mm BIS sieve.

All fine and coarse aggregates proposed for use in the works shall be subject to the Engineer-in-Charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in-charge.

Aggregates shall consist of natural sand, stone (crushed or uncrushed) and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, non-flaky, strong, hard, durable against weathering, or limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the "mix design" and preliminary tests on concrete specified later. The aggregates shall be brought from the source as mentioned in Volume–I Clause C.1.39.

Sampling and testing

Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to Engineer-in-charge in advance of the work, for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by the contractor.

Storage of aggregates

All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign material and earth during storage and while heaping the materials shall be avoided. The aggregates must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rakers shall be piled in layers not exceeding 1.20 m in height to prevent coning or segregation. Each layer shall cover the entire area of stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

Specific Gravity

Aggregates having a specific gravity below 2.4 (saturated surface dry basis) shall not be used.

Fine Aggregate

Fine aggregate shall consist of natural or crushed sand conforming to IS 383 conforming to tests as per IS 2386 part I to IV. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities / strength/ durability of concrete.

Screening and Washing : Sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fraction.

Foreign Material limitations : The percentage deleterious substances in sand delivered to the mixer shall not exceeding the following :

Sr. No.	**Foreign Material**	**Percentage by weight**	
		Uncrushe	**Crushed**
1	Material finer than 75 micron IS sieve	3.0	15.0
2	Shale	1.0	--
3	Coal and Lignite	1.0	1.0
4	Clay Lumps	1.0	1.0

Gradation : Unless otherwise directed or approved by the Engineer-in-charge, the grading of sand shall be within the limits indicated hereunder.

IS : Sieve Designation	**Grading Zone-I**	**Grading Zone-II**	**Grading Zone-III**	**Grading Zone-IV**
10 mm	100	100	100	100
4.75 mm	99 – 100	90 – 100	90 – 100	95 – 100
2.36 mm	60 – 95	75 – 100	85 – 100	95 – 100
1.18 mm	30 – 70	55 – 90	75 – 100	90 – 100
600 microns	15 – 34	35 – 59	60 – 79	80 – 100
300 microns	5 – 20	8 – 30	12 – 40	15 – 50
150 microns	0 – 10	0 – 10	0 – 10	0 – 15

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 microns IS sieve, by total amount not exceeding 5%, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates

conforming to grading zone IV shall not be used. Mix designs and preliminary tests shall show its suitability for producing concrete of specified strength and workability.

Fineness Modulus

The sand shall have a fineness modulus of not less than 2.2 or more than 4.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieve sizes (4.75 mm, 2.35 mm, 1.18 mm, 600 microns and 150 microns) and dividing the sum by 100.

Coarse Aggregate

Coarse aggregate for concrete, except as noted above, shall conform to IS 383 and IS 2386. This shall consist of crushed stone and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

Screening and Washing : Crushed rock shall be screened and or washed for the removal of dirt or dust coating, if so requested by the Engineer-in-charge.

Grading

Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits :

IS Sieve	**Percentage passing for single sized Aggregate of normal size**					**Percentage passing for graded aggregate of normal size**			
Size (mm)	**40 mm**	**20 mm**	**16 mm**	**12.5 mm**	**10 mm**	**40 mm**	**20 mm**	**16 mm**	**12.5 mm**
63	100	--	--	--	--	--	--	--	--
40	85–100	100	--	--	--	95–00	100	--	--
20	0–20	85–100	100	--	--	30–70	95–100	100	100
16	--	--	85–100	100	--	--	--	90–100	--
12.5	--	--	--	85–100	100	--	--	--	90–100
10	0 – 5	0–20	0–30	0–45	85–100	10–35	25–55	30–70	40–85
4.75	--	0–5	0–5	0–10	0–20	0–5	0–10	0–10	0–10
2.36	--	--	--	--	0–5	--	--	--	--

The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only within tolerance limits which will not affect adversely the strength and or durability or concrete. The maximum size of coarse aggregate shall be 40 mm for M7.5 and M10 and 20 mm for M15 to M20 concrete, or as directed by the Engineer-in-charge or specified otherwise. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than ¼th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. For plain concrete the maximum size of aggregate shall be of 40 mm. for heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover reinforcement whichever is smaller.

Foreign material limitations

The percentage of deleterious materials in the aggregate delivered to the mixer shall not exceed the following :

Sr. No.	Foreign Material	Percentage by weight	
		Uncrushe	Crushed
1	Material finer than 75 micron IS sieve	3.0	3.0
2	Coal and lignite	1.0	1.0
3	Clay lumps	1.0	1.0
4	Soft fragments	3.0	--

Water

Water used for both mixing and curing shall conform to IS : 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.

Reinforcement

Reinforcement bars shall conform to IS : 432, IS : 226 or IS : 1786 and the welded wire fabric to IS : 1566 as shown or specified on the drawings.

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirty dust or any other substance that will destroy or reduce bond.

If permitted by Engineer, welding of reinforcement shall be done in accordance with IS ; 2751 or IS : 9417 as applicable.

Reinforcement shall be TMT Fe-500.

Admixtures

Accelerating, retarding, water-reducing and air entraining admixtures shall conform to IS : 9103 and integral water proofing admixtures to IS : 2645.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of Engineer based upon evidence that with the passage of time neither the compressive strength nor its durability is reduced. An admixture's suitably and effectiveness shall be verified by trial mixes with the other material used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedments.

Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

Wastage

No wastage allowance for cement and steel shall be considered and paid for.

SAMPLES AND TESTS

All materials used for the works shall be tested before use.

Manufacturer's test certificate shall be furnished, for each batch of cement / steel and when directed by Engineer samples shall also be got tested by the Contractor in a laboratory approved by Engineer at no extra cost to Client. However, where material is supplied by Client, all testing charges shall be borne by Client; but transportation of material samples to the laboratory shall have to be done by Contractor at no extra cost.

Sampling and testing shall be as per IS : 2386 under the supervision of Engineer. The cost of all tests, sampling etc. shall be borne by Contractor.

Water to be used shall be tested to comply with requirement of IS : 456.

Contractor shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be used. If directed the admixture shall be got tested and approved laboratory at no extra cost.

STORING OF MATERIALS

All material shall be stored in a manner so as to prevent its deterioration and contamination which would preclude its use in the works. Requirements of IS : 4082 shall be complied with.

Contractor will have to make his own arrangements for the storage of adequate quantity of cement even if cement is supplied by Client. Cost of such rejected cement, where cement is supplied by Client, shall be recovered at issue rate or open market rate which ever is higher. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage arrangement shall be approved by Engineer. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order or receipt.

Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleepers to avoid contract with ground / water. Each type and size shall be stacked separately.

CONCRETE

General

Concrete grade shall be as designated on drawings. In concrete grade M15, M20, M25 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS : 456. Concrete in the works shall be **"Design Mix Concrete"** or **"Normal Mix Concrete".** All concrete works of **grade M5, M7.5,M-10 and M15 shall be Nominal whereas all other grades, M20 and above, shall be Design Mix Concrete.**

Design Mix Concrete

Mix Design and Testing

For Design Mix Concrete, the mix shall be designed according to IS : 10262 and SP: 23 to provide the grade of concrete having the required workability and characteristics strength not less than appropriate values given in IS : 456. The design mix shall in addition be such that it is cohesive and does not segregate and should result in dense and durable concrete and also capable of giving the finish as specified. For water retaining structures, the mix shall also result in water-tight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

Unless otherwise specifically mentioned, the minimum cement content for Design Mix Concrete shall be as given below.

