ADDENDUM TO

INVITATION TO BID

ITB Number WBMSC/Offc Bldng/06/2011

ENGAGEMENT OF CONTRACTOR FOR CONSTRUCTION OF MULTI STORIED BUILDING AT PREMISES OF SWASTHYA BHAWAN

BOQ for Sanitary Plumbing Works – SECTION-III

Sl. No.	Description	Sch Ref	Unit	Quantity	Rate(Rs)	Amount(Rs)
1	Supplying fitting and fixing G.I. pipes TATA make with all necessary accessories, specials viz. socket, bend, tee, union, cross, elbow, nipple, long screw, reducing socket, reducing tees, short piece etc. fitted with holder bats clamps, i/c. cutting pipes, making threads, fitting fixing etc. complete in all respects i/c. cost of all necessary fittings as required, jointing materials and two coats of painting with approved paint in any position above ground. (Payment will be make on the centre line measurements of the total pipe line i/c. all specials. No separate payment will be made for accessories specials) a) 15 mm. dia Medium Quality	lt 1 a (ii) / 2	metre	150	194.00	29,100.00
				Rate in words:	(Rupees one hundred ninty four only)	
	b) 25 mm. dia Medium Quality	lt 1 c (ii) / 2	metre	200	300.00	60,000.00
				Rate in words:	(Rupees three hundred only)	
	c) 32 mm. dia Medium Quality	lt 1 d (ii) / 10	metre	320	343.00	109,760.00
				Rate in words:	(Rupees three hundred forty three only)	
	d) 40 mm. dia Medium Quality	lt 1 e (ii) / 10	metre	65	399.00	25,935.00
				Rate in words:	(Rupees three hundred ninty nine only)	
2	Supplying fitting and fixing in position G.I. pipes TATA make for underground works will all necessary accessories, specials viz. socket, bend, tee, unions, cross, elbows, nipple short piece etc. i/c. cost of all materials, jointing materials cutting pipes, making threads, cutting trenches upto 1.5 mtr. below surface in all sorts of soils and refilling the same as directed with two coats of painting on G.I. pipes and specials with bituminous paint complete in all respect (Payment will be made					

	on the centre line measurement of the total pipe line i/c. all specials. No separate payment will be made for accessories specials)					
	a) 65 mm. dia Medium quality	lt 2 (vii) / 3	metre	25	640.00	16000
				Rate in words:	(Rupees six hundred forty only)	
3	Supply,fitting & fixing of PVC pipes of appvd make of (medium duty) conforming to ASTMD-1785 & threaded to match with GI pipes as per IS 1239 (part I) with all necessary accessories ,specials i.e, socket,bend,tee,union,cross,elbow,nipple,longscrew ,reducing tee ,socket ,short piece etc fitted with holder bat clamps ,incl. cutting pipes,making threads,fitting,fixing etc. complete in all respect including cost of all fittings as reqd ,jointing materials & two coats of painting with appvd paint in any position above ground. (payment will be made on the centreline measurement of total pipeline incl all specials.No separate payment will be made for accessories,specials.)					
	40mm dia	lt 19 (i) / 12	metre	125.00	233.00	29125
				Rate in words:	(Rupees two hundred thirty three only)	
4	25mm dia	lt 19 (i) / 12	metre	150.00	142.00	21300
				Rate in words:	(Rupees one hundred forty two only)	
	Supply,fitting & fixing of PVC pipes for underground works of appvd make of (medium duty) conforming to ASTMD-1785 & threaded to match with GI pipes as per IS 1239 (part I) with all necessary accessories ,specials i.e, socket,bend,tee,union,cross,elbow,nipple,longscrew ,reducing tee ,socket ,short piece etc fitted with holder bat clamps ,incl. cutting pipes,making threads,fitting,fixing etc. complete in all respect including cost of all fittings as reqd ,jointing materials & two coats of painting with appvd paint in any position above ground. (payment will be made on the centreline measurement of total pipeline incl all specials.No separate payment will be made for accessories,specials.)					
	65mm dia	lt 19 (ii) / 13	metre	90.00	483.00	43470
				Rate in words:	(Rupees four hundred eighty three only)	
5	Supplying, fitting and fixing peet's valve fullway gunmetal standard pattern best quality of approved brand bearing I.S.I. marking with fittings (tested to 21 kg./sqcm.) and direction of Engineer-In-Charge)					

	a) 40 mm.	lt 4 (v) / 5	each	12	1800.00	21600
				Rate in words:	(Rupees one thousand eight hundred only)	
	b) 25 mm	lt 4 (vii) / 5	each	10	926.00	9260
				Rate in words:	(Rupees nine hundred twenty six only)	
	c) 20mm	lt 4 (viii) / 5		2	645.00	1290
				Rate in words:	(Rupees six hundred forty five only)	
6	Supplying fitting and fixing gunmetal wheel valve 50mm dia	lt 5 (iv) / 5	each	15	1824.00	27360
				Rate in words:	(Rupees one thousand eight hundred twenty four only)	
7	Chromium plated Bibcock (angular shape withh wall flange) (equivalent to code no. 5037 & model - Florentine of Jaquar or similar brand).	lt 7 c(i) /6	each	80	892.00	71360
				Rate in words:	(Rupees eight hundred ninty two only)	
8	Wash basin white vitreous china of approved make (without fittings) supplied fitted & fixed in position on 75 mm. x 75 mm. X 75 mm wood blocks and C.I. brackets i/c. two coats of painting of C.I. brackets a) 630 mm. x 450 mm. size	lt 1(iii) /38	each	30	1425.00	42750
				Rate in words:	(Rupees one thousand four hundred twenty five only)	
9	Chromium plated shower arm 190 mm long (equivalent to code no 536A & Model Tropical/Sumthing Special of Essco or similar brand).	lt 3a iii / P 4	each	10	380.00	3800
				Rate in words:	(Rupees three hundred eighty only)	
10	Supplying, fitting and fixing approved brand P.V.C. Connector white flexible with both end coupling with heavy brass over C.P. nut 15 mm. dia a) 600 mm. long	lt 9iii / 40	each	30	74.00	2220
				Rate in words:	(Rupees Seventy four only)	
11	Supplying, fitting and fixing approved brand P.V.C. waste pipe with coupling at one end fitted with brass CP nut 32 mm. dia a) 750 mm. long	lt 10ii / 40	each	30	66.00	1980
				Rate in words:	(Rupees Sixty six only)	

12	Supplying,fitting & fixing 15mm swan neck tap with left & right hand operating nob with aerator (equivalent to code no 510,510A & Model TROPICAL/SUMTHING SPECIAL OF ESSCO OR similar brand)	It 16 / 41	each	5	951.00	4755
				Rate in words:	(Rupees nine hundred fifty one only)	
13	Waste fittings supplied, fitted and fixed complete a) C.P. over brass i) 32 mm.	It 17 ii /41	each	20	218.00	4360
				Rate in words:	(Rupees two hundred eighteen only)	
	ii) 40 mm	It 17 iii /41	each	15	274.00	4110
				Rate in words:	(Rupees two hundred seventy four only)	
14	Supplying, fitting and fixing dome shaped C.P. waste grating for urinals a) 50 mm. dia	It 23ii /43	each	15	289.00	4335
				Rate in words:	(Rupees two hundred eighty nine only)	
15	Cast iron soil pipe only conforming to I.S. 3989/1970 and I.S. 1729/1964 with bobbins, nails etc. i/c. making holes in the wall, floor etc. and cutting trenches etc. in any floor through masonary concrete if necessary and mending good damages with necessary jointing materials and painting two coats to the exposed surface with approved paint complete. a) With lead caulked joints i) 100 mm. dia (internal)	It 1b(ii) /57	metre	512	768.00	393216
				Rate in words:	(Rupees seven hundred sixty eight only)	
16	Cast iron single branch equal with door, conforming to I.S. 1729/1970 i/c. jointing and painting two coats to the exposed surface a) With lead caulked joints i) 100 mm. dia	It 2b(ii) /58	each	35	855.00	29925
				Rate in words:	(Rupees eight hundred fifty five only)	
17	H.C.I. bend with door conforming to I.S.S. i/c. jointing complete a) With lead caulked joints i) 100 mm. dia	It 4b(ii) /59	each	35	593.00	20755
				Rate in words:	(Rupees five hundred ninty three only)	
18	H.C.I. bend without door conforming to I.S.S. including jointing complete a) With leadcaulked joints i) 100 mm. dia	It 5b (ii) / 59	each	25	530.00	13250

				Rate in words:	(Rupees five hundred thirty only)	
19	Approved patent vent cowl H.C.I. conforming to I.S.S. a) 100 mm. dia	It 9(i) /61	each	15	317.00	4755
				Rate in words:	(Rupees three hundred seventeen only)	
20	Supplying fitting and fixing cast iron 'P' or 'S' trap conforming to I.S. 3989/1970 and 1729/1964 i/c. lead caulked joints and painting two coats to the exposed surface a) 'P' Trap - i) 100 mm. dia	It 14a(iii) /63	each	12	943.00	11316
				Rate in words:	(Rupees nine hundred forty three only)	
21	E.P.W.C. in white glazed vitreous chinaware of approved make supplied fitted and fixed in position complete with necessary bolts, nuts etc. a) With P trap	It 2a /75	each	48	1279.00	61392
				Rate in words:	(Rupees one thousand two hundred seventy nine only)	
22	Orissa pattern water closet in white glazed vitreous chinaware of approved make supplied fitted and fixed in position complete excluding P or S trap (excluding cost of concrete for fixing) a) 580 mm. x 440 mm.	It 4i /75	each	12	1660.00	19920
				Rate in words:	(Rupees one thousand six hundred sixty only)	
23	Flat back urinal (half stall urinal) in white vitreous chinaware of approved make supplied fitted and fixed in position with brass screw on 75 mm. x 75 mm. x 75 mm.Wooden blocks complete a) 465 mm. x 355 mm. x 265 mm.	It 5ii /75	each	12	766.00	9192
				Rate in words:	(Rupees seven hundred sixty six only)	
24	Half round channel with or without outlet as required set in cement concrete (6:3:1) with jhama chips complete a)White Vitreous chinaware-600mm X 100mm	It 7(bii) /76	Mtr.	30	546.00	16380
				Rate in words:	(Rupees five hundred forty six only)	
	i)Channel with or without outlet,stop end & L or T	It 7(Ai) /76	Mtr	12.5	36.00	450
				Rate in words:	(Rupees thirty six only)	

25	Supplying,fitting & fixing Closet seat of appvd. Make with lid & C P hinges,rubber buffer & brass screws complete. E.W.C (Bestolite solid type - black)	lt 9(iii) /76	each	12	559.00	6708
				Rate in words:	(Rupees five hundred fifty nine only)	
26	Squating plate with integral flushing in white vitrius chinaware of appvd make supplied ,fitted,fixed in cement concrete 1:3:6 with jhamachips complt……----------450mmx350mm	lt 6 / 76	each	10	1049.00	10490
				Rate in words:	(Rupees one thousand forty nine only)	
27	Supplying, fitting and fixing gunmetal stop cock/bib cock of approved make and brand tested to 21 kg. per sq.cm. bearing ISI marking with fittings and as per direction of Engineer-in-charge. a) 15 mm.	lt 7 i/ 16	each	15	151.00	2265
				Rate in words:	(Rupees one hundred fifty one only)	
	b) 25 mm.	lt 7 iii/ 16	each	15	434.00	6510
				Rate in words:	(Rupees four hundred thirty four only)	
28	Supplying, fitting and fixing bevelled edged mirror 5.5 mm. thick silver red as per I.S. 3438/1965 together with brass C.P. hinges a) 600 mm. x 450 mm.	lt 14ii /77	each	24	441.00	10584
				Rate in words:	(Rupees four hundred forty one only)	
29	Supplying fitting and fixing towel rail with two brackets a) C.P. over brass i) 25 mm. dia and 600 mm. long	lt 21(ii) /78	each	24	339.00	8136
				Rate in words:	(Rupees three hundred thirty nine only)	
30	Supplying,fitting & fixing liquid soap container Chromium plated	lt 16a /77	each	50	428.00	21400
				Rate in words:	(Rupees four hundred twenty eight only)	
31	Supply , fitting & fixing yard gully with appvd H C I					
	grating complete 225 mmx 150 mm with 230 mm gratiings	lt 20 (i) /65	Each	4	514.00	2056
				Rate in words:	(Rupees five hundred forteen only)	
32	Supplying , fitting & fixing of Aluminium domical grating : 125 mm	lt 10 (ii) /62	Each	5	54.00	270
				Rate in words:	(Rupees fifty four only)	