Grade of Concrete	Minimum Cement Content in Kg/Cu.m of concrete
M20	330
M25	365
M30	380
M35	400

The minimum cement content stipulated above shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventually and nothing extra shall become payable to the Contractor in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor.

He shall furnish to Engineer at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS : 516 shall comply with the requirements of IS : 456.

Grade of Concrete	**Minimum Compressive Strength (N/Sq.mm at 7 days)**	**Specified Compressive strength (N/Sq.mm at 28 days)**
M 20	13.5	20.0
M 25	17.0	25.0
M 30	20.0	30.0
M 35	23.5	35.0
M 40	27.0	40.0

A range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer is given below :

Structure / Member	**Slump in millimeters**	
	Maximum	**Minimum**
Reinforced foundation walls and footings	75	25
Plain footings, caissons and substructure walls	75	25
T.G. and massive compressor foundations	50	25
Slabs, beams and reinforced walls	100	25
Pumps and miscellaneous equipment foundations	75	25
Building columns	100	25
Pavements	50	25
Heavy mass construction	50	25

Batching and Mixing of Concrete

Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water cement ratio specified shall be maintained. Each time the work stops, the mixer shall be cleaned out, and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

Arrangement should be made by Contractor to have the cubes tested in an approved laboratory or in field at his own expense, with prior consent of Engineer. Sampling and testing of strength and workability of concrete shall be as per **IS : 1199, IS : 516 and IS : 456.**

Nominal Mix Concrete

Mix Design and Testing

Mix design and preliminary tests are not necessary for Nominal mix Concrete. However works tests shall be carried out as per IS : 456. Proportions for Nominal Mix Concrete and **water / cement ratio may** by adopted as per Table 3 of IS : 456. However it will be Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

Batching and Mixing Concrete

Based on the adopted nominal mixes, aggregates and cement shall be measured by weight.

FORM WORK

Form work shall be all inclusive and shall consist of but not limited to shores, bracings, sides of footings, walls, beams and columns, bottom of slabs etc. including ties, anchors, hangers, inserts, falsework, wedges etc.

The design and engineering of the formwork as well as its construction shall be the responsibility of Contractor. However, if so desired by Engineer the drawings and calculations for the design of the formwork shall be submitted to Engineer for approval.

Formwork shall be designed to fulfill the following requirements :

a) Sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and appropriate to the methods of placing and compacting.
b) Made of suitable materials.
c) Capable of providing concrete of the correct shape and surface finish within the specified tolerance limits.
d) Capable of withstanding without deflection the worst combination of self weight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, wind and weather forces.
e) Capable of easily striking without shock, disturbance or damage to the concrete.
f) Soffit forms capable of imparting a camber if required.
g) Soffit forms and supports capable of being left in position if required.
h) Capable of being cleaned and / or coated if necessary immediately prior to casting the concrete; design temporary openings where necessary for these purposes and to facilitate the preparation of construction joints.

The formwork may be of timber, plywood, steel, plastic or concrete depending upon the type of finish specified. Sliding forms and slip for may be used with the approval of Engineer. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, work holes, warps and other surface defects. Joints between formwork and formwork and between formwork and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.

The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.

Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of Engineer. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

Permanent formwork shall be checked for its durability and capability with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.

Wire ties passing through beams, columns and walls shall not be allowed. In their placed bolts passing through sleeves shall be used. Formwork spacers left in situ shall not impair the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage or moisture.

For liquid retaining structures sleeves shall not be provided for through bolts or shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.

Where specified or shown on drawings, all corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size.

Forms for substructure may be omitted when, in the opinion of Engineer, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such excavations shall be slightly larger, as directed by Engineer, than that required as per drawing to compensate for irregularities in excavation.

The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.

The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side limit the drop of concrete to 1.0 m or as directed by Engineer. The Contractor shall temporarily and securely fix items to be cast in (embedments / inserts) in a manner that will not hinder the striking of forms or permit loss of grout.

Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty form work, shall be entirely removed and formwork corrected prior to placement of new concrete at the cost of the Contractor.

The striking time for formwork shall be determined based on following requirements :

a) Development of adequate concrete strength;
b) Permissible deflection at time of striking form work;
c) Curing procedure employed – its efficiency and effectiveness;
d) Subsequent surface treatment to be done;
e) Prevention of thermal cracking at re-entrant angles;
f) Ambient temperature; and
g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20 Deg. C) forms may be struck after expiry of the time period given in IS : 456, unless directed otherwise by Engineer. For portland pozzolona / slag cement the stripping time shall be suitably modified as directed by the Engineer. It is the Contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stressed arising during the construction period.

Reinforcement Workmanship

Reinforcing bars supplied bent or in coils shall be straightened cold without damage at no extra cost. No bending shall be done when ambient temperature is below 5 Deg. C. Local warming may be permitted if steel is kept below 100 Deg. C.

All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings / schedules or as directed by Engineer.

Re-bending or straightening incorrectly bent bars shall not be done without approval of Engineer.

Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by Engineer prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spalling of the concrete cover.

Binding wire shall be 16 gauge soft annealed wire. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.

Substitution of reinforcement, laps / splices not shown on drawing shall be subject to Engineer's approval.

TOLERANCES

Tolerance for formed and concrete dimensions shall be as per IS : 456 unless specified otherwise.

Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

PREPARATION PRIOR TO CONCRETE PLACEMENT

Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets etc. provided.

All arrangements formwork, equipment and proposed procedure, shall be approved by Engineer. **The Contractor shall maintain separate Pour Card for each pour** and shall produce before commencement of concreting to Engineer-in-charge.

TRANSPORTING, PLACING AND COMPACTING CONCRETE

Concrete shall be transported from the mixing plant to the formwork with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.

In all cases concrete shall be deposited as nearly as practicable directly in its final position. To avoid segregation concrete shall not be rehandled or caused to flow. For locations where direct placement is not possible and in narrow forms. The Contractor shall provide suitable drops and 'Elephant Trunks'. Concrete shall not be dropped from a height of more than 1.0 m as stipulated in clause D.9.8.13.

Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremies or by pipeline from the mixer and shall never be allowed to fall freely through the water.

While placing concrete the Contractor shall proceed as specified below and also ensure the following :

a) Continuously between construction joints and predetermined abutments.
b) Without disturbance to forms or reinforcement.
c) Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.
d) Without dropping in a manner that could cause segregation or shock.
e) In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.
f) Do not place if the workability is such that full compaction cannot be achieved.
g) Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the lining progressively as concrete is placed.
h) If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.
i) Ensure that there is no damage or displacement to sheet membranes.
j) Record the time and location of placing structural concrete.

Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked around reinforcement and embedded fixtures and into all corners of the formwork. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, formwork and finished surfaces after start of initial set. Over vibration shall be avoided.

Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by Engineer. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

Except when placing with slip forms, each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete before the start of subsequent placement. Placing shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as determined by Engineer. Concrete shall be protected against damage until final acceptance.

MASS CONCRETE WORKS

Sequence of pouring for mass concrete works shall be as approved by Engineer. The Contractor shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

CURING

Curing and protection shall start immediately after the compaction of the concrete to protect it from :

(a) premature drying out, particularly by solar radiation and wind;
(b) leaching out by rain and flowing water;
(c) rapid cooling during the first few days after placing;
(d) high internal thermal gradients;
(e) low temperature of frost;
(f) vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

All concrete, unless directed otherwise by Engineer, shall be cured by use of continuos sprays or ponded water or continuously saturated coverings of sacking, canvas, hessain or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

Where a curing membrane is directed to be used by the Engineer, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be got approved from the Engineer before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

Extra precautions shall be exercised in curing concrete during cold and hot weather.

CONSTRUCTION JOINTS AND KEYS

Construction joints will be as shown on the drawing or as approved by Engineer. Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approved of Engineer.

Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as directed by Engineer.

Before resuming concreting on a surface which has hardened all laitance and loose stone shall be thoroughly removed by wire brushing / hacking and surface washed with high pressure water jet and treated with thin layer of cement slurry for vertical joints and a 15 mm thick layer of cement sand mortar for horizontal layers, the ratio of cement and sand being the same as in the concrete mix.

When concreting is to be resumed on a surface which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this a layer of concrete not exceeding 150 mm thickness shall be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

FOUNDATION BEDDING

All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy area shall be cleaned out and back filled with either soil cement mixture, lean concrete or clean sand compacted as directed by Engineer. The surfaces of absorptive soils shall be moistened.

Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

FINISHES

General

The formwork for concrete works shall be such as to give the finish as specified. The Contractors shall make good as directed any unavoidable defects consistent with the type of concrete and finish specified; defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. The Contractor shall construct the formwork using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

Surface finish Type F1

This type of finish shall be for non-exposed concrete surface against which back fill or concrete is to be placed. The main requirement is that of dense, well compacted concrete. No treatment is required except repair of defective areas, filling all form tie holes and cleaning up of loose or adhering debris. For surfaces below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which could interfere with proper and effective application or waterproofing material specified for use.

Surface finish Type F2

This type of finish shall be for all concrete work which will be exposed to view upon completion of the job. The appearance shall be that of a smooth dense, well-compacted concrete showing the slight marks of well fitted shuttering joints. The Contractor shall make good any blemishes.

Surface finish Type F3

This type of finish shall be for concrete work which will be exposed to view but to give an appearance of smooth, dense, well-compacted concrete with no shutter marks, stain free and with no discoloration, blemishes, arrises, air holes etc. Only lined or coated plywood with very tight joints shall be used to achieve this finish. The panel size shall be uniform and as large as practicable. Any minor blemishes that might occur shall be made good by Contractor.

Integral cement finish on concrete floor

In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screened off to proper level and tamped with tamper having conical projections so that the aggregate shall be forced below the surface. The surface shall be finished with a wooden float and a trowel with pressure. The finish shall be continued till the concrete reaches its initial set. No cement or cement mortar finish shall be provided on the surface. Where specified, a floor hardener as approved by the Engineer shall be supplied and used as recommended by the manufacturer.

REPAIR AND REPLACEMENT OF UNSATISFACTORY CONCRETE

Immediately after the shuttering is removed, all the defective areas such as honey-combed surfaces, rough patches, holes left by form bolts etc. shall be brought to the notice of Engineer who may permit patching of the defective areas or reject the concrete work.

All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

Rejected concrete shall be removed and replaced by Contractor at no additional cost to Client.

For patching of defective areas all loose materials shall be removed and the surface shall be prepared as directed by the Engineer.

Bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the Engineer as to the method of repairs to be adopted shall be final and binding on the Contractor and no extra claim shall be entertained on this account. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as directed by Engineer.

VACUUM DEWATERING OF SLABS

Where specified floor slabs, either on grade or suspended, shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum processing, floating and trowelling as per equipment manufacturers recommendation. The equipment to be used shall be subject to Engineer's approval.

HOT WEATHER REQUIREMENTS

Concreting during hot weathers shall be carried out as per IS : 7861 (Part – I)

Adequate provisions shall be made to lower concrete temperatures which shall not exceed 40 Deg. C at the time of placement of fresh concrete.

Where directed by Engineer, Contractor shall spray non-wax based curing compound of unformed concrete surfaces at no extra costs.

COLD WEATHER REQUIREMENTS

Concreting during cold weather shall be carried out as per IS : 7861 (Part-II).

The ambient temperature during placement and upto final set shall not fall below 5 Deg. C. Approved antifreeze / accelerating additives shall be used where directed.

For major and large scale concreting works the temperature of concrete at times of mixing and placing, the thermal conductivity of the formwork and its insulation and stripping period shall be closely monitored.

LIQUID RETAINING STRUCTURES

The Contractor shall take special care of concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

The minimum level of surface finish for liquid retaining structures shall be type F2. All such structures shall be hydro-tested.

The Contractor shall include in his price of hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipelines etc.

Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.

Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement / epoxy pressure grouting, guniting or such other methods as may be approved by the Engineer. All such rectification of the Client / Engineer at no extra cost to the Client.

TESTING CONCRETE STRUCTURES FOR LEAKAGE

Hydro-static test for water tightness shall be done at full storage by Engineer, as described below :

In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.

In the case of structures whose external faces are submerged and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs. over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven day shall be taken as an indication of the water tightness of the structure. The Engineer shall decide on the actual permissible nature of this drop in the surface level, taking into account weather the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

Each compartment / segment of the structure shall be tested individually and then all together.

For structures such as pipes, tunnels etc. the hydro-static test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

OPTIONAL TESTS

If Engineer feels that the materials i.e. cement, sand coarse aggregates, reinforcement and water are not in accordance with the specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the Engineer, as per relevant IS Codes. Client shall pay only for the testing of material supplied by the Client, otherwise Contractor shall have to pay for the tests. Transporting of all material to the laboratory shall however be done by the Contractor at no extra cost to Client.

In the even of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, Engineer reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. All these tests shall be carried out by Contractor at no extra cost to the Client. Alternatively Engineer also reserves the right

to ask the Contractor to dismantle and re-do such unacceptable work at the cost of Contractor.

If the structure is certified by Engineer as having failed, the cost of the test and subsequent dismantling / reconstruction shall be borne by Contractor.

The quoted unit rates / prices of concrete shall be deemed to provide for all tests mentioned above.

GROUTING

Grout shall be provided as specified on the drawings. The proportion of standard Grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage. Surface to be grouted shall be thoroughly roughened and cleaned. All structural steel elements to be grouted, shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by ENGINEER. The grout proportions shall be limited as follows :

	Use	**Grout Thickness**	**Mix Proportions**	**W/C**
a)	Fluid mix	Under 25 mm	One part Portland cement to one part sand.	0.44
b)	General Mix	25 mm and over but less than 50 mm	One part Portland cement to 2 part sand.	0.53
c)	Stiff mix	50 mm and over	One part Portland cement to 3 part sand.	0.53

Non Shrink Grout

Non-shrink grout where called for in the Schedule of Quantities or specified on the drawings shall be provided in strict accordance with the manufacturer's instructions/ specifications on the drawings.