33	Supplying fitting & fixing pillar cock….C.P..15mm (Code no 5011 & Model - FLORENTINE of JAQUAR or equivalent)	lt 19c /P42	each	10	885.00	8850
				Rate in words:	(Rupees eight hundred eighty five only)	
34	Supplying , fitting & fixing of 10 ltr PVC low down cistern conforming to IS spec with PVc fittings complete , C I brackets incl two coats of painting to bracket etc.	lt 2 / 33	Each	60	1129.00	67740
				Rate in words:	(Rupees one thousand one hundred twenty nine only)	
35	Constructing inspection pit inside measure-ment 600 mm. x 600 mm. x Upto 600 mm. (depth) with 250mm.thk. 1st. class brick work in cement mortar (4:1) on all sides, bottom of the pit consisting of 100 mm. thick cement concrete (6:3:1) with jhama khoa over a layer of jhama brick flat soling 20 mm. thick (4:1) cement plaster to bottom of the pit, providing necessary invert with cement concrete (4:2:1) with jhama chips as per direction, neat cement finishing to entire internal surfaces the top of the pit covered with 100 mm., thick R.C.C. slab (3:1.5:1) with stone chips and necessary reinforcement upto 1% and shuttering i/c. 6 mm. thick (4:1) cement plaster in all external surfaces of the slab and one 560 mm. dia R.C.C. manhole cover of approved make fitted and fixed in the slab with necessary fittings, necessary earthwork in excavation in all sorts of soils, filling the sides of the pit with earth and removing spoils after work complete in all respects. With Pakur Variety	lt 1 /81	each	30	6018.02	180541
				Rate in words:	(Rupees six thousand eighteen & paise two only)	
36	Construction of circular soak well 2.50 mtr. deep in all types of sandy soil with dry B/W upto 1.60 mtr. from the bottom having 150					
	mm. intermediate cement B/W (6:1) band all round and cement B/W (6:1) upto 0.90 mt.from top with19mm.thk cement plaster(4:1) to inside face upto the depth of cement B/W 12 mm. thick plaster (4:1) on outer face of G.L. and 6 mm. thick plaster (4:1) on top of R.C.C. slab i/c. filling bottom 1.0 mtr. of the well with brick metal (50-63 mm. size) i/c. R.C.C. slab cover of the design thickness with concrete (4:2:1) with stone chips with necessary reinforcement and shuttering & R.C.C. manhole cover of approved make					

	with lifting arrangement to cover a hole of 560 mm. dia in R.C. slab cover making necessary arrangements for pipe connection excavation of well and filling brick metal to inside i/c. shoring, dewatering and removing the excess earth from the premises as per direction complete with all costs of labour and materials a) With 250 mm. thick dry brick work and 250 mm. thick cement brick work (6:1) and 1 mtr. inside dia	lt 4 / 87	each	1	13058.22	13058
				Rate in words:	(Rupees thirteen thousand fifty eight & paise twenty two only)	
37	Supply , fitting & fixing with cement jointing (3:1) salt glazed stoneware pipe including excavation of earth upto 1.5 m depth in all sorts of soil both mixed or unmixed and refilling (but excluding concreting at bottom and sides) 150 mm dia	lt 16/ 64	mtr	75	300.00	22500
				Rate in words:	(Rupees three hundred only)	
	225 mm dia		mtr	80	502.00	40160
				Rate in words:	(Rupees five hundred two only)	
	300 mm dia		mtr	75	925.00	69375
				Rate in words:	(Rupees nine hundred twenty five only)	
38	Supplying plastic water storage tank of approved quality with closed top with lid (Black) muitilayer. 5000 ltr capacity	lt 5h /34	Each	4	30461.00	121844
				Rate in words:	(Rupees thirty thousand four hundred sixty one only)	
39	Labour for hoisting plastic water storage tank above 1500 ltr upto 5000 ltr capacity Upto 2nd storey from G L	lt 9iia /34	Each	4	140.00	560
				Rate in words:	(Rupees one hundred forty only)	
40	Labour for punching hole in plastic water storage tank upto 50 mm dia	it 12/ P 35	Each	16	12.00	192
				Rate in words:	(Rupees twelve only)	
41	Supply,fitting & fixing Stainless steel sink complete with waste fittings & two coats of painting of C I brackets. Sink only 530 mm x 430 mm x 180 mm	lt 6a)(i) /39	each	4	3613.00	14452
				Rate in words:	(Rupees three thousand six hundred thirteen only)	

42	Supplying, fitting and fixing glass shelf with aluminium guard rails. a) Ordinary type with 5.5 mm sheet glass i) 450 mm X 125 mm	it 15ai/ P 77	each	20.00	322.00	6440.00
				Rate in words:	(Rupees three hundred twenty two only)	
43	Supplying, fitting & fixing UPVC pipes A type & fittings conforming to IS 13592 - 1992 with all necessary clamps nails including making holes, in walls, floor, etc. and cutting trenches in any soil, through masoury concrete structures etc. and cutting trenches in any soil, through masoury concrete structures etc. if necessary and mending good damages including jointing with jointing materials (Spun yarn, valamoid / bitumen / M. Seal etc. complete). 110mm dia	it 21A/ p365	mtr	475.00	260.48	123728.00
				Rate in words:	(Rupees two hundred sixty & paise forty eight only)	
44	UPVC Fittings 110mm dia Tee junction	it 21B/ p365	each	50.00	190.28	9514.00
				Rate in words:	(Rupees one hundred ninty & paise twenty eight only)	
45	110mm dia Y junction	it 21B/ p365	each	50.00	250.88	12544.00
				Rate in words:	(Rupees two hundred fifty & paise eighty eight only)	
46	110mm dia shoe of down pipe	it 21D/ p365	each	40.00	117.67	4706.80
				Rate in words:	(Rupees one hundred seventeen & paise sixty seven only)	
47	Supplying, fitting, fixing C.I. grating (heavy type) a) Upto 100 mm. square or 100 mm. dia	It 10a /P359	each	25.00	65.08	1627.00
				Rate in words:	(Rupees sixty five & paise eight only)	
	b)Above 100 mm. & upto 150 mm. sq.or round	It 10b /P359	each	35.00	112.69	3944.15
				Rate in words:	(Rupees one hundred twelve & paise sixty nine only)	
					TOTAL (Rs)	**1884616**

Schedule of Item Rates & Quantities for Internal Road -V

Sl	Item Description	Sch ref	Unit	Qty	Rate (Rs)	Amount (Rs)
1	Box cutting or filling in road embankment in all sorts of soil i/c spreading the spoils properly over the flank as necessary or on berm to approximate grade & camber & rolling the subgrade with power roller to proper camber & grade i/c uprroting & removin	ROAD. Sch. P-257, It.-1	sqm	1192.50	9.24	11018.70
				Rate in words:	(Rupees nine & paise twenty four only)	
2	Rolling subgrade by power roller in all sorts of soil to proper camber and grade including watering as per direction and satisfaction of engineer - in - charge.	Road Sch P-257, It.-2	sqm	1490.63	2.70	4024.69
				Rate in words:	(Rupees two & paise seventy only)	
3	Spreading & compacting sand to the rquired thickness in layers not exceeding 15 cm to proper gradient & camber, inundating each layer by water & packing & ramming layer by layer to achieve desired compaction i/c cost of sand lighting, guarding, barricading & making earthen bundh where necessary, curing with water as per direction, mending, cracks it 8/ 122 - & depressions by ramming when necessary as per direction of EIC.	It 7 / P193 of Road Sch	cum.	208.69	270.50	56449.97
				Rate in words:	(Rupees two hundred seventy & paise fifty only)	
4	Providing & laying single brick flat soling (75mmthk) of picked jhama bricks/1st class bricks with necessary cushioning over bed & filling up joints with local sand/klin rubbish i/c cost of all materials & ramming , watering all complete.	1 / P33 bldg sch	sqm	1406.25	264.31	371686
				Rate in words:	(Rupees two hundred sixty four & paise thirty one only)	
5	Brick edging 75mm wide with picked jhama bricks , laid true to line & level i/c cutting necessary trenches in all sorts of soil i/c refilling the trenches with spoil & ramming the side complete as per direction of EIC. Brick on end edging (75 mm wide & 250 mm deep)	3 b/395	Mtr	250.00	49.28	12319
				Rate in words:	(Rupees forty nine & paise twenty eight only)	
6	Cement Concrete M 20 (mix 3:1.5:1) with graded stone chips (20 mm. down) excluding shuttering and reinforcement, if any, as per IS 456-2000 in gr floors	7a / P86	cum.	229.37	5675.32	1301725

				Rate in words:	(Rupees five thousand six hundred seventy five & paise thirty two only)	
7	Hire and labour charges for shuttering with centering and necessary staging upto 4 m. using approved stout props and thick hard wood planks of approved thickness with required bracing for concretes slabs, beams, columns, lintels curved or straight i/c. fitting, fixing and striking out after completion of works (In all floor) steel shuttering or 9 to 12mm thick approved quality plyboard shuttering in any concrete work.	16(c) / P98	sqm.	202.50	310.82	62941
				Rate in words:	(Rupees three hundred ten & paise eighty two only)	
8	Reinforcement for reinforced concrete work in all sorts of structures i/c. distribution bars, stirrups, binders etc. including supply of rods, straightening and removal of loose rust (if necessary) cutting to requisite length, hooking and bending to correct shape, placing in proper position and binding with 16 gauge black annealed wire at every inter-section, complete as per drawing and direction Tor steel--- gr fl	19 a(i) / P100	MT	2.25	55954.40	125897
				Rate in words:	(Rupees fifty five thousand nine hundred fifty four & paise forty only)	
					Total	**1946062**

B.O.Q of Fire System for proposed G+II storied (8 storied foundation) multistoried office building - Section-VI

Fire Detection & fighting system

SL. NO	NAME OF ITEMS	QUANTITY	UNIT	RATE {RS}	TOTAL AMMOUNT [RS]
A.	**PUMP HOUSE**				
i	11 M3/Hr capacity 70 MWC Jockey Pump with suitable Motor complete	1	Set	70,000.00	70,000.00
ii.	137 M3/Hr capacity 70 MWC main Pump with suitable motor capacity for Yard Hydrant & Wet Riser system	1	Set	165,000.00	165,000.00
iii.	Composit Control Panel with DOL Starter for Jockey Pump and star Delta Starter for Main Pumps.	1	Set	165,000.00	165,000.00
iv.	CIDF Valves				
	a. Gate Valve				
	200 mm	2	Nos.	18,900.00	37,800.00
	150 mm	5	Nos.	12,700.00	63,500.00
	50 mm	3	Nos.	6,500.00	19,500.00
	b. N.R. Valve				
	150 mm	3	Nos.	11,500.00	34,500.00
	50 mm	1	No.	6,000.00	6,000.00
v.	Cabling anf earthing inside Pump House	1	Lot	35,000.00	35,000.00
vi.	Pressure Gauge with isolating valve.	6	Nos.	18,000.00	108,000.00
vii.	Pressure Switches with isolating valve.	5	Nos.	4,500.00	22,500.00
	Total Cost Of Fire Pump House :				**726,800.00**

B.	**Piping for Wet Riser .**				
i.	MS Pipe medium class ISI marked.				
	200 mm NB	30	M	1,800.00	54,000.00
	150 mm NB	75	M	1,400.00	105,000.00
	100 mm NB	100	M	1,100.00	110,000.00
	80 mm NB	100	M	800.00	80,000.00
	50 mm NB	125	M	550.00	68,750.00
	40 mm NB	200	M	400.00	80,000.00
	32 mm NB	200	M	270.00	54,000.00
	25 mm NB	300	M	220.00	66,000.00
	12 mm NB	100	M	140.00	14,000.00
ii.	MS Fitting for				
	a. Wet Riser System	1	Lot	25,000.00	25,000.00
iii.	Support				
	a. Wet Riser System	1	Lot	8,000.00	8,000.00

iv.	Anti Corrosive Treatment on Pipe a. Wet Riser System	1	Job	20,000.00	20,000.00
	Total Cost of Wet Riser				**684,750.00**

C.	**ACCESSORIES**				
i.	SS Hydrant Valve complete with blank cap & Chain	10	Nos.	7,500.00	75,000.00
ii.	MS Hose Box to accommodate Hose and Branch Pipe				
	2 X 15 Mtr. Long	3	Nos.	2,300.00	6,900.00
	1 X 15 Mtr Long	4	Nos.	1,700.00	6,800.00
iii.	63 mm Nb 15 Mtr Long Hose with Coupling	15	Nos	2,800.00	42,000.00
iv.	Short Branch Pipe with Nozzle	7	Nos.	1,800.00	12,600.00
v.	Swinging Hose Valve Reel complete with30 M long 25 mm Nb Rubber Tube and Nozzle.	4	Nos.	5,500.00	22,000.00
vi	3 way FB Collecting Head with 1Set Butterfly Valve and NR Valve.	2	Sets	8,500.00	17,000.00
vii.	Installation Control Valve with Gang 100 mm size	4	Nos.	45,000.00	180,000.00
viii.	Ci Gate Valve 150 mm 100 mm	 4 3	 Nos Nos	 12,700.00 9,900.00	 50,800.00 29,700.00
	Total Cost of Yard Hydrant Sysytem				**442,800.00**

D I.	**FIRE DETECTION SYSTEM** Micro Processor bassed Zone Panel with battery back up and public address sysem.	1	Set	75,000.00	75,000.00
ii.	Optical Smoke Detector	40	Nos.	1,700.00	68,000.00
iii.	Heat Detector	8	Nos.	1,400.00	11,200.00
iv.	Break Glass type Manual Cell Point.	6	Nos.	900.00	5,400.00
v.	Electronic Hooter	6	Nos.	1,500.00	9,000.00
vi.	2C X 1.5mm^2 arrmoured Copper Cable	1200	M	160.00	192,000.00
	Total Cost Of Fire Detection System				**360,600.00**

E	**PORTABLE FIRE EXTINGUISHER**				

I.	Gas Pressure stored ABC Powder type complete				
	5 Kg. Capacity	8	Nos.	2,700.00	21,600.00
	10 Kg. Capacity	2	Nos.	3,900.00	7,800.00
ii.	4.5 Kg.capacityCo2 Cylender filled with Gass	4	Nos.	5,900.00	23,600.00
iii.	9 Ltr capacity Mechanical Foam type.	2	Nos.	1,900.00	3,800.00
	Total Cost Of Portable Fire Extinguisher				**56,800.00**
	Total Cost :				**2,271,750.00**
	(Ruppes twenty two lakh seventy one thousand seven hundred fifty only)				

TECHNICAL SPECIFICATION FOR CIVIL, S&P , & PILE .