INSPECTION

All materials, workmanship and finished construction shall be subject to continuous inspection and approval of Engineer. Materials rejected by Engineer shall be expressly removed from site and shall be replaced by Contractor immediately at no extra cost to Client.

CLEAN-UP

Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood etc. resulting from the work shall be removed and the premises left clean.

ACCEPTANCE CRITERIA

Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

a) Properties of constituent materials;
b) Characteristic compressive strength;
c) Specified mix proportions;
d) Minimum cement content;
e) Maximum free-water / cement ratio;
f) Workability;
g) Temperature of fresh concrete;
h) Density of fully compacted concrete;
i) Cover to embedded steel;
j) Curing;
k) Tolerances in dimensions;
l) Tolerances in levels;
m) Durability;
n) Surface finishes;
o) Special requirements such as :

i) water tightness;
ii) resistance to aggressive chemicals
iii) resistance to freezing and thawing
iv) very high strength
v) improved fire resistance
vi) wear resistance
vii) resistance to early thermal cracking

The Engineer's decision as to the acceptability or otherwise of any concrete work shall be final and binding of the Contractor.

For work not accepted, the Engineer may review and decide whether remedial measures are feasible so as to render the work acceptable. The Engineer shall in that case direct the Contractor to undertake and execute the remedial measures. These shall be expeditiously and effectively implemented by the Contractor. Nothing extra shall become payable to the Contractor. Nothing extra shall become payable to the Contractor by the Client for executing the remedial measures.

MODE OF MEASUREMENT AND PAYMENT

The unit rate for concrete work under various categories shall be all inclusive and no claims for extra payment on account of such items as leaving holes, embedding inserts, etc. shall be entertained unless separately provided for in the schedule of quantities. No extra claim shall also be entertained due to change in the number, position and / or dimensions of holes, slots or openings, sleeves, inserts or on account of any increased lift, lead of scaffolding etc. All these factors should be take into consideration while quoting the unit rates. Unless provided for in the Schedule of Quantities the rates shall also include fixing insets in all concrete work, whenever required.

Payments for concrete will be made on the basis of unit rates quoted for the respective items in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc. and opening less than 0.100 of a sq.m in areas where concrete is measured in sq.m and 0.010 cu.m where concrete is measured in cu.m. Where no such deduction for concrete is made, payment for shuttering work provided for such holes, pockets, etc. will not be made. Similarly the unit rates for concrete work shall be inclusive or exclusive of shuttering as provided for in the Schedule of Quantities.

Payment for beams will be made for the quantity based on the depth being reckoned from the understood of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned upto the underside of slab / beams.

The unit rate for precast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including setting mortar, provision of lifting arrangement etc. complete. Reinforcement and inserts shall be measured and paid for separately under respective item rates.

Where the formwork is paid for separately, it shall be very clearly understood that payment for formwork is inclusive of formwork, shuttering, shoring, propping scaffolding etc. complete. Only the net area of concrete formed (shuttered) shall be measured for payment. Unless otherwise stated clearly form work will not be paid separately and it is deemed to beam included in the respective concrete item.

Under remarks indicate deviations from drawings & specifications congestion in reinforcement if any unusual occurrences such as failure of equipment sinking of supports / props, heavy rain affecting reasonable. Poor compaction improper curing other deficiencies observations etc.

MATERIALS : STRUCTURAL STEEL

All structural steel shall be comply with the requirements of IS 226-1961 and structural steel work IS 1915-1962 specifications for structural steel appropriate for bridge work.

Steel for Pins and Rollers

Rolled steel pins and rollers, shall comply with requirements of the IS specifications appropriate for the work. Steel casting for cast steel pins shall conform to grade 1 or 3 of IS 1030-1956 specifications for steel casting (for general engineering purposes as appropriate).

Bolts and Nuts

Mild steel for bolts and nuts when tested shall comply with IS 1608-1960 and shall have tensile strength of not less than 2500 Kg/cm^2. Plain washers shall be made of steel.

Welding Electrode

Mild steel electrodes shall comply with requirements of IS 814-1957 specification for covered electrodes for metal arc welding of mild steel.

Workmanship

All work shall be in accordance with the drawings and shall satisfy IS specification No. 1915-1961. Care shall be taken to ensure that all parts in assembly fit accurately together. Notes or specifications on the drawings supplied by the Engineer-in-Charge/consulting Engineer, are to be constructed as superseding or cancelling any clause of this specifications with which they conflict. On all drawings dimensions shown in figures shall be acted in preference to measurement by scale.

Straightening

All structural steel members and parts shall have straight edges. All straightening shaping and levelling etc. shall be done by pressure only and not by hammering. All joggles and knees shall be formed by pressure and where practicable in making these, the metal shall not be cut and welded.

Cutting

All structural steel parts where required shall be sheared, cropped sawn or flame cut and ground accurately to the required dimensions and shape.

Bolts Holes

The diameter of bolts holes shall be 1.5 to 2.0 mm. larger than the nominal diameter of bolt. All holes for bolts shall be drilled unless permitted by Engineer-in-Charge for punching the holes. Care shall be taken, such as surrounding material is not deformed or damaged in case of punching the hole is allowed.

Welding

Welding of steel conforming to relevant IS specifications shall be in accordance with general requirements of metal arc welding. In additional to general requirement, the following care shall be taken :-

(a) The welding shall be positioned for downward welding wherever practicable.
(b) The welding current shall conform with respect of voltage and empeare to the recommendations of the manufacturers of the electrode being used. The arc length, voltage and empeare shall be suited to the thickness of material, type of groove and other circumstances of the work.
(c) The surface to be welded and surrounding material for a distance of atleast 155 mm shall be free from scale, dirt, grease, paint, heavy rust or other surface deposit.
(d) Members to be welded shall be held in correct position by holes, clamps, wedges, jigs or other suitable devices or by tack welding until welding has been completed, such fastening as may be used shall be adequate to ensure safety. Suitable allowance shall be made for war page and shrinkage.
(e) Tack welds located where the final welds will later be made shall be subject to the same quality requirements as final welds. Defective and broken tack welds shall be removed before final welding.
(f) Fusion faces shall be made or cut by shearing, chipping, machining or by gas cutting.
(g) Exposed faces of welds shall be made reasonably smooth and regular so as to conform as closely as practicable to design requirements and shall not be of less than the required cross section.
(h) Finished welds and adjacent parts shall be protected with clean boiled linseed oil after all slag has been removed.

Safety Precautions

(a) Operators of welding and cutting equipment shall be protected from the rays of the arc flame gloves and by helmet, hand shields, or goggles equipped with suitable filter lenses.
(b) Closed space shall be ventilated properly while welding is being gone therein.
(c) Welders should be provided with such staging as will enable them to perform the welding operation. For site welding shelter should be provided to protect welders and the parts to be welded from the weather.