TECHNICAL SPECIFICATION FOR BUILDING WORKS

CIVIL WORKS

(A) MATERIALS

GENERAL :

All materials is to be used in works shall conform to Indian Standards specification as published by I.S.I from time to time (and in the absence thereof as approved by the Engineer - in- Charge).

A-1 BRICKS :

All bricks shall be approved quality of standard specifications, made of good brick earth, uniform deep red, cherry colour , thoroughly burnt in kiln (machine made) without being vitrified , regular in shape and size , sound , hard ,homogeneous in texture , true to shape and of standard dimensions and shall be free from cracks, chips, flaws, stones or humps of any kind and shall not show appreciable signs of efflorescence either dry or subsequent to soaking in water. The size of bricks shall be 9.3/4" x 4.3/4" x 2.3/4" (conventional) , 190 x 90 x 90 mm. (modular). The bricks shall emit a clear ringing sound on being struck and have a minimum crushing strength of 110kg/sqm. All the bricks which absorb water more than 20% of their own dry weight after 24 hours immersion in cold water shall be rejected.

A-2 COARSE AGGREGATES FOR CEMENT CONCRETE WORKS :

Stone chips or stone ballast for cement concrete(plain or reinforced) shall be hard, of uniform and fine texture, free from faults or planes of weakness and free from weathered faces and coatings. The ballast or chips must be free from loam, clay or any surface coating , free from organic matter or other impurities and screened , free of dust. Trap stone of black and hard variety as is generally available from quarries in Pakur or Chandil areas will be normally used. Stone aggregates from other sources may also be used provided the same is a trap stone with high density, linear cleavage, low absorption of water and finally found suitable in the opinion of Engineer - in -charge. The opinion of Engineer-in charge must be recorded in writing. The ballast or chips shall be obtained by breaking from large blocks and must be more or less cubical in shape. Stone aggregate with flakiness index more than 25% is not allowed.

SIZE OF COARSE AGGREGATES :

For any of the following nominal sizes of graded coarse aggregates , grading shall be in conformity with the requirements laid down in the Indian Standard Specification . IS; 383-1963 as shown in Table I.

TABLE - I

I.S. Sieve Designation	Percentage passing for graded aggregate of nominal size			
	40 mm	20 mm	16 mm	12.5 mm
1	2	3	4	5
80 mm	100	-		
63 mm	-	-		
40 mm	95 -100	100		
20 mm	30 -70	95 -100	100	100
16 mm	-	-	90 -100	-
12.5 mm	-	-	-	90 -100
10 mm	10 -35	25 -55	30 -70	40 -85
4.75 mm	0 -5	0 -10	0 -10	0-10
2.36 mm	-	-	-	-

When coarse aggregate brought to the site is ungraded , single size coarse aggregate of different nominal sizes conforming to the requirements vide Table II given below , shall be mixed at site with the other ingredients of concrete either directly in the mixture or on the platform to the proportion indicated in Table III below :-

TABLE II

I.S. Sieve Designation	Percentage passing for single sized aggregate of nominal size					
	63 mm	40 mm	2 0 mm	16 mm	12.5mm	10 mm
1	2	3	4	5	6	7

80 mm	100					
63 mm	85-100	100				
40 mm	0-30	85-100	100			
20 mm	0-5	0-20	85-100	100		
16 mm	-	-	-	85-100	100	
12.5 mm	-	-	-	-	85-100	100
10 mm	0.5	0-5	0-20	0-30	0-45	85-100
4.75 mm	-	-	0-5	0-5	0-10	0-20
2.36 mm	-	-	-	-	-	0-5

TABLE III

Sl. No.	Cement Conc. mix.	Nominal size of aggregate	Parts of aggregate of size 63 mm.	Parts of aggregate of size 40 mm.	Parts of aggregate of size 20 mm.	Parts of aggregate of size 12.5 mm	Parts of aggregate of size 10 mm.
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	1:6: 12	63 mm	9	-	3		
2	1: 6: 12	40 mm	-	9	3		
3.	1: 5: 10	63 mm	7.1/2	-	2.1/2		
4.	1: 5 :10	40 mm	-	7.1/2	2.1/2		
5.	1: 4: 8	63 mm	6	-	2		
6.	1: 4: 8	40 mm	-	6	2		
7.	1:3: 6	63 mm	4.1/2	-	1.1/2		
8.	1: 3 : 6	40 mm	-	4.1/2	1.1/2		
9.	1: 3 : 6	20 mm	-	-	4.1/2	-	1.1/2
10.	1: 2 : 4	40 mm	-	2.1/2	1	-	1/2
11.	1 :2 : 4	20 mm	-	-	3	-	1
12.	1:2 :4	12.5 mm	-	-	-	3	1
13.	1: 1.5 :3	20 mm	-	-	2	-	1

Notes :- The proportions indicated in Table III above are by volume. These proportions may be varied somewhat by Engineer- in - charge after making sieve analysis of the aggregates brought to the site, when considered necessary for obtaining better density and strength of concrete.

A 2.1) **ALL - IN - AGGREGATES** : If combined aggregates are available ,they need not be seperated into fine and coarse, but necessary adjustment may be made in the grading by the

addition of single size aggregates. The grading of the all- in- aggregate when analysed as described in IS : 2386 (Part I) shall be in accordance with Table IV.

TABLE IV

I.S. Sieve Designation	Percentage passing for all- in- aggregate of	
	40 mm. Nominal Size	20 mm. Nominal Size
80 mm	100	
40 mm.	95 -100	100
20 mm	45 -75	95 - 100
4.75 mm	25 - 45	30 -50
600 micron	8 -30	15 -35
150 micron	0 - 6	0 -6

A 2.2) **GRAVEL** ,for use as coarse aggregates in cement concrete work , must be hard absolutely free from surface coating and on being broken , the fractured surface must indicate a uniform and fine texture free from laminations ,planes of weakness. It shall be thoroughly washed and free from any foreign elements. Dead stones are not allowed.

A 2.2) **JHAMA** chips, not to be used in structural concrete whether plain or R.C., for cement concrete work shall be obtained by breaking good quality over bricks or jhama bats, must not be spongy or with any coating of foreign materials and should be homogeneous in texture. The chips shall be more or less cubical in shape and to be screened to make removal of dust. No under-burnt brick aggregates should remain present. All coarse aggregates for concrete works must be well-graded .These shall be screened for removal of dust and if so necessary in the opinion of the Engineer -in- Charge shall be washed at the cost and expense of the contractor.

A **-3 COARSE AGGREGATE FOR LIME CONCRETE WORKS :**

i) Brick aggregates for lime concrete in foundation or flooring shall consist of approved , clean, hard and over-burnt jhama khoa. The khoa must be well- graded and unless otherwise specified , shall pass through 32 mm sieve.

ii) Brick aggregates for lime terracing work on roof shall consist of khoa broken from 1st class bricks bats and unless otherwise specified, shall pass through 25 mm sieve and be suitably graded . No over -brunt or under burnt bricks or bats are to be broken for preparing such aggregates. No jhama khoa should be used in lime terracing work.

A -4 **SAND:-**

All sand shall be clean sharp and free from clay, loam , organic or any other foreign matter, shall be obtained from approved source. The Contractor shall get the sample of sand to be used in different kinds of work approved by the Engineer- in -Charge before using the same in work. Sand which in the opinion of the Engineer -in -Charge or his representative is dirty must be washed to his satisfaction at the cost and expenses of the Contractor.

i) Sand for all cement concrete work must be coarse. The sand shall pass through a mesh 4.75 mm square measured in the clear. Sand shall not be used for concrete works if contains more than 10 % of fine grains passing through a 76 mesh sieve as used for cement test nor should fineness modules be less than 2.00.

ii) Medium sand may be used for cement mortar , for masonry ,plaster etc. Fineness modulus shall be between 2 to 1.8.

iii) Sand filling in plinth or foundation where specified may be done with fine sand or silver sand but should be free from clay or loam.

A -5 **SURKI :-**

Surki shall be made from well burnt 1st class bricks bats , so as to pass through a mesh 2 mm. each way , and shall be perfectly clean and free from foreign matter. No under- burnt brick aggregate should be pulverised for making surki.

A- 6 **LIME :-**

All lime shall be freshly burnt and slaked and screened before use. The slaking should be done at site of work. Lime for works including roof terracing shall be Bisra, Satna or other approved stone lime

The specification covers lime as used in construction of buildings and other structures as described below:-

a) **Quick - lime** shall mean a calcined material the major part of which is calcium oxide in natural association a relatively small amount of magnesium oxide and capable of slaking with water.

b) **Fat- lime** shall mean the lime which has high calcium oxide content (between 95 and 100 per cent) and is dependent for setting and hardening on the absorption of carbon dioxide from the atmosphere. This is defined as class "C" in I.S. : 712-1973 which is used for finishing coat in plastering , white washing etc. and with addition of pozzolonic material (surki) for masonry mortar.

c) **Hydraulic lime** shall mean the lime which contains small quantities of silica and alumina and /or iron oxide which are in chemical combination with some of the calcium oxide content giving a putty or mortar that has the property of setting and hardening under water.

d) **Hydrated lime** shall mean a dry powder resulting from treatment of quick-lime with water enough to satisfy its chemical affinity for water under the conditions of hydration.

CLASSIFICATION OF LIME :

Class A : Eminently hydraulic lime used for foundations and other hydraulic structures shall be supplied as hydrated lime only and should be used particularly in any masonry work below G.L. It should be noted here that no masonry work below G.L should be taken up with the use of any other lime other than specified hydraulic lime. In case of doubt, if any, in respect of hydraulic lime being used in work below G.L. it is preferable not to use lime mortar at all below G.L.

Class C : Fat lime used mainly for lime punning , white washing and with suitable admixture , such as surki or any other pozzolonic material to produce artificial hydraulic mortar.

A- 7 **CEMENT :**

a) Unless otherwise specified , cement shall be ordinary Portland cement/Slag cement of grade 33 or 43 conforming to IS : 269 / IS: 455 of approved make and brand and to be tested at an approved laboratory.

b) It shall be stored in a dry place in regular piles not exceeding 10 bags high and in such a manner that it is adequately protected from moisture and contamination.

c) Different consignments shall be stacked seperately so that they can be used in the order in which they are received.

A- 8 **STEEL REINFORCEMENT :**

i) **MATERIALS :**

a) Mild steel reinforcement shall be hot rolled mild steelbars conforming to IS : 432 - Grade- I or IS: 226 - 1962 - " Standard Quality". Other qualities of Steel shall not be acceptable .

b) Strength of hot rolled mild steel deformed bars shall conform to IS: 1139 and cold twisted deformed bars should conforming to IS : 1786.

c) Each consignment shall be of approved make and if necessary certificates of test performed by a recognised testing laboratory or the manufacturer shall be produced. These test certificates shall give the ultimate stress, yield stress, elongation and results of cold bend test. If further required steel shall be tested at an approved laboratory.

d) Reinforcing steel of different varieties and sizes and types shall be stacked seperately.

e) Reinforcement bars shall be stored at the site in such a manner as to prevent rusting and contamination of the surface by deleterious materials like dirt ,oil, grease, paint, etc.

f) When placed in the work, reinforcement shall be free of loose mill scale, rust, dirt, oil, grease, paint etc.

g) Steel reinforcement shall always be protected from damages due to impact and rough handling.

ii) **FABRICATION , BENDING & SPLICING :**

a) Bars shall be cut to size and bent to shape in accordance with the appropriate dimensions shown in the drawings. When an overall or an internal dimension of bent bar is specified , the tolerance unless otherwise specified , shall be as in Table XI of IS : 2502.

b) Bars shall be bent cold gradually by machine or any other means approved by the Engineer- in- Charge except in case of mild steel bars larger than 28 mm. If approved by the Engineer-in- Charge , mild steel bars greater, than 28 mm. dia and conforming to IS : 433 only may be bent hot at cherry red heat (not exceeding 850 C). Bars bent hot shall be allowed to cool gradually in air and shall not be cooled by quenching . High yield strength deformed steelbars shall not be hot bent.

c) Bars having cracks or splits shall be rejected.

d) All bars shall be properly tagged for easy identification.

e) All reinforcement shall be furnished in full length indicated in the drawing. Splicing of bars, except those shown on the drawings, will not be permitted without the written authority of the Engineer- in charge.

f) At a tension splice, the minimum clear distance between bars shall be maintained. Splices in adjacent tension bars shall be staggered. At a compression splice , each side of lapped bar may be contacted but the minimum clear spacing between the splice and an adjacent splice shall be that specified for adjacent unspliced bars.

g) In no case shall the clear distance between two adjacent bars be less than the diameter of the bar (larger of the diameters to be considered if the adjacent bars of different diameters) or 6 mm more than the maximum size of coarse aggregate used in the concrete Guidance as per I.S.I. code 456.

h) Unless otherwise stated in the working drawing provisions of clause No. 25.4 of IS : 456 regarding cover to the reinforcement shall be followed.

iii) **PLACING AND FASTENING :**

a) All steel reinforcement shall be accurately placed in position shown on the drawing and firmly held during the placing and setting of concrete. Bars shall be tied together with mild steel wire (annealed) not less than 0.9 mm dia. (conforming to IS : 280) or secured with clips at all intersections. Where the spacing of intersection is less than 30 cms. in each direction alternative intersections shall be tied . Binders shall tightly embrace and shall be securely held . Placing of bars on layers of fresh concrete as the work progress shall not be permitted. Adjusting bar spacing in concrete already poured shall not be permitted.

b) Distance of the bars from the form work shall be maintained by approved concrete spacer blocks, ties, hangers and other approved supports. Metal chairs which are in contact with the exterior surfaces of concrete where specially allowed shall be galvanised or painted with epoxy. Layers of bars shall be supported at correct spacing by precast mortar blocks or other equally suitable devices approved by the Engineer- in - Charge. The mortar for the precast blocks shall have the same composition as the concrete in which it is embedded and shall have been cured for at least 28 days before being placed in position. The use of pebbles, pieces of broken stone of bricks , metal pipe or wooden blocks will not be permitted for use as spacers.

c) No reinforcement shall be bent when in position in the work without the approval of the Engineer- in -Charge whether or not it is partially embedded in concrete . Workmen will not be permitted to climb on bar extensions until the concrete has sufficient strength so as not to be damaged and no movement of the bar is possible.

A- 9 **TIMBER :**

All timber shall be of specified type best quality well - seasoned and / or well - treated for preservation and protection against decay etc . It shall be uniform in substance, straight in fibre free from large or dead knots, sap , flaws, sun- cracks , shakes or blemishes of any kind . Any insect damage or splits across the grain shall not be permissible. The colour of the timber shall be uniform throughout, firm and shining with a silky lustre when planed and shall not emit dull sound when struck.

A- 10 **GLASS**

All glasses shall be of the specified type ,colour ,clear visibility and sound and shall be free from cracks ,flaws spick bubbles and blemishes and shall not weigh less than 7.4 Kg./Sq.m. unless otherwise specified.

A- 11 **TIMBER DOORS, WINDOWS ETC. AND THEIR FITTINGS :**

i) Doors and windows works shall be carried out as per detailed drawings or as directed by the Engineer-in -Charge. Specified timber shall be used , and it shall be sawn in the direction of the grains and be straight and square.

ii) Fittings shall be of anodised iron, brass, aluminium or as specified. These shall be well made, reasonably smooth and free from sharp edges , flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. Iron fittings shall be finished bright or black enameled or copper oxidised. Brass fittings shall be finished bright, brass oxidised or chromium -plated (Electroplated) .All fittings shall be finished bright or anodised , or as specified . Fittings shall be got approved by the Engineer- in -Charge before fixing . In case of renewal works, the new fitting shall, as far as possible ,match with the existing ones. Screws shall be driven with screw driver and not hammered in.

A- 12 **PAINT ETC**.

All paints shall be Hi- gloss Synthetic Enamel and shall be delivered in strong containers and marked with the colour of the paint, brand, volume of paint content in litres and of the best quality of approved make and brand as approved by the Engineer- in - Charge. Under no circumstance shall the paint be diluted with linseed oil or otherwise. Any paint although or approved brand , which so hardens in the container that it cannot be readily broken up with a stirrer to a smooth uniform painting consistency , shall be rejected . Any paint too thick for proper brush application shall be rejected. No paint should be used after one year of the date of manufacture.

(B) EXECUTION

GENERAL :

All works shall be carried out in proper workmanlike manner. Items of works not covered by the following , shall carried out as per best practice according to the directions of the Engineer - in - Charge and to his satisfaction. Unless otherwise specified in this section or in the description of item , the cost of all stages of works mentioned hereunder shall be deemed to have been included in the rates of items provided in the Tender.

B- 1 (A) EXCAVATIONS OF FOUNDATION AND FILLING UP TRENCHES :

i) Foundation when excavated to the level shown in the drawing will be shown to the Engineer -in Charge and if on account of bad ground or for any reason whatsoever he decides to go deeper with the foundation , the Contractor shall excavate further to the depths required by the Engineer- in - Charge . In no case shall the foundation soling or concrete be laid prior to receiving orders to that effect from the Engineer- in -Charge or his authorised representative.

ii) Excavating shall include throwing the excavated earth at least one metre or half the depth of excavation , whichever is more , clear of the edge.

iii) The excavated areas around the foundation of structures are to be filled up properly to the required levels with earth obtained from excavation or other materials as directed , well rammed with water and consolidated in layers not exceeding 150 mm. at a time. The quantity for this item of work will be measured on the basis of quantity of excavation paid for less the volume occupied by the structure in foundation.

(B) SHORING

i) Shoring for loose earth and when the depth of excavation exceeds 3 metres poling boards (Vertical members) of 50 to 75 mm. in thickness and 175 to 225 mm in width preferably of sal- wood to be placed close together and to be driven about 300 mm. in ground below the bottom of the trench with intermediate sal-bullah pilling of dia not less than 100 mm. at the rate of 900 to 1000 mm. centre to be placed in between the vertical surface of trench and the poling

boards and double struts of sal- bullah of not less than 100 mm. in dia. between two wallings (horizontal member) of 250 mm in width and 75 mm thickness held horizontally between them.

ii) For medium clay and when the depth of excavation exceeds 2 metres but does not exceed 3 metres single struts will be provided and sal- bullah piling may not be placed. Other requirements are to be satisfied as (i) above.

B- 2 CEMENT CONCRETE WORKS (PLAIN OR REINFORCED) :

i) SHUTTERING AND STAGING :

Wherever necessary , shuttering and staging must be provided. Unless otherwise stated no payment will be made for such shuttering or staging and the cost thereof will be deemed to have been covered by the rate of relevant finished item of work. Where payment for shuttering has been specified , the rate shall be deemed to cover the cost of the necessary staging as well. Payment if any, for shuttering will be on the basis of surface area of shuttering in actual contact with concrete.

Shuttering may be of approved dressed timber true to line , not less than 25 mm. thick. Surface to be in contact with concrete are to be planed smooth except where otherwise stated. As an alternative, sufficiently rigid steel shuttering may be used . In every case , joints of the shuttering are to be such as to prevent the loss of liquid from concrete. In timber shuttering the joints must be perfectly covered with polythene sheets of approved quality. In case of steel shuttering also the joints are to be similarly lined.

All shuttering and framing must adequately be stayed and braced to the satisfaction of the Engineer- in- charge for properly supporting the concrete during the period of hardening. It shall be so constructed that it may be removed without shock or vibration to the concrete. The stays should be preferably with sal-bullahs of girth not less than 20 cm. and straight in length. If Bamboos are used as stays, girth less than 20cm. will not be allowed. These should invariably be straight in length. The bottoms of stays should be flat and should rest on a wider platform so as to minimise chance of settlement when concrete is vibrated.

Before the concrete is placed those faces of the formwork come in contact with the concrete shall be treated to prevent concrete adhesion to them and to reduce the risk of damage to the concrete when the formwork is struck.

Interior of all moulds and boxes must be thoroughly washed out with a hose pipe or otherwise so as to be perfectly clean and free from all extraneous matter prior to the deposition of concrete.

All form works shall be removed without shock or vibration. Before the form work is stripped, the concrete surface shall be exposed where necessary in order to ascertain that the concrete has hardened sufficiently .

In normal weather and with ordinary cement , vertical or side shuttering may be removed after three days and the bottom shuttering of horizontal member after fourteen days in case of slab and twenty one days in case of beams and twenty eight days for cantilevers etc. from the date of placing the last concrete in the structure . The above figures are minimum and may be extended if found necessary. Before stripping the shuttering of structural member the contractor shall take prior permission of the Engineer-in-Charge or his representative.

No plugs , bolts , ties , hold fasts or any other appliances whatsoever for the purpose of supporting the shuttering are to be fixed in the structure of placed in such a way that damage might result to the work in removing the same when the shuttering is struck.

ii) STRIPPING TIME :

Forms shall not be struck until the concrete has reached a strength at least twice the stress to which the concrete may be subjected at the time of removal of formwork. The strength referred to shall be that of concrete using the same cement and aggregates , with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work. Where possible , the formwork shall be left longer as it would assist the curing.

In normal circumstances and where ordinary Portland cement is used , forms may generally be removed after the expiry of the following periods :

a) Walls, columns and vertical faces of all structural members	24 to 48 hours as may be decided by the Engineer- in - Charge
b) Slabs (props left under)	3 days
c) Beam soffits (props left under)	7 days
d) Removal of props under slabs :	
(1) Spanning up to 4.5 m	7 days
(2) Spanning over 4.5 m	14 days
e) Removal of props under beams and arches:	
(1) Spanning up to 6 m	14 days
(2) Spanning over 6 m	21 days

The above period are minimum and may be extended for other type of cement used if necessary . Before Stripping the shuttering of structural members the contractor shall take previous permission of Engineer - in - Charge or his representative.

iii) SCAFFOLDING :

The scaffolding must be strong and rigid stiffened with necessary cross bracers and always decked and boarded on the sills with close boarded ceiling and swings to prevent any injury to persons. The contractor shall have to allow other traders to make reasonable use of his scaffolding as and when directed by the Engineer- in - Charge.

If for the interest of the work the contractors have to erect scaffolding in other's properties including local bodies or Corporation, the arrangement for the same including the cost of licensing fees etc. shall have to be borne by the contractor and the department should be kept free from any liability on this account.

iv) MIXING, PLACING AND COMPACTING :

The proportion specified is by volume in dry condition of the different constituent. Boxes of suitable size shall be used for measuring sand and aggregate. Boxes of suitable size shall be used for measuring cement weighting 50 kg. and this shall be taken as 0.035 cubic metre. While measuring the aggregate , shaking ,ramming or hammering shall not be done. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand, allowance for bulkage be made. Cement is also to be measured in boxes unless otherwise directed in writing by Engineer- in - Charge.

All structural concrete shall be mixed in mixer machine of appropriate capacity & shall have to be vibrated with suitable vibrator (needle or form vibrator). Mixing shall be continued until there is a uniform colour and consistency , but in no case shall the mixing be done for less than two minutes. Concrete mix obtained from mixer machine should be laid within 20 minutes from the time water is added to the dry mix. Beyond 20 minutes the mix should not be used in structural concrete. No hand mixing is permissible under any circumstances.

As the bulking of sand may vary from day to day and at different parts of the day on account of varying moisture content , frequent tests for bulking shall be carried out with the sand to be used and the amount of bulking allowed for in the field mix so as to keep the actual proportion constant throughout.

Only such quantities are as required for immediate use are to be mixed at any one time. Sufficient water is to be added to obtain proper workability so that the mixture may flow readily round the reinforcement and into every part of the moulds. The workability shall be measured by the amount of slump.

The quantity of water to be used for each mix of 50 kg. cement to give the required consistency shall not be more than 34 litres for 1 : 3 : 6 mix. 32 litres for 1 : 2 : 4 mix. 30 litres for 1: 1.5 :3 mix. and 27 litres for 1 : 1 : 2 mix. In the case of vibrated concrete , the limit specified may be suitable reduced to avoid segregation. Water cement ratio shall conform to IS : 456.

The total water content in each batch of concrete shall always be kept constant as the amount previously determined by trial mixes. The quantity of water to be actually added may , therefore , vary depending on the moisture content in the aggregates. In actual job if the quantities

of the ingredients remain constant the amount of slump may be taken as a good guide indicating the total water content in the mixture. The consistency and consequently the water content of the concrete shall, therefore , be kept constant and checked from time to time as work proceeds , by means of standard slump tests. The slump tests shall be carried out with concrete immediately after it has been mixed and before any initial set has commenced , the sample being taken perfectly at the point where the concrete is being delivered for placing in the moulds.

The Slump Cone shall be filled about one-fourth of its height with concrete which shall then be tamped , using 25 strokes of a 16 mm diameter rod , 60 cm long and bullet -pointed at the lower end. The filling shall be completed in successive layers similar to the first and top struck off so that the Slump Cone is exactly filled.