The Constructor shall employ a competent welding supervisor to ensure that the standard of workmanship and the quality of materials comply with requirements laid in these specification.

The Constructor shall provide free access to the representative of Engineer-in-Charge/Consulting Engineer to the work being carried out at all reasonable times and facilities shall be provided so that during the course of welding he may be able to inspect any layer of weld metal. He shall be at liberty to reject any material that does

not conform to the terms of the specifications and to require any defective welds to be cut out and welded. The representative of the Engineer-in-Charge/Consulting Engineer shall be notified in advance of any welding operations.

Inspection and testing of welds shall be done as laid down in IS 822 and IS 11017.

No welder shall be employed in any position expect those who are fully qualified to welding. Qualification for welders shall be as laid down in IS 812.

Joints

All steel work intended to be bolted together must be in contact over the whole surface. Joints which have to take compressive stress and the ends of all stiffeners shall meet truly over the whole of the butting surface.

Assembling

All member shall be so arranged that they can be accurately assembled, without being unduly packed, strained or forced into position and when built shall be true and free from twist kinks, buckets or open joints between component pieces. Work shall be kept properly bolted together and no drifting shall be allowed except for the purpose of drawing assembled sections together in accuracy's in matching of holes may be corrected. But drifting to enlarge holes is prohibited. Failure in any of the above respect will involve the rejection of defective members.

Mode of Measurement and Payment

Measurement of this item shall be as per IS 1200(Part VIII) - 1974 or as per its latest revision so far as applicable.

The contract rate shall be suitable for unit of one metric tonne of structural steel.

MATERIALS : REINFORCEMENT

Specification for TMT bars reinforcement (Fe-500)

Scope of work : The scope of work consists of providing and laying mild steel reinforcement and TMT reinforcement for RCC works of various components of the structure. This may be of **Tiscon, Sulekhram, SAIL or Punjab Rolling Mill** or any other approved make. This includes cuttings, bending, binding, placing, with all equipments and labour required for the work as directed by the Engineer-in-charge and all operations covered within the intent and purpose of the specification.

Bending of Reinforcement : Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to the relevant IS codes (latest revision) Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-charge using a proper bar bender, operated by hand or power to attain proper radii of bends.Bars shall not be bent or strainghened in a manner that will cause injury to the material. Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending.

The bending of the TMT bars shall be carried out as per the following :

Sr. No.	Operation	Size	TMT Fe-500
1	Bend	Upto 22 mm dia.	3d
		Over 22 mm dia.	4d
2	Rebend	Upto 10 mm dia.	4d
		Over 10 mm dia.	5d

Placing of Reinforcement :

All reinforcing bars shall be accurately placed in the 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 conforming to IS : 280 and by using stays blocks or metal chairs, spacer, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation over the work. All devices used for positioning shall be of noncorrodible material. Wooden and metal supports will not extend to the surface of concrete, except where shown on the drawings, Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices.Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed.To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed upto a level just below them.Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting. As far as 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 or 1 1/4 times the maximum size of the coarse aggregates whichever is greater, by concrete between them. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1mm thickness twisted tight in eight shape around the lapped bars. The overlaps shall be staggered for different bars and located at fixed locations only along the span where neither shear nor bending moment is maximum.

Welding of Bars Welding of TMT bars can be permitted if specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section, not more than 33 per cent of the rods are welded. No pre-warming or post heat treatment is necessary. Interpass temperature should be limited to 200^{o}C with low heat input and equivalent strength low hydrogen type electrode. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned property. Ends of the bars shall be cleaned of all loose scale, rust. grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work.

Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer-in-charge.

DRILLING OF HORIZONTAL BOREHOLE FOR LAYING OF PIPELINE BELOW ROAD / CANAL /RAILWAY ETC.

SCOPE

The scope of item includes following :

- Preparing the required drawings & to get the permission / approval for lowering, laying & jointing pipeline below Road / Canal / Railway under the supervision of concerned authority & also obtaining completion certificate from the concerned authority after completion of work. RMC will reimburse all statutory charges & sign the necessary papers related to the work as per requirement. All other charges shall be born by the contractor.
- Drilling horizontal bore & providing, fixing RCC casing pipe with jointing.
- Constructing temporary R.C.C. thrust block & base concrete as per requirement for facility of pushing the pipeline and dismantling the same on completion of work
- Fixing of water main pipe.
- Sealing the both ends of pipe with construction of brick work including C.C 1:3:6.

GENERAL TECHNICAL REQUIREMENTS:

Sr. No.	**Particulars**
1	Casing pipe shall be of RCC pipes. Pipe shall be as per IS-458.
2	For insertion of casing pipe, boring shall be carried out by auger type boring device with cutting head to drill a horizontal bore. The hole drilled shall be of suitable size to accommodate casing pipes. The casing pipe shall be inserted along with boring to keep the formation supported to prevent any settlement of the track. The casing pipes will be installed with even bearing throughout its length. The work will be done under the supervision of concerned authority.
3	The casing pipe will be Deep below the natural ground level As Per concerned authority Requirements. The length of casing pipe shall be upto the end of land boundary.
4	Care shall be taken to isolate the pipeline crossing installation from aerial electrical wires & shall be suitably insulated from underground conduits carrying electrical wires.
5	The pipeline shall be tested for specified test pressure to check for leakage.
6	To protect casing pipes as well as carrier pipe against corrosion, following action will be taken: (a) Outer surface of casing pipe will be painted with a coat of zinc rich epoxy primer of thickness 4 mils. (b) Suitably 3 roller support at 4 mts interval of steel pipe shall be welded spacers of high density polyethylene or either similar material shall be installed in between the carrier & casing pipe to prevent carrier pipe forming metallic contact with casing pipe.
7	The alignment of the pipeline shall be so decided that it crosses track nearest to right angle.
8	These special conditions and the schedule of work shall govern the work to be executed under this contract in addition to and/or in part super session of the General Conditions of Contract & Standard Specifications.

The fixing of water main shall be as per detail specifications in section.

Scope also covers

- Shifting of service lines and reinstating the same
- Demolishing all types of R. C. C., masonry work
- Pumping / Bailing out water etc.

No extra payment shall be made for dewatering when any work is done below water level.

The rate quoted by the Contractor/s shall be deemed to include diversions, bunds, approach road to the site of work etc. and such other works, necessary for setting out and execution of works in different phases as ordered by the Engineer and / or his representative. No extra payment shall be made for such works or any other phase works carried out which are necessary for satisfactory execution of work. The diversion for traffic shall be made by the agency as per requirement without any extra cost.

Any timbering work required to be done for retaining earth during excavation of foundations will have to be arranged by the contractor which shall conform to the provision laid down in Specification of Timber Shoring.

The working area may be water logged during monsoon or any untimely rains. Contractor should take the special note while preparing the programme schedule for this work. Contractor should also specify the method which they propose to avoid water logging in the working area, however it may be clearly noted that bailing out / pumping out shall not be payable.

The rate is on Rmt.basis for specified length as per detail description in item. However, during execution as per site condition, if the length of pushing is increasing / decreasing the excess / reduce payment will be adjusted accordingly.