The Slump Cone then be removed by raising vertically immediately after filling. The mould concrete shall then be allowed to subside and the height of the specimen measured after coming to rest.

The consistency shall be recorded in terms of millimeters of the subsidence of the specimen during the test , which is known as Slump.

The following slumps shall be adopted for different works :-

SL. NO.	**TYPE OF WORK**	**SLUMPS**	
		When vibrators are used	**When vibrators are not used**
1.	Mass concrete in foundation footings and retaining walls and pavements	10 to 25 mm	50 to 75 mm
2.	Mass concrete in R.C.C foundation, footings and retaining walls.	10 to 25 mm	80 mm
3.	Beams ,slabs and columns simply reinforced	25 to 40 mm	100 to 125 mm
4.	The R.C.C section or section with congested steel	40 to 50 mm	125 to 150 mm

IS : 456 - 1978 allows use of nominal mix of concrete upto grade M 20 and may be allowed in works at the discretion of Engineer -in - Charge and will be guided by the provision of IS : 456-1978. For grade of concrete above M20 design mix has to be adopted. For determination of mix proportion for design mix concrete , the target strength should be higher than the specified characteristic strength to ensure that characteristic strength is attained at 28 days. Accordingly to the Explanatory Hand Book on IS : 456-1978 (S.P. 24 -1983) .

Target strength = characteristic strength + 1.65 x Standard deviation .

If controlled concrete is to be adopted , design mix is required. Otherwise proportion with cubic strength of concrete at 28 days shall be the guidance.

Standard deviation for different grades of concrete in absence of any test may be taken as per IS : 456- 1978 as follows :-

GRADE OF CONCRETE	**ASSUMED STANDARD DEVIATION (N/MM ^{2})**
M 10	2.3
M 15	3.5
M 20	4.6
M 25	5.3
M 30	6.0

Once the target strength of cube moulds with specific mix design is obtained in the laboratory , it may be inferred that corresponding characteristic strength of concrete , prepared with the materials used in the test mould (s) cured under identical condition as that of the test specimen , shall be obtained at site at 28 days.

Frequency Of Sampling :

Sampling Procedure - A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested ; that is, the sampling should be spread over the entire period of concreting and cover all mixing units.

Frequency - The minimum frequency of sampling concrete of each grade shall be in accordance with the following :-

QUANTITY OF CONCRETE IN THE WORK (M^3)	**NO. OF SAMPLES**
1 -5	1
6 - 15	2
16 - 30	3
31 - 50	4
51 and above	4 (Plus one additional sample for each additional 50 M^3 or part thereof.)

Test Specimen - Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the form work , or to determine the duration of curing , or to check the testing error. Additional cubes may also be required for testing cubes cured by

accelerated methods as described in IS : 9013 - 1978. The specimen shall be tested as described in IS : 516-1959.

Test Strength Of Sample - The test strength of the sample shall be the average of the strength of three specimens. The individual variation should not be more than ± 15 percent of the average.

Transporting ,Placing , Compacting - Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent the segregation or loss of the ingredients. It shall be deposited as nearly as practicable in the final position to avoid rehandling or flowing. Unless specially permitted by the Engineer - in- Charge , concrete shall not be dropped freely from a height of more than 1.5 metres.

Before placing the concrete , the moulds shall be cleaned of shavings, pieces of wood or other rubbish. The concrete shall be carefully placed against the moulds so that the faces of concrete shall be left perfectly smooth and free from honey- combing upon withdrawal of the moulds. Any defect in this respect must be dealt with by the contractor as directed by the Engineer-in -Charge without any extra charges therefore.

During placing and also immediately after deposition ,the concrete shall be thoroughly compacted by ramming ,spearing etc. until it has been made to penetrate and fill all the spaces between and around the steel rods, around embedded fixtures ,and into the corners of form work in such a manner as to ensure a solid mass entirely free from voids. If so directed by the Engineer - in - Charge , in addition to usual ramming ,spearing etc., sufficient number and suitable type of vibrators may have to be used on important jobs to enable working with a comparatively low water -cement ratio and ensure the maximum possible degree of compaction and homogeneity. Use of form vibrators for slabs, nozzled vibrators for beam and columns are permitted. It is imperative that the work should be done quickly as well as efficiently and adequate number of hands must therefore be employed to ensure this. Concrete shall be placed and compacted in its final position before setting is commenced and shall not subsequently be disturbed.

Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be predetermined by the Engineer- in -Charge or his representative. Any rest, pauses , such as for meal, shall also be subject to his approval.. All concreting work should be so programmed as not to necessitate work at night. If for any reasons this becomes imperative ,the contractor shall obtain previous permission of the Engineer- in -Charge or his representative and make proper lighting arrangements to his satisfaction.

v) PROTECTION AND CURING :

The Contractor shall adequately protect freshly laid concrete , for about 1 to 2 hours after its laying from too rapid drying due to sunshine , drying winds etc. and also from rains or surface water and shocks. About 24 hours after laying of concrete , the surface shall be cured by flooding with water of minimum 25 mm depth or by covering with wet absorbent materials. The curing shall be done for a minimum period of 10 days. Over the foundation concrete the masonry work

may be started after 48 hours of its laying , but the curing of cement concrete shall be continued along with the masonry work for a minimum period of 10 days.

In case of cement concrete used as sub- grade for flooring , the flooring may be commenced within 48 hours of the laying of sub-grade . In case it is not possible to do so due to exigencies of work, the sub-grade shall be roughened with a steel wire brush without disturbing the concrete , wetted and neat cement slurry at the rate of 1.75 kg of cement per square /metre applied to the base before laying floor . Full rate of IPS / mosaic flooring will be paid with the specific orders of the Engineer - in - Charge. The curing to be continued along with the top layer of flooring for a minimum period of 10 days.

vi) CONSTRUCTION JOINTS :

All joints in slabs and other horizontal members are to be formed by inserting vertical boards against which the concrete deposited can be properly rammed. The positions where such joints to be made will be indicated by the Engineer- in -charge or his representative.

In the case of horizontal joints any excess mortar or laitance shall be removed from the surface after the concrete is deposited and before it has set.

When the work has to be commenced on a surface which has hardened , such surface shall be well roughened and all laitance removed ; the surface shall then be swept clean., thoroughly wetted and covered with a thin layer of mortar composed of equal volumes of cement and sand. Such works shall be deemed to be covered by the rates for concrete.

vii) **MAJOR R.C.C WORKS :**

Where concrete is specified by strength the mix should not be leaner than 1 : 2 : 4 so as to give ultimate crushing strength not less than 20 N/mm^2 at 28 days cured under field condition. The mix. for the concrete is to be so adopted and the slump is to be so allowed as to give specified strength and proper workability at the existing site conditions. Contractor shall remain fully responsible for producing concrete of specified strength in the actual job and therefore cast at his own cost test specimens of 15 cm. cube as already specified during work and cure the same in similar way as for laid concrete for being tested for strength. Each set of test specimen shall be taken to cover the quality of concrete laid on the job during the period from the time of taking the previous set of specimens and the quantity will be estimated by the Engineer - in- Charge from records maintained by him.

a) When the job concrete is compacted by ordinary methods, the test specimen shall be moulded by placing the fresh concrete in the mould in three layers, each approximately one-third of the volume of the mould. In placing each scoopful of concrete , the scoop shall be moved around the top edge of the mould as the concrete slides from it in order to ensure a uniform distribution of concrete within the mould. Each layer shall be rodded , 25 times with a 16 mm. rod, 60 cm. in strength , bullet pointed at the lower end. The strokes shall be distributed in a uniform manner over the cross- section of the mould and shall penetrate into the underlying layer. The bottom layer shall be rodded, throughout its depth. After the top layer has been rodded , the

surface of the concrete shall be struck off with a trowel and covered with a glass plate at least 6.5 mm thick or machined metal plate. The whole process of moulding shall be carried out in such a manner as to preclude the alteration of the water-cement ratio of the concrete , by loss of water either by leakage from the bottom or overflow from the top of the mould.

b) When the job concrete is placed by vibration and consistency of the concrete is such that the test specimens cannot be properly moulded by hand rodding as described under (a) above , the specimens shall be vibrated to give a compaction corresponding to that of the job concrete. The fresh concrete shall be placed in the mould in two layer each approximately half the volume of the mould. In placing each scoopful of concrete , the scoop shall be moved around the top edge of the mould as the concrete slides from it , in order to ensure a symmetrical distribution of concrete within the mould. Either internal or external vibrator may be used. The vibration of each layer shall not be continued longer than is necessary to secure the required density. Internal vibrators shall be of appropriate size and shall penetrate only the layer to be compacted. In compacting the first layer , the vibrators shall not be allowed to rest on the bottom of the mould. In placing the concrete for the top layer , the mould shall be filled to the extent that there will be no mortar loss during vibration.

After vibrating the second layer, enough concrete shall be added to bring the level above the top of the mould. The surface of the concrete shall then be struck off with a trowel and covered with a glass or steel plate as specified under (a) above. The whole process of moulding shall be carried out in such a manner as to preclude the alteration of water-cement ratio of the concrete by loss of water either by leakage from the bottom or overflow from the top of the mould.

After curing , the specimen properly wrapped shall be made over to the Engineer- in -Charge or his representative who will arrange to have them tested at 28 days from the date of casting from either National Test House or other Authorised Test House. If there be any delay for any reason whatsoever the result of the test shall nevertheless be valid and will be applicable as per rules in each case for all test specimens whatsoever.

The Contractor shall be responsible for proper packing of the specimens at his own cost, for safe and convenient transport of the same from the site to the testing laboratory. The cost of testing the test moulds from the work site to the particular laboratory (both ways) and other incidental charges in this connection will have to be borne by the contractor.

In case of concrete showing , on the result or the cube tests, strength less than that specified in (a) and (b) of the Acceptance Criteria ,but has a strength greater than (c) & (d) of the said Acceptance Criteria concrete may , at the discretion of the Engineer- in -Charge be accepted as being structurally adequate without further testing.

If the concrete is deemed not to comply pursuant to (c) & (d) of the Acceptance Criteria , the structural adequacy of the parts affected may be investigated as per provision of clause 16.3 and /or clause 16.5 of IS : 456- 1978 i.e. , core test /or load test , as the case may be before rejection on the application of the Contractor with the undertaking to bear the cost of such tests.

If the strength of the concrete is such that it satisfies provisions made in sub- clause 16.5.3 of IS : 456- 1978 , concrete in that member represented by such tests shall be considered acceptable but the Engineer - in -Charge shall have the full power to fix the rate of deduction.

In case the test results do not satisfy the relevant requirement of the proceeding paragraph , the volume of concrete so deficient shall be deemed to be un-acceptable and shall be removed from the structure and replaced by fresh concrete of specified strength .The Contractor shall, in that case , have to carry out the instruction of the Engineer -in- Charge irrespective of the amount of loss, inconvenience and difficulties involved.

The Contractor shall remain liable to act /to carry out instructions under the provision of this clause , notwithstanding issuing by the Engineer- in - Charge of any certificates or the passing of any bills or accounts.

B-3 **1ST- CLASS BRICK WORKS :**

Cement mortar shall be prepared by mixing sand and cement in specified proportion. Sand shall be measured on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulkage

Brick work shall be laid in English bond. The brick shall be laid by Larrying method. A layer of mortar shall be spread on full width for suitable length of the lower courses. Each brick shall first be laid so as to project over the one below , both at the end and at the side , then pressed into the mortar and shoved into final position so as to embed the brick and to fill its inside face fully with mortar. cut bricks shall not be used except where necessary.

The walls shall be taken up truly plumb with plumb bob. The thickness of brick courses shall be kept uniform and for this purpose , wooden straight edge with graduations giving thickness of each brick course including joint shall be used. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate course shall come directly one over the other. A set of tools comprising wooden straight edge , masons sprit level, square , half metre rule , line and pins , string and plumb shall be kept for every 3 masons for frequent checking during progress of work. Faces of walls found not in plumb shall be dismantled.

Both the faces of walls of thickness greater than 25 cm (10”) shall be kept in proper plane. All the connected brickwork shall be carried up nearly at one level and no portion of the work shall left more than 1 m. below the rest of the work. Where this is not possible , the work shall be racked according to bond (and not left toothed) at an angle not steeper than 45^0

Brick shall be so laid that all joints are quite full of mortar. The thickness of joints shall not exceed 10 mm. Bricks shall be laid with frogs upward except in the top course where from shall be placed downward. The face joints shall be racked to a minimum depth of 15 mm by racking tools daily during the progress of work when the mortar is still green , so as to provide proper key for plaster or pointing to be done. Where plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying

The face of brick work shall be cleaned the very day that brick work is laid and all mortar droppings removed

Green work shall be kept wet for a period of at least 7 days. The top of masonry work shall be left flooded at the close of the day Scaffolding shall be sound and strong and holes left in masonry work for supporting the scaffolding shall be filled and made good before plastering.