STONEWARE PIPE

1.1 MATERIALS

1.1.1 The pipe shall confirmed to IS- 651-1989 or its latest revision of IS code for specification for salt glazed stone ware pipe -Class -AⅡ pipe to be used for Sewer lines.

1.1.2 The specification briefly covers the requirement of quality, dimension, and test for stone ware pipes.

1.2 Classification

1.2.1 The salt glazed stone ware pipe shall be classified as -grade AⅡ.

1.2.2 Pipes complying in every respect with the requirements of IS-651-1989 out of which only 5% (percent) have been subjected to the hydraulic test by the manufacturer and found satisfactory shall be classed as -Grade AⅡ.

1.3 General quality

1.3.1 The pipe shall be found, free from visible defect such as fire cracks or hair cracks which impair the strength durability and serviceability. The glazed of pipe shall be free from cracking. They shall be given a sharp clear note when struck with a light hammer. There shall be no broken blisters.

1.3.2 Max. Of 10% Percent of pipe shall be accounted with any one of the following blemishes which do not impair the strength durability and serviceability provided these pipes with- stand test satisfactorily.

a) A thin chipping not exceeding one quarter of thickness of the body and not exceeding 10 sq.cm on outside of the spigot or on either side of the socket.

b) One blister, unbroken not more than 3 mm high nor more than 4 cm in largest dimension inside or outside of pipe.

c) Half line surface cracks.

1.3.3 The interior and the exterior surfaces which remained exposed after jointing shall be glazed.

1.4 DIMENSIONS

1.4.1 The internal dia., thickness of barrel, thickness ok socket, depth of socket, excess shoulder measurement, length of grooving shall be as per table given below.

Dimensions of Barrel and Socket				
Internal dia. of pipe (mm)	**Mean thickness of barrel and of socket (mm)**	**Internal depth of socket (mm)**	**Excess shoulder measurement (mm)**	**Length of grooving on spigot (mm)**
100	12	50	10	75
150	16	57	11	85.5
200	17	63	12	94.5
230*	19	63	12	95.0
250	20	70	16	105.0
300	25	70	16	105.0
350	30	75	16	112.5
400	35	75	16	112.5
450	38	76	16	114
500	40	80	19	120

Dimensions of Barrel and Socket				
Internal dia. of pipe (mm)	**Mean thickness of barrel and of socket (mm)**	**Internal depth of socket (mm)**	**Excess shoulder measurement (mm)**	**Length of grooving on spigot (mm)**
600	44	90	19	135

*Note: The manufacture of 230 mm dia. of pipe is permitted for a limited period.

1.4.2 The length of barrel of straight pipe excluding the internal depth of socket shall be 60 cm, 75 cm, or 90 Cms.

1.4.3 The interior of the socket shall be conical having a minimum taper of 1 mm measurement on the diameter, per 15 mm length (i.e. 1 in 30) thus the diameter of socket 50 mm. deep will be at-least 3 mm greater at the top than at the bottom.

1.4.4 The interior of the sockets, and the exterior of the spigots shall be grooved circumferentially and such grooving on the spigot shall be for a length equal to one and half times the depth of the sockets and the depth of such grooves shall be between 1mm and 2 mm.

1.5 Tolerances:

1.5.1 The tolerance on the internal diameter of pipes shall be as follows:

Internal dia. of pipes (mm)	**Permissible deviation from Dia. (mm)**
100	3
150	5
200 to 230	6
250 to 350	8
400 to 450	10
500 to 600	12

1.5.2 Tolerance on thickness of barrel and of socket:

The tolerance on the thickness of barrel and socket shall be as follows

Internal dia. of pipe (mm)	**Tolerance (mm)**
Not exceeding 450	2
500 to 600	3

1.5.3 Tolerance of length:

The tolerance on length shall not be more than 5 mm for pipes 60 cm. in length and not be more than 10 mm for pipes 75 cm in length.

1.5.4 Deviation from straightness

The maximum deviation straightness of the barrel of pipe shall be 5 mm for pipes 60 cm in length and 6 mm for pipes 75 cm in length.

1.6 TESTS

1.6.1 Hydraulic test

The pipe shall withstand an internal hydraulic test pressure on the barrel of 1.5 kg/cm2 without showing signs of leakage. The pressure shall be applied at the rate of .75 kg/cm2 in 5 seconds and full pressure shall be maintained for at least 5 seconds. Care shall be taken to ensure that all air is extracted before the test is commenced. This test shall be carried out at the manufactures works.

1.6.2 other tests

The manufacturer shall arrange to conduct the following tests in addition to hydraulic test, if the engineer in charge desires.

Specifications for Restoration of Road Work

Item No. 1

Excavation for Road work surface upto 20 cm depth
Note: For addl. depth @ every 5 cm rate will be increased Rs. 0.50 per sq. mtr. upto addl. depth of 45 cm

For depth above 45 cm, the rate for the excavation will be given on CuM basis

Item No. 2

Excavation for additional 20cm depth

Earth work in cutting including preparing the slope and stacking or utilizing the cutting stuff in bans as directed up to RMC limit from the end of cutting with all leads and lift.

The land with required for the road way shall be cleared of all trees having a girth of 30 cms and less, loose stones, vegetation, bushes, stumps and all other objectionable materials. The roots of trees and stumps shall be removed to a depth of 30 cms below the grade of formation and slope of excavation filled up with excavated materials and compacted. All the materials cleared will be the property of Rajkot Municipal Corporation.

After clearing the site, the alignment of the road shall be properly set out true to lines, curves, grades and sections as shown on plan or directed by the engineer in- charge. The contractor shall provide all labour and materials such as lime, strings, pegs, nails, bamboos, stone mortal, concrete etc. required for setting out alignment establishing bench marks and giving profiles. The contractor will be responsible for maintaining BM alignments, and other stakes and marks.

The excavation shall be finished neatly smooth and evenly to correct lines, curves, grades if loose shall be scarified watered and compacted. The contractor shall on no account excavate beyond the slope or below the specified level or outside the section. It shall not be paid for and the contractor shall be required to fill up at his own cost with good and approved material by engineer in charge.

All necessary traffic arrangement is to be done by contractor. No extra will be paid for this.

All the excavated materials shall be property of government. The useful excavated material is to be directly deposited at the required location in the specified layers within RMC limit and all lift as per instructions of engineer-in charge.

The payment shall be made at Rs.12.00 per square meter basis for for excavation up to 20 cm depth. For addl. depth @ every 5 cm rate will be increased Rs. 0.50 per sq. mtr. upto addl. depth of 45 cm. For depth above 45 cm, the rate for the excavation will be given on CuM basis .

Item No. 3

Supply & Laying of Black Trap Metal / Rubble

Supply and laying of Black Trap Metal / Rubble (Kabru Dabbar):

The stones for the works shall be of the specified varieties which are hard, durable, fine grained and uniform in colour free from veins, flaws and other defects. The contractor shall supply sample stones to the RMC for approval.

Stones shall be laid with its grains horizontal so that the load transmitted is always perpendicular to the natural bed.

Kabru dubber stone (Black Trap Metal) used at site must be hard and sharp as per size of the black trap metal (0.15 to 0.30 m). If oversize stone seen at the site, contractor shall have to arrange for crushing the same as per size specification. If any stain observed in stone will not be permissible to use in the work. Spreading of stone shall be in proper line and level. Quarry spoil should be used as filling work after completion of stone layer. No voids and cavity will be permissible. The whole work must be done as directed and instructions of engineer in charge.

The rate will be paid for a unit of one cubic meter basis.

Item No. 4

Supply & Laying of Field Metal (4-10 cm) Size

Supply of graded field metal of following size:

i) Hand broken field metal 4 cm to 10 cm / 10 cm to 15 cm size (15 cm layer each).

ii) Spreading the field metal for rolling and W.B.M. including filling interstices to required camber.

The field metal shall be obtained from quarries approved by the Addl. City Engineer prior to collection. The field metal shall be of approved quality with all leads and lift. The field metal shall be obtained from hard tough, sound, durable, field metal of close texture as is locally available and reasonably free from decay and weathering pieces of the field metal shall be angular and roughly cubical in shape and round. Elongated or flaky material shall be rejected. The size of field metal shall be 4 cm to 10 cm and 10 cm to 15 cm and shall be hand broken.

The payment shall be in cubic meter basis without deduction for voids. The rate also includes labour cost of level, Surveying and soft and hard copy of cross section and longitudinal section for measuring quantity supplied by contractor.

The rate includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labours, tools, equipment and other incidental expenses. The rate quote are inclusive of all such tools, duties, fees, royalties, taxes etc.

ii) Field Metal shall not be spread without permission of the engineer-in charge.

Field Metal should be spread under careful supervision by trained collies. The required quantity of material stacks at the site. The field metal shall be screened and rubbish, dust, grass shall be removed and spread evenly on the prepared surface in grade and camber by using camber boards so as to ensure that the surface is true to cambers and grade. At least two camber board shall be in use at site. The surface shall be brought to required camber shall be checked at every 50 ft. (15 m) by means of templates of while the necessary of the camber in between shall be tested by strings and corrected as required to ensure that the material is spread to required thickness. At the time of rolling all surfaces irregularities, hollows, depression, humps etc shall be set right. The rate for this item shall be paid on cubic meter basis includes all the above operations with all lead and lifts.

The rate shall be for a unit of one cubic metre.

Item No. 5 & 6

Supply & Spreading Soft Murrum
Supply & Spreading Hard Murrum

A) Supplying of soft - Hard murrum binding material.
B) Spreading bindage or road crust filling the gaps in metal and levelling to camber and gradient and directed murrum.

A) Material for the purpose shall be approved quality. Any material which is found inferior shall be rejected and contractor shall remove such rejected material from the site at his own cost.

The material shall be got approved by the City Engineer (Sp.) prior to collection on the site. It shall be free from all rubbish, dust and any organic materials as well as clouds of black cotton soils.

For road work, complete stocking of materials as per requirements shall be carried out 200 m length or as per condition of site or as per instructions of site in charge before spreading. The stacks of materials shall be got cross checked by Dy. Ex. Engineer as per rules before spreading.

Where any doubt exists as whether quantity of stacking of murrum corrected by contractor, no extra payment shall be claimed by contractor.

If the quantity of murrum in any stack found less than standard measurement viz; 1.5 cmt. The entire shall be paid on the basis of the quantity so found.

The payment shall be on cubic meter basis without deduction for voids.

The contractor shall maintain all stacks in regular and proper size till whole material shall not measure and finally accepted by the department.

The rates includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labours, tools, equipment and other expenses. The rates quoted are inclusive of all such tools, duties, royalties, taxes etc.

Spreading of material shall be started after the full supply in particular length is collected, measured and recorded. Permission of Engineer in charge shall be obtained before spreading. It shall be seen that formation is dressed to required camber and grade. If the murrum is to be spread over the metaled surface then the spreading shall be uniform and as it has to act as binding surface. It shall be used for filling the interstices of metal and forming a smooth running surface as far as possible. Murrum bindage shall be spread evenly with a twisting motion of the baskets. No more murrum shall be used than specified as bindage. The contractor shall do good all unevenness, depression, projection etc. during consolidation work. Rate of these items includes all these operation except consolidation. Also, the work is to be carried out with Mini Roll / Road Roller / Hand Roll as may be required for the work as per the requirement and instructions of engineer in charge. The payment shall be made on cubic meter basis.

The testing of material is to be carried out by the Agency at his own cost.

Item No. 7
Rolling work with Roller 8-10 Ton capacity over metalling murrum for soling or single layer arriving proper compaction (with watering)
Removal of Excavated Stuff and Laying within the sites specified in Notification as directed by Engineer-in-Charge

After Refilling the pipe / chamber trenches by the excavated stuff is 15 cm thick layer, including ramming, watering and consolidating up to possible extent as specified in excavation & refilling item, the surplus stuff shall be disposed off at the following sites as directed within the prescribed limits of Notification as directed by the engineering in charge.

1. Beside Kotharia Police Station near Stone Quarry
2. All Quarry areas of Raiya Smart City

If the contractor fails to dispose the excavated stuff as specified, penalty will be imposed by Rajkot Municipal Corporation as per the Notification for C&D waste, After refilling surplus earth shall have to carted by the contractor within specified limit including loading transporting unloading spreading without any extra cost.

Mode Of Measurement And Payment:

The rate shall be per Cubic Meter of truck-body basis.

Item No. 8

Rolling work with Roller 8-10 Ton capacity over metalling murrum for soling or single layer arriving proper compaction (with watering)

Rolling and consolidation water bound macadam (except laterite and kankar) including watering not exceeding 150 mm thickness main layer including binding material including filling in depression which occur during the process (B) with roller 8 tonne and not exceeding 12 tonne.

Immediately following the spreading of the coarse aggregates rolling shall be

started with three wheeled roller of 8 to 10 tonne capacity. The rolling watering includes of work for two separate metalling layer.

Except on super elevated portions where the rolling shall proceed from inner edge to outer, rolling shall from the edges gradually progressing towards the center. First the edges shall be compacted with roller running forward and backward. The roller shall then more inwards parallel to center line of the road in successive passes uniformly lapping preceding tracks by at least one half the width. The total work includes four times of rolling-watering in two layers of metalling.

Rolling shall continue until the aggregate is thoroughly keyed and creeping of the aggregate ahead of the roller is no longer visible. 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 aggregate and rolling until the entire surface conforms to desired camber and grade.

The bindage material where it is to be used shall be applied successively in two or more than layers of a slow and uniform rate after each application, the surface shall be copiously sprinkled with water, which water shall be applied to the wheels of 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 moving roller.

After the final compaction of water bound macadam course, the load shall be allowed to any overnight. Next morning hungry spots shall be filled with screenings of binding materials as directed lightly sprinkled with water if necessary and rolled.

Payment will be made at Rs.7.50 per square meter basis of the finished work for single layer and shall include water, rent of machinery, cost of fuel, wages of drivers and cleaners and murrum bund etc. for both.

ADDITIONAL CONDITIONS

1. The contractor shall have to provide his own level instrument for this work.

2. Lowering, laying and jointing works of all the pipelines shall have to be carried out by using Sight Rails and Boning Staves.