B-4 **DAMP PROOF COURSE :**

This shall be laid to specified thickness over walls for the full thickness of the super - structure walls. The surface shall be levelled and prepared before laying the cement concrete. Edge of damp proof course shall be straight , even and vertical. Side shuttering shall consist of wooden form and shall be strong and properly fixed so that it does not get disturbed during compaction and the mortar does not leak through. The concrete mix shall be of workable consistency and shall be tamped thoroughly to make a dense mass. When the sides are removed , the surface should come out smooth without any honey- combing. The damp proof course shall be laid continuous and the surface shall be double chequered. Damp proof course shall be cured for at least seven days , after which it shall be allowed to dry . Water proofing materials of approved quality shall be added to the concrete mixture in accordance with the manufacturer's specification. No extra payment will be made for such admixture of water proofing compound.

B- 5 **CEMENT PLASTER :**

The proportion of mortar of exterior or interior plaster shall be as specified in the items of work.

The plaster shall be of thickness as specified and the surface shall be similarly cured as for cement concrete. The moulding shall be carried out as shown in the drawing and shall be separately measured in overall length unless otherwise specified in the items. Interior corners and edges of openings if so directed by the Engineer - in- Charge shall be rounded of or chamfered with the same mortar for which no extra payment will be allowed. All cement concrete surface should be chipped off properly before taking up the plastering work.

(i) **Barium Plaster** shall be done by mixture of one part of cement , two parts of fine barium sulfate and two parts of coarse barium sulphate thoroughly mixed with requisite amount of water. Cement used shall be fresh Portland cement of approved brand and sand shall be medium clean and free from organic matter and clay or any other deleterious materials. Water to be used shall be clean potable water. The mixture shall be well stirred during the use to maintain an even consistency.

The mixture as mentioned above shall be applied over a layer of cement sand (1:4) backing of thickness of 20 mm. admixtured with approved water proofing compound as per manufacturers specification. The application of the mixture shall be done uniformly to maintain a thickness of about 1.5 mm. and to be rubbed thoroughly with wooden trowel. Finishing shall be done with steel

trowel to give a smooth surface. The surface should be kept wet by sprinkling water for at least one week.

B - 6 **WHITE WASHING , COLOUR WASHING :**

Preparation of surface : All surface for white washing , colour washing , painting , shall thoroughly cleaned free from mortar droppings and foreign matter and prepared to the satisfaction of Engineer - in - Charge , before application of the treatment.

Before white washing , all the nails etc. have to be removed from the walls and all nails or other holes ,small depressions or damages in plaster or wall surface shall be filled or repaired to original condition with lime consisting 2 parts of shell lime and 1 part of stone lime.

Treatment of oily surface to be done with soda & sajimati cleaned with fresh water.

Preparation of White wash : The white washing is to be done with 5 parts of stone lime and one part of shell lime with necessary gum (2 kg. per cu. m. of lime) using indigo as necessary and to be mixed as per standard practice.

Preparation of Colour wash : Colour washing shall have primer of white wash and shall be of shade as approved by the Engineer- in - Charge. Sufficient quantity of colour wash enough for complete job shall prepared in one operation to avoid any difference in shade. Procedure and preparation of surface shall be same as in white washing.

Application of white wash and colour wash : The operation for each coat shall consist of four consecutive strokes of the brush , one horizontally from right to left and next from left to right and the third stroke bottom upward and the fourth from top downward before the previous stroke dries. Each coat shall be allowed to dry before the next coat applied. No portion of the surface shall be left out initially to be patched up later on. The brush shall be dipped in white wash or colour wash , pressed lightly against the wall of the container and then applied by lightly pressing against the surface with the full swing of hand.

The white wash on ceiling should be done prior to that on walls.

Protective Measures : Surface of doors ,windows , floors, articles of furniture , beams etc. and such other parts of the building not to be white or colour washed shall be protected from being splashed upon. Such surface shall be cleaned of white or colour wash splashed, if any. Dados are to be cleared as also the windowsills.

Plaster of Paris : The material (gypsum) shall be in the form of a fine white powder of smooth texture , free from foreign matter and lumps conforming to IS : 2547

The Plastered surface over which plaster of Paris to be applied shall be thoroughly cleaned and kept wet with water for at least 24 hrs. before application. The powder should be stirred with requisite quantity of water to form a paste and the paste shall be applied uniformly to maintain a

thickness of about 1.5 mm. and the surface shall be rubbed thoroughly with wooden trowel. Finishing should be done with steel trowel to give a shining appearence.

B -7 DRY DISTEMPERING:

Dry distemper of approved brand and manufacture shall be used. The shade shall be got approved from the Engineer - in - Charge before application of the distemper. The dry distemper shall be stirred slowly in clean water using 6 decilitres (0 - 6 litre) of water per kg. of distemper or as specified by the manufacture. Warm water shall preferably be used. It shall be allowed to stand for at least 3 minutes (or if practicable over night) before use. The mixture shall be well stirred before and during use to maintain an even consistency. Distemper shall not be mixed in larger quantity than is actually required for one day's work.

Before new work is distempered , the surface shall be thoroughly cleared free from mortar dropping and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry for at least two months before applying distemper. In case of old work, all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease ,dirt etc. Pitting in plaster shall be made good with plaster of Paris mixed with dry distemper of the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patch. The surface shall be allowed to dry thoroughly before the regular coat of distemper is applied. The priming coat of whiting shall be applied and no white washing coat shall be used as a priming coat for distemper.

Whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form a thin slurry which shall be screened through a clean cloth. Areldite or equivalent adhesive to be added as per manufacturers specification and the mix then be diluted with water to the consistency of milk so as to make a wash ready for use.

The treated surface shall be allowed to dry before distemper coat is given. In the case of new work, the treatment shall consist of a priming coat of whiting followed by the application of two or more coats of distemper till the surface shows an even colour. For old work the surface is to be prepared as described above and one or more coats of distemper shall be applied till the surface attains an even colour. The application of each coat shall be as follows :-

The entire surface shall be coated with the mixture uniformly , with proper distemper brushes (ordinary white-wash brushes shall not be allowed) in horizontal strokes followed immediately by vertical ones which together shall constitute one coat. The subsequent coats shall be applied only after the previous coat has dried. The finished surface shall be even and uniform and shall show no brush marks. Enough distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room , which cannot be completed the same day. After each day's work , the brushes shall be washed in hot water and hung down to dry. Old brushes which are dirty or hardened with distemper shall not be used.

B - 8 **PAINTING :**

All surface for painting shall be properly sand papered and cleaned and where necessary good quality ready- mixed putty shall be used to hide all holes, cracks, open joints etc. The rate for painting includes such work. Paint shall be applied with approved brushes and surfaces shall be sand papered after drying of every coat. All work when completed shall present a smooth , clean solid and uniform surface , to the satisfaction of the Engineer- in -Charge.

a) **Primer :** All surface for painting , if they are new , should have a coat of priming before application of the paint. Old surface where existing paints have been completely worn out and raw wooden surface is exposed owing to long use should also receive a coat of priming before application of fresh painting. The primer should be of approved quality of ready mix primer.

i) **Wood Primer :** Wood primer of approved brand and manufacture is to be applied on the wooden surface which would be free from moisture and loose particles.

ii) **Steel Primer :** For steel surface red oxide primer , zinc chromate primer of approved brand and manufacture and as per direction of the Engineer - in -Charge is to be applied on the surface. The surface should be made free of grease , rust , moisture and loose particles. All blistered surface should be made free by hammering , filling or otherwise so as to have smooth surface before priming.

iii) **Cement Primer Coat (Alkali Resisting Primer) :** Cement primer coat is to be used as base coat on wall finish of cement, lime or lime cement plaster or on asbestos cement surface before application of any wall coating e.g. oil bound distemper ,oil based paints, synthetic enamel, plastic emulsion etc. on them. The cement primer is composed of a medium and pigment which are resistant to the alkalis present in the cement , lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of oil bound distemper or paints. Priming coat shall be preferably applied by brushing and not by spraying. Hurried priming shall be avoided particularly on absorbent surface. New plaster patches in old work before applying oil bound distemper paints etc. should also be treated with cement primer. The surface shall be thoroughly cleaned of dust ,all white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty ,made of plaster of Paris with water on the entire surface including filling up the undulation and then sand papering the same after it is dry. The cement primer shall be applied with a brush on the clean dry and smooth surface. Horizontal stroke shall be given first. Vertical strokes are to be applied after horizontal stroke is absorbed on wall/ ceiling surface immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush mark. It shall be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

b) **Aluminium Paint :** Aluminium paint of approved brand and manufacture shall be used. The paint comes in compact dual containers with the paste and the medium separately. The two shall be mixed together to proper consistency before use. Each coat shall be allowed to dry for 24 hours and lightly rubbed down with fine grade sand paper and dusted before the next coat is

applied. The finished surface shall present an even and uniform appearance. As aluminium paint is likely to settle in the container , care shall be taken to frequently stir the paint during use.

c) **Plastic (Acrylic) Emulsion Paint :** Plastic (acrylic) emulsion paints are not suitable for application on external surface and surface which are liable to have condensation and are to be used generally on internal surface. For plastered surface a cement priming coat is required before application of plastic emulsion Plastic emulsion paint of approved brand and manufacture and of the required shade shall be used. The paint will be applied in the usual manner with brush or roller. The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hardened the next coat can be applied. The time for drying varies from one hour on absorbent surface to 2 to 3 hours on non- absorbent surfaces. Thinning will be particularly required for the undercoat which is applied on the absorbent surface. The quantity of thinner to be added shall be as per manufacturer's instructions. The surface on finishing shall present a flat ,velvety , smooth finish.

If necessary more coats will be applied till the surface present a uniform appearance.

Precaution :

i) Brushes should be quickly washed in water , immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.

ii) In the preparation of walls for plastic emulsion painting , an oil base putty shall be used in filling cracks , holes etc.

iii) Splashes in floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

iv) Washing of surface treated with emulsion paints shall not be done within 3 to4 weeks of application or the time specified by manufacturer.

OIL EMULSION (OIL BOUND DISTEMPERING)

Materials :

Oil emulsion (Oil Bound) distemper (IS- 428-1969) of approved brand and manufacture shall be used. The primer where used as on new work shall be cement primer or distemper primer as described in the item. These shall be of the same manufacturer as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for days work shall be prepared.

The distemper and primer shall be brought by the contractor in sealed tins in sufficient quantities at a time to suffice for a fortnight's work ,and the same shall be kept in the joint custody of the Contractor and the Engineer. The empty tins shall not be removed from the site of work , till this item of work has been completed and passed by the Engineer.

Preparation of the Surface :

For new work the surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty , made of plaster of Paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry.

In the case of old work ,all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease , dirt etc. pitting in plaster shall be made good with plaster of Paris mixed with the colour to be used . The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

Application :

Priming Coat - The priming coat shall be with distemper primer or cement primer , as required in the description of the item.

If the wall surface plaster has not dried completely cement primer shall be applied before distempering the walls. But if the distempering is done after the wall surface is dried completely, distemper primer shall be applied

Oil bound distemper is not recommended to be applied , within six months of the completion of wall plaster.

Distemper Coat -

For new work ,after the primer coat has dried for at least 48 hours , the surface shall be lightly sand papered to make it smooth for receiving the distemper , taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. One coat of distemper properly diluted with thinner (water or other liquid as stipulated by the manufacturer) shall be applied with brushes in horizontal strokes followed immediately by vertical ones which together constitute one coat.

The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied over the primer coat to obtain an even shade.

A time interval of at least 24 hours shall be allowed between consecutive coats to permit the proper drying of the preceding coat. For old work the distemper shall be applied over the prepared surface in the same manner as in new work. One or more coats of distemper as are found necessary shall be applied to obtain an even and uniform shade.

15 cm. double bristled distemper brushes shall be used . After each day's work brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

Touch Wood Finish -

Touch wood polyurethane clear wood finish to be applied whenever specified in the Bill of quantities as per the following direction of use :-

Touch Wood Clear Matt : is to be applied on filled wood surface , (Apcolite wood filler) which have been smooth sanded along the grains with emery paper No. 320. Staining with Apcolite wood stainer is also to be done. It is to be ensured that surface coated is free from all loose dust. TOUCHWOOD Clear Mat is a single pack system . The contents should be well stirred and strained through a clean muslin cloth prior to use. Two coat of touch wood to be applied by brush with thinner 101. The first coat of TOUCHWOOD Clear Mat should be allowed to dry for 6 - 8 hour prior to sanding and recoating. Container s should be well capped after use.

Flat Wall Painting : The painting coat shall consist of "Distempering Primer or Cement Primer" . The flat wall paint shall be of approved brand and manufacture and of required shade. The surface shall be prepared as described in sub-head " Cement Primer Coat" . Flat wall paint shall normally be applied on walls 12 months after their completion (in case of new work) , in which case Distemper Primer will be sufficient . If the walls are to be painted earlier the primer coat shall consist of cement Primer.