3. Work is required to be carried out in residential area where all the services like water supply, sullage water pipeline, telephone / electric cable are existing. Under the circumstances, prior to starting the work agency shall have to excavate the trenches manually for up to 1 mt. depth. During the course of execution, all the services shall have to be maintained by the agency and any damage to any services or property, the agency shall have to get it repair at their cost.

4. For excavation of trench, use of JCB machine will not be permitted directly on the top surface of the roa After excavation up to minimum 1.00 mt. depth from road surface or existing ground level, same shall have to be carried out manually or by using Breaker and after locating underground services like; water supply pipeline, water connection lines, pipe gutters, telephone cables, electric cables etc., and thereafter upon taking the prior approval of the Engineer-In-Charge, the excavation can be carried out by using JCB machine.

5. Rajkot Municipal Corporation shall recommend to the competent authority to give Controlled Blasting License to the contractor for carrying out excavation in hard rock. In case of blasting license not permissible from the competent authority in some places then excavation is to be done by using wedges and hammers, chiseling, breakers, pneumatic tools, etc. Also in case where blasting license is permitted but even then if there is no possibility of carrying out the blasting for whatsoever reason, the excavation is to be done by using Wedges and hammers, chiseling, breakers, pneumatic tools etc. No extra payment shall be made for excavation to be carried out in any of the above mentioned both the situations.

6. Excavation in soft rock and hard rock shall have to be carried out only by Chiseling, Breaker (pneumatic tools) etc., as far as possible. If excavation is not possible in terms of above and if excavation is required to be carried out with the help of blasting then the same shall have to be carried out only after taking prior approval and necessary license for blasting from the competent authority.

7. In case of excavation not possible manually or by chiseling in certain place(s) as well as if blasting is also not possible due to various reasons i.e. to avoid damage to nearby water pipeline, pipe gutter, telephone cables / Duct, Raw houses / week buildings / narrow street etc., then the excavation by blasting will not be permitted Under these circumstances, excavation shall have to be carried out only by Breaker (pneumatic tools) as per the instructions of the Engineer-In-Charge. No extra payment will be made for such type of excavation done by using Breaker. The rate for excavation shall be paid as per the rate of related item mentioned in Schedule-B.

8. The safety of the trenches is the prime important factor. Along the trenches on both the side, a hump of excavated stuff of minimum height 3 to 5 ft shall have to be provided till the work is got complete However, where there is no defined road, in such area, the fencing/ lighting etc., requires to be provided as per clause 1.1.15. Sign Board shall have to be provided at required locations, so that there will not be any fatal accident.

9. Regarding the width of excavation, as (a) it is difficult to carry out the vertical trench excavation, (b) possibility of sliding the soil, and (c) uneven excavation trench width in case of blasting. In this connection, for every 1.5 mt lift if there is less width upto 5 cm at the bottom then the top width of excavated trench, it shall be considered as per the specified trench width or actual trench width carried out at the ground level by the contractor whichever is less. If excavation is carried out more than the specified width then the payment will be made only for the specified width of excavation. For mode of measurement for excavation, the width of excavation will be considered as given at the time of line out by engineer-in-charge or actual width done whichever is less.

10. The pipes shall be with ISI mark whereas that of manhole frame and cover shall be confirming to relevant IS.

11. After entering into an agreement, the agency shall have to finalize the agency for supply of the material like pipes, manhole / house connection chamber frame and covers etc., and the name of manufacturer / supplier should immediately be informed to Rajkot Municipal Corporation so that Rajkot Municipal Corporation can also expedite the manufacturer / supplier for the material. If necessary, Rajkot Municipal Corporation will visit and inspect the factory. During the inspection, if Rajkot Municipal Corporation is not satisfied then the contractor shall have to procure the material from other manufacturer(s).

12. While the work in progress, there is possibility of change in drainage line routes according to the site conditions. Under these circumstances, the contractor shall have to carry out the work accordingly, for which, no extra payment shall be made in such situations. Over and above, the decision of Engineer-in-charge for change in drainage line routes shall be final and binding to the contractor.

13. The quantity of various items mentioned in the schedule-B is liable to increase or decrease up to any extent. Under the circumstances, the contractor shall have to carry out the work accordingly without any rate escalation. Rajkot Municipal Corporation will not entertain any dispute in this regard.

14. In excavation, the decision regarding classification of strata shall rest with the Engineer-In-Charge and his decision in this regards shall be final and binding to the Contractor.

15. The rates are inclusive of dewatering, if required.

16. Regarding water supply for hydro / flow testing, necessary water, power, labour etc. required for the necessary test shall be arranged by the contractor at his own cost.

11. During construction activity, proper care must be taken for labour safety and must follow the provisions of the Labour Laws.

18. Testing of the material like; Brick, Sand, Aggregate etc. should have to be tested periodically as suggested by the engineer- in-charge at Government approved material testing Laboratory and testing charges for the same has to be borne by the contractor.

19. In case of any ambiguity found in specifications / drawings etc. the engineer-in-charge is empowered to take necessary decision for rectification and same shall be final and binding to the contractor.

20. The contractor shall have to get registered under ESI (Employer's State Insurance)

21. Act and obtain ESI Registration number if the number of workers are 10 Nos. or more. Also, the agency shall have to give all the benefits to the workers as available under the ESI Act. The agency should follow all the rules and regulations of ESI Act as per prevailing norms.

22. The contractor will be responsible to avail P F Code as per the prevailing Circular of Government for the employees on work. The required documents regarding deduction of P F shall have to be submitted by the contractor to the competent authority.

23. The restoration work for the excavation done is to be carried out immediately as per the instructions of engineer in charge. The excess material shall have to be disposed with no extra cost at the site specified by engineer-in-charge.

CITY ENGINEER
Rajkot Municipal Corporation

Signature of Contractor

BILL OF QUANTITIES AND PRICE

The Bill of quantities consists of following sections :

CIVIL WORKS:

Civil works requires following:

- Excavation of Trenches
- Providing, supplying, lowering, laying, jointing, and commissioning of various dia. RCC pipe / stone ware pipe as per drawing and detailed specifications.
- Bedding for pipes with selected excavated earth and murrum
- Construction of brick masonry circular manhole as per drawing and specifications.
- Drilling of borehole for laying pipeline under railway / highway.
- Refilling the pipeline trenches with proper ramming
- Excavation of road work and restoration of road as per bill of quantities and specifications.
- All required necessary items as directed by engineer in charge.

The bill of quantities forms the most important part of the e-tender documents. The supply, lowering laying jointing, erection testing and commissioning of pipeline which form a part of total works are indicated in the schedules separated include in the documents. The e-tendering contractors shall price of this document.

Performance testing and commissioning:

The bill of quantities, general conditions of contractor and the specifications which from an integral part of this contractor shall be read in conjunction.

The bill of quantities, general conditions of contractor and the specifications which from an integral part of this contractor shall be read in conjunction.

Payment for different items shall be paid on % (percentage) above or below quoted by the contractor online in the given price bid. However for any extra items to be carried out with permission of engineer in charge rates will be decided by the Rajkot Municipal Corporation as per GC-70 wherever not specified in the tender.