When the surface is dry , painting with the wall in uniform and even layers will be done to the required number of coats. Each coat shall be allowed to dry overnight and lightly rubbed with very fine grade of sand paper and loose particles brushed off before the next coat is applied. If after the final coat of wall paints the surface obtained is not upto the mark, further one or more coat as required shall be given to obtain a smooth and even finish at the cost of Contractor . If primer or wall paint gets thickened it shall be thinned suitably with the thinner as recommended by manufacturer.

B - 9 TERRAZZO FLOORING (CAST IN SITU) I.S. 2114 -1962

(a) i) The aggregates used in terrazzo topping shall be marble aggregates of required colour. Marble powder used in terrazzo topping shall pass through I.S. Sieve 30.

ii) Aggregates for terrazzo under layer as well as the base concrete shall conform to the requirements of ordinary cement concrete.

b) Cement used for floor finish work shall ordinary cement or white cement of approved quality as specified in the bill of quantity.

c) Pigments incorporated in terrazzo shall be of approved make and brand and of permanent colour.

d) The dividing strips may be of aluminium or glass or similar materials as specified in the bill of Quantities. The thickness of strip shall not be less than 1.5 mm and width not less than 20 mm.

(e) i) The base concrete shall be lean cement concrete of mix 1 : 3 : 6 or lime concrete of mix 18 : 36 : 100 and thickness shall be not less than 100 mm.

ii) The cushioning layer shall preferably be lime concrete of mix 18 : 36 : 100 and thickness shall be not less than 75 mm..

iii) The under layer shall be of cement concrete of 1 : 2 : 4 size of coarse aggregates not exceeding 10 mm. The thickness of terrazzo topping shall be not less than the following , depending upon the grades and size of chips used.

Grade No.	Size of Chips	Minimum thickness of topping
00	1 to 2 mm	6 mm
0	2 to 4 mm	
1	4 to 7 mm	9 mm
2	7 to 10 mm	12 mm

f) The mix for terrazzo shall consist of cement with or without pigments, marble powder , marble aggregates and water. The proportions of cement and marble powder shall be 3 parts of cement and one part of powder by WEIGHT. For every part of cement marble of powder mix, the proportion of aggregates by VOLUME shall be as follows depending upon the size and grade of marble aggregates :-

For grades 00.0 and 1	Proportion of aggregates to under mix
For grades 00.0 and 1	1. 1/4 Parts
2	1.1/3 Parts

g) The proportions of cement shall be inclusive of any pigments added to cement. The proportions in which pigments are mixed with ordinary cement or white cement to obtain different colour to the binder, shall be as specified in the following Table :

Colour	Pigment to be used	Proportion of pigment Portland Cement	Proportion ordinary cement	Proportion of white cement
Red	Red Oxide of iron	1	15 to 20	Nil
Black	Carbons black	1	25 to 40	Nil
Pink	Red Oxide	1	Nil	100 to 400
Cream	Yellow Oxide of iron	1	Nil	100 to 400
Yellow	lead chromed	1	Nil	25 to 75
Light Green	Green Chromium oxide	1	Nil	50 to 150
French Grey	----------	Nil	1 to 2	1

(h) i) Terrazzo topping shall be laid while the under after layer is still soft but is hardened sufficiently , normally between 18 and 24 hours. After the laying of the under layer , terrazzo topping may be laid. A cement slurry , preferably of the same colour as the topping shall be brushed on the surface immediately before laying is commenced.

The terrazzo topping shall be compacted thoroughly by tamping or rolling and trowelled smooth. Excessive trowelling or rolling in early stages shall be avoided. The compaction shall ensure that air is cleared from the mix.

ii) The surface shall be left dry for a duration of 12 to 18 hours and then be cured by allowing water to stand in pools over it for a period of not less than 7 days.

iii) Grinding and polishing may be done either by hand or by machine. The first and second grinding shall be done with carborundum stone of grit size 60 and 80 respectively. After each grinding , the surface shall be washed clean and grouted with neat cement grout of the same colour (without marble powder) of cream like consistency and then shall be allowed to dry for 24 hours and wet cured for 4 days. The third grinding shall be done with carborundum stone of grit 120 to 150 and the surface shall then be washed clean and allowed to dry for 24 hours and wet cured for 4 days. The fourth grinding shall be done with carborundum stone of grit size 320 to 400 and the surface shall then be washed clean and rubbed hard with felt and slightly moistened oxalic acid powder (5 grams of Oxalic acid powder per sq.m of floor area shall be adequate) and finally the surface shall be washed clean with dilute oxalic acid solution and dried.

B - 10 **ARTIFICIAL STONE FLOORINGS :**

All cement concrete surface should be chipped off properly before taking up flooring work. The artificial stone flooring shall be laid in panels of shape and size as directed. The casting of the panels will be so programmed as to prevent bonding on the freshly laid panel with adjacent panels.

Unless otherwise specified , the underlay shall be with graded stone chips 12 mm down the thickness of topping shall be of 10 mm. thick and colouring pigment as may be required shall only be added with the topping. The topping and the underlay shall not be laid in one operation . After laying the ‘ Underlay’ the surface shall be left out to dry. The topping shall be laid only after the Underlay has sufficiently dried and after thoroughly brushing with hand wire brush and sweeping clean and after application of slurry. The topping shall be finished with an English trowel and a piece of clean dry linen. During all the stages, the required level shall be carefully observed and maintained. Suitable grading , where required shall be provided in the flooring for water drainage as directed by the Engineer- in - Charge.

The corner between floor and wall shall be round off if directed by the Engineer- in - Charge for which no separate payment shall be made.

(2) **Ironite flooring :**

Ironite flooring shall be done with the mixture of 6 mm. nominal stone chips, cement and Ironite powder (or equivalent metallic floor hardening compound). Four parts of cement to be mixed with one part of Ironite powder with requisite amount of water to form a paste . One part of the paste shall be mixed with two parts of 6 mm. nominal size stone chips with requisite amount of water to get workability and the mixture to be laid over a backing of 40 mm. thick cement concrete (4 : 2 : 1) (4 parts of graded stone aggregate 20 mm. nominal size : 2 parts of coarse sand : 1 part of cement) . The mixture shall be laid uniformly to maintain a thickness of 12 mm. and the surface should be finished smooth with steel trowel. Immediately after the flooring surface is finished it shall be protected from rapid drying by erecting barriers against wind, or strong sunlight.

As soon as the surface is hardened curing shall be started and continued for at least ten days by means of wet gunny bags or stagnating or by standing water with mud bunds.

TERRAZZO (MOSAIC) TILES :

Materials :

a) Marble mosaic tiles (Terrazzo tiles) shall be of the colour and pattern approved by the Engineer and the size shall be 25 cms. x 25 cms. They shall conform to IS : 1237 in respect of constituent materials , manufacture , shape , dimensions , tolerances , wearing layers, colour and appearance , general quality, strength resistance to wear , water absorption etc. Prior to use , the samples of tiles shall be approved by the Engineer who shall keep them in his office for reference. Tiles shall be properly cured by immersion in water before incorporation.

Tiles shall conform to the detailed specification , and shall be of colour and pattern as approved by the Engineer , who shall keep samples in his office for reference.

Mortar for bedding the tiles shall be in the proportion of one part of cement to four parts of sand. The mortar shall be thoroughly mixed either manually or mechanically. The water added shall be the minimum required to give sufficient plasticity in laying and compacting. Care shall be taken in the preparation of the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the tiles.

CONSTRUCTION DETAILS :

a) A bed of cement mortar consisting of one part of cement to four parts sand shall be laid and properly levelled to an average thickness of 20 mm. , the surface being kept slightly rough to provide a key for the tiles.

b) Neat cement paste of honey like consistency shall be spread over the mortar bed over such an area as would be covered by about twenty tiles.

c) Tiles should be soaked in water for 15 minutes and allowed to dry for an equal amount of time before being laid.

d) The tiles shall then be coated with a thin coat of cement paste on the back and fixed in place and gently tapped with a wooden mallet till it is properly bedded and level with the adjoining tiles. The joints between tiles shall be fine and nearly imperceptible (1.1/2 mm maximum.).

e) After tiles have been laid in a room or a days work completed , surplus cement paste that has come out of the joints should be wiped clean. A thick slurry of coloured cement , matching the colour of the tiles is then spread over the laid tiles and rubbed so as to seal even the thinnest joint between the tiles.

f) The floor shall be cured for 14 days.

g) The floor shall be polished and finished in accordance with IS : 1433.

Skirting :

Skirting shall be 25 cms. high unless otherwise specified and shall perfectly match with the adjacent flooring. Mortar used shall be 1 :4 cement mortar and polishing shall be done by hand to a smooth and plane surface . Skirting tiles shall be as per 1 A, 2 A, and 3 A 1B , 2 b, and 3 B shown in IS : 1237.

POLISHED STONE TILE WORKS :

This item relates to the requirements of furnishing materials and installation of Polished Stone Tile work. The types of work that are mainly intended under this head are Marble , Kota, stone Dholpur stone , Agra red stone , Tandur, Shahabad or Cuddappah stone slabs in flooring and wall facing.

Reference to Standard specifications :

IS : 1805 - Glossary of terms relating to stone , quarrying and dressing.

IS : 1129 - Dressing of Natural Building Stones.

IS : 1143 - Laying and finishing of natural Building stones.

IS : 1128 - Line stone (Slabs and tiles)

IS : 1130 - Marble (Blocks , slabs and tiles)

IS : 3622 - Sand stone (Slabs and tiles)

Materials :

Stone shall be of the best quality available in the locality and of specified colour. The stones shall stand weathering and when immersed in water for 24 hours shall not absorb more than

5% of its dry weight, when tested according to IS : 1124. All stones shall generally be freshly quarried and shall not have any streaks or flaws and shall be free from discolourations , oil or any unwanted matter that may prevent adhesion of mortar or be otherwise harmful to the work. Particular attention shall be paid to uniformity of colour and matching patterns and grains. The thickness shall be as specified in the detailed specifications.

Laying and Polishing :

The tiles shall be machine cut to specified sizes and shall be of approved colour and quality. They shall be of specified thickness and laid to patterns as directed. The floor surface to be tiled shall be thoroughly brushed and scrubbed and profusely watered and cleaned. Mortar for bedding shall be as specified and shall be no less than 3/4" (20 mm) thick.

Immediately each stones is laid it shall be tapped with a wooden mallet and set joints shall be not more than 1 mm thick. The floor shall be perfectly even with no depressions or mounds as per levels indicated and joints shall be in line. Joints shall be grouted with cement mortar of matching colour with the tiles. The tiled surface shall be kept wet and allowed to set for 14 days No movement of personnel be allowed over newly set tiles for at least 3 days.

After the work has set , the surface shall be machine polished to be satisfaction of the Engineer-in-Charge. The final polish shall be with Oxalic Acid.

GLAZED TILES :

General :

This item relates to the furnishing of materials and installations of glazed tiles in flooring ,dado, and also in counters , shelves, sinks etc. Tiles shall conform to IS : 777 and workmanship shall be per IS : 1443.

Materials :

The tiles shall be of first quality of ' SPARTEX'/ ' REGENCY ' or other approved manufacturers. The size of tiles shall be as specified as directed in the drawing and shall be at least 6 mm thick. No chipped ,cracked, crazed or warped tiles shall be used. Glazed rounded corners and cups (convex or concave) shall be provided at corner of walls , edge, junctions of floor and dado etc., if so specified. The mortar shall be in the proportion 1 : 3. Preparation of mortar shall be as specified for Terrazzo tiles.

Laying :

The fixing shall generally conform to IS : 1443.

Workmanship :

The surface to be covered shall be plastered rough to a thickness of 20 mm. Fix 12 mm size stone chips (5 no. one in each corner and one in the middle of each tile with Adhesive viz., Areldite of equivalent for keying action) and the tiles shall be soaked in water for at least 2 (two) hours prior to fixing at site. A thin layer of cement paste shall be buttered on the back of the tile and on the side after which the tile shall be pressed and tapped home taking care that the corner tiles are perfectly matching. After the backing coat has set the tile joints shall be grouted with neat, white cement slurry with necessary pigment. All surplus slurry that remains on the surface shall be carefully wiped off before it sets. Care shall be taken to ensure that the finished surface is absolutely plumb and to proper levels without any profusions , waviness or zig- zag. Joints between tiles shall be uniform in straight level lines. After completion of the entire work or part of it , the surface shall be cleared of all stains , cement etc., by washing with oxalic acid (1:10) or any other approved compound.

(1) CARPENTARY WORK :

Door , Window, Frames and Shutters :- All doors , window frames must have plaster rabbit 12mm x 12mm. Rabbit for receiving shutter 12 mm deep. Wood work shall not be painted , oiled or otherwise treated before it has been approved by the Engineer - in - Charge. All portion of timber abutting against or embedded in masonry or concrete shall be painted with boiling coal tar or creosote, before being placed in position. In case of door frames without sills, the vertical members shall be buried in floor 40 mm deep . When sills are provided these sills shall be sunk in

the floor to 40 mm depth and shall rest on damp- proof course. Sills shall be provided , where so directed . The door frames without sills while being placed in position , shall be provided with temporary wooden bracing or dry bricks well wedged between the styles at the sill level . These shall be retained to keep the frames from warping during construction. The frame shall also be protected from damage during construction.

EXTERNAL DOORS :

All external doors should be Factory -made Panel doors made of kiln seasoned and chemically treated commercial hardwood (hollock timber of Assam or approved variety timber) to all styles and rails accurately plained , and rounding shaped to the size rebates , and rounding as per dimensions shown in drawings , jointing or plugging to knots of any kind shall not be permitted. All panels are of 12 mm thick waterproof pressure treated plywood (conforming to I.S. 4990-1969) of full width of panel . Panels other than one parts are not permissible.

Door , Window Clamps or Holdfasts :

a) unless otherwise specified the clamps shall be fixed to outer side of the frame with screws. For the purpose of receiving clamps a recess of at least 12 mm deep of suitable size shall be cut into the frame. After fixing the frame true to plumb with the clamps, the exposed face of the clamps shall be covered by a thin wooden covering fixed with screws.

b) the side of the door ,window frames which remains in contact with masonry shall invariably be painted with coal tar or creosote oil.

Schedule of Fittings :

i) Fittings shall be of iron , aluminium or as specified .

These shall be well made , reasonably smooth and free from edges , corners, flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. All hinge pins shall be of steel and their riveted heads shall be well formed.

Iron fittings shall be finished bright or black enamelled or copper oxidised. Brass fittings shall be finished Bright ,Brass-oxidised or Chromium - plated (electroplated) and all aluminium fitting shall be of extruded section and surface screwed should be used. Fittings shall be got approved by the Engineer- in - Charge before fixing .

ii) Screws used for fittings shall be of the same metal and finish as the fittings. However , anodised brass screws or chromium brass screws shall be used for fixing aluminium fittings.

iii) Fittings shall be fixed in proper position as shown in the drawings or as directed by the Engineer- in - Charge. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with screw driver and not hammered in. Recesses shall be cut to the exact size and depth for the counter -sinking of hinge.

(2) **FALSE CEILING :**

These specifications refer to the supply and installation of False ceiling.

Materials :

a) **Suspension System :**

The main load bearing member shall be a rectangular pressed metal formed section of size 2" x 1.5 " fabricated from 22 gauge G.I. sheet. The cross runners or furring channel shall be in the form of a trough 2" x 3/8 " fabricated from 24 gauge G.I sheet. Wall angles shall be 1" x 1". The main runners or load bearing members shall be suspended from the R.C. Roof by means of a metallic expansion fastener. The hanger rods with threaded ends and 2 heavy M.S. Checknuts shall hold the main runners with level adjusting holding clamp of size 3" x 1". The main runners shall be fixed at 3 feet centre to centre and the cross runner shall be fixed to the underside of the main runners at a distance not greater than 1'-6 " and at right angles to the main by means of Galvanised Clips diagonally , made of 10/12 SWG G.I. Wire.

b) **Ceiling Tiles :**

The ceiling tiles shall be 12 mm teakwood particle board plain tiles bonded with phenol formaldehyde synthetic resin or as specified. They shall be of approved quality and manufacture .

Workmanship :

After the runners are fixed at the required height they shall be checked for straightness. They shall be made perfectly level by means of the threaded hangers. Before fixing the tiles, the upper surface and edges of the tiles shall be treated with double coat of double boiled linseed oil or water- resistant varnish. They shall then be screwed on to the underside of the cross runners. Care must be taken that the tiles present an absolutely flat and level surface and that all joints are perfectly straight. All joints shall be sealed with filler of approved quality.

(3) **A.C.SHEETING :**

This item of specification relates to the furnishing of materials and installation of asbestos cement sheets for roof, cladding and ceilings including specials and accessories.

Reference to Standard specifications.

The provisions of the following Indian standard specifications shall form a part of this specification in so far as applicable or referred to specifically , hereinafter.

IS : 459 - Specifications for un-reinforced corrugated asbestos cement sheets.

IS : 730 - Specification for fixing accessories for corrugated sheet roofing.

IS : 1120 - Specifications for steel square or hexagonal head coach screw with gimlet points.

IS : 2098 - Specification for asbestos cement building boards.

IS : 3007 - Code of practice for laying of asbestos cement sheets Part -I corrugated sheets.

IS : 3007 - -do- Part II semi- corrugated sheets.

Materials :

a) **Corrugated or Semi - Corrugated Asbestos Sheets :**

The asbestos cement sheets (corrugated or semi - corrugated) shall conform to the requirements of IS : 459. The sheets shall be free from cracks , deformities and other defects and damage when laid in place. All defective and damage sheets shall be removed and replaced.

b) **Plain Asbestos Sheets :**

Plain asbestos sheets shall conform to the requirements of IS : 2098 and other requirements regarding defects and damages in (a) above.

c) **Fixing Accessories :**

Fixing accessories such as J- Bolts , roof washers etc., shall conform to the requirements of IS : 730. They shall be at least 8 mm in diameter.

Storage , Handling and Safety Precaution :

Provisions of clause No. 6 & 7 IS : (Part -I) or IS : 3007 (Part -II) shall apply with regard to storage , handling and safety precautions. All damages caused due to inadequate care in transport , handling , storage etc., shall be borne by the Contractor.

Laying and Fixing of sheets :

In laying and fixing of sheets , all applicable requirements of IS : 3007 (Part - I) for corrugated sheets and IS : 3007 (Part -II) for semi- corrugated sheets shall be followed.

Specials and Accessories :

Various specials like north - light curves valley gutters, corner pieces, aprons etc., shall be furnished and installed .

Finished Surface :

Finished Surface shall be smooth and leakproof. Slope or fall shall be 1 to 50 unless otherwise specified and shall be sloped from ridges to outlets. The junction of roof and parapet wall shall be neatly rounded off. Average thickness shall be as specified.

(4) **BITUMEN MASTIC FOR WATER PROOFING OF ROOF :**

It should be carried out as per IS : 4365

(5) **RAIN WATER PIPES**:

Materials :

P.V.C Pipes :

P.V.C pipes shall conform to the relevant specifications of IS : 4985. (Pipes shall be Wavin make or equivalent) . They shall be made of unplasticised polyvinyl chloride and shall be with good surface finish , mechanical strength and opacity. During manufacture , only those additives may be added which are required to produce the above characteristic. No additives shall be added separately or together in quantities sufficient to constitute toxic hazard, or impair the fabrication or welding properties of the pipe , or impair its chemical or physical properties. Addition of the manufacturers own re-work material is permissible only upto10 %. Pipes shall be spigot and socket type. Pipes shall have pressure rating (Class 3). Tolerance shall be as per IS : 4985.

ii) **Jointing P.V.C. Pipes :**

The pipe shall be cut to the length required with a hacksaw. Pipe shall be cut square. The socket and spigot shall be clean and dry and burrs removed , both inside and outside , with a file. The surface of the lengths to be in contact shall be roughened with emery paper, and dry fit checked. A thick coat of solvent cement shall be applied to the outer surface to the spigot and on the inside surface of the socket by means of a brush.

Solvent cement shall be of approved make and manufacture. The pipe shall then be inserted into the socket and turned for 90^0 to ensure even distribution of cement. Excess solvent cement shall be wiped off.

(6) **STEEL WORK :**

Mild Steel Grills :

These should be made of the best quality material and shall be of the shape , size and pattern ordered. They shall be free from dust , burrs, blisters and cracks . Welding shall be neatly done and all slag chipped off, before primer coat is applied . Spot welding only will not be accepted.

Grills shall be true to shape and accurate in dimensions so that they fit exactly into the door/window frame. They shall be fitted into the frame by means of 10 mm square steel lugs welded to the grill. If screws are used , the screw heads shall be welded to the grill and welding is ground off neatly.

Rate shall include cost of materials, cutting , fabricating , transport to site, fixing etc. , complete with one coat of shop paint. Rate shall be in sq.m. or kg. as specified.

STEEL WINDOW / VENTILATORS:

General :

a) All steel casement windows and ventilators shall be of approved make and quality and shall conform to IS:7452. Putty for glazing shall be as specified in IS:420. Hinges shall be of projecting type. Handles and peg- stays shall be of steel or as specified. Suitable legs to be provided for fixing.

b) Glazing clips shall be provided at a spacing not exceeding 30 cms. The holes for the same will have to be drilled during fabrications by the manufacturer and not while fixing glazing.

c) The sections for the fixed and hinged frame shall be mitred and electrically flash butt welded to form a solid and true right angle.

d) All windows shall be thoroughly cleaned of rust , mild scale dirt, oil etc., either by mechanical or by chemical means and be given 2 coats of primer.

e) All steel casement windows and ventilators etc., shall be stacked vertically at site and proper care taken that they are not warped or twisted.

Construction Operation :

a) Casement shall be fitted to their frames by the Contractors as to provide continuous contact for weathering on the inside and outside and shall be secured in closed position by the fittings which shall have been properly checked and adjusted.

b) All windows ,ventilators shall be got checked by the Engineer-in-Charge before erecting in position.

c) All the steel windows are to be fixed in brick masonry or concrete on the sides and concrete lintel on top and sill at bottom.

d) The sizes of the prepared openings should be checked first and these should be cleared of all the obstructions. All the units shall be fixed into the opening. They shall not be forced into the openings which are not square or too small. The sizes shown on drawings are those of the opening before plastering. The size of the window , ventilators shall be 15 mm less all round to allow for plastering . The frames of each unit shall be grouted with cement mortar (1 : 2) tamped into the channel of the frame.

e) The windows , ventilators shall be erected and set straight to plumb level and shall operate satisfactorily after fixing.

f) Directly after fixing , and before glazing , the units shall be thoroughly cleaned , set and bedded and then painted with one coat of paint. After glazing , the final coats of paint shall be applied. In no circumstances, shall the finishing coats contain lithophone or carbon black.

g) There shall be no direct contact between glass and metallic part of the frame without a layer of putty in between.

GLAZING :

Glass for glazing shall be as specified in the drawing and/ or specifications. All glass shall be sheet free from spots, stains , air bubbles, waviness or other defects.

All glazing shall be bedded on putty and secured by glazing clips and putty of approved quality. Where the unsupported area of glazing is less than 1.50 sq.m. 4mm glass shall be used. Where unsupported glazing area is 1.50 sq.m. or more , thickness of glass shall be 5.5 mm . All glazing shall be cleared of all cement , paint and other stains , putty etc. before handing over.

ROLLING SHUTTERS AND GRILS :

Rolling Shutters :

The rolling shutters shall be of approved make and the design and shall be suitable for fixing in the position shown in the drawing i.e. , inside, outside, or below lintel or below joists. The shutter shall be of the manually push and pull type upto 9 sq.m. If the area of the shutter is between 9 sq.m. and 12 sq.m. There ball bearing shall be provided for easy operation . When the area is more than 12 sq.m. mechanical gear arrangements shall be provided. The rolling shutters shall generally conform to IS : 6248. The shutter shall be complete with door suspension , shafts, locking arrangements, pulling handles and other accessories. The slats shall not be less than 1 mm. in thickness.

Mode of Measurement :

a) Measurements shall be in Sq.m

b) Payment shall be made for the clear size of the opening only and the Contractor shall include in his rate for the side guide rails , pipe shaft , springs, hood/ cover and brackets.

c) Rate shall include for all materials, fabrication , transport , erection , maintaining in place till completion of the job. One coat of shop paint , all tools ,tackle , plant , equipment , scaffolding etc., required for the completion of the job as per the specifications.

COLLAPSIBLE GATE/ DOOR

The Collapsible gate / door shall be of approved make and design . It shall be of single or double leaf as indicated in the drawing made out of 20 mm gate channel with jointing of 20 mm x 5 mm throughout the length and height of the gate , fitted with ball bearings, handles and a coat of red- oxide paint . The spacing of lattice shall be 150 mm both ways.

The rollers shall be of 40 mm dia. and fixed to alternate lattices at the bottom . The rollers shall roll over a Tee rail fixed inside a channel box. The top guide shall also be a continuous channel section. The fixed end of the shutter shall be fixed to the joints by welding the shutter to top plate insert already left in wall complete with locking arrangements and all accessories.

(7) ALUMINIUM DOORS & WINDOWS AND PARTITIONS .

Materials :

a) All sections shall be obtained from approved , reputed , manufacturers such as Jindal or Indal and shall be extruded from aluminium alloy conforming generally to IS : 733 - 1983 and IS : 1285 - 1975.

b) Sections shall be as per detailed drawings and generally , conform to IS : 1948.

c) All sections shall be anodised in natural matt finish or such colour as specified . The thickness of anodising shall be a minimum of 20 microns and the contractor shall furnish necessary evidence in proof of this to the satisfaction of the Engineer-in-Charge.

d) The engineer at his discretion may send samples to an independent laboratory for testing at the cost of the contractor and if the test report from the laboratory indicates any deficiency the materials shall be rejected.

Workmanship :

a) All frames for windows , ventilators , doors partitions etc., shall be flat , with all corners at right angles and shall not be warped.

b) Frames shall be fabricated from sections machine cut to length , mitred and rivetted with clips at corners. Sub- dividing bars shall be tenoned and rivetted into the frame.

c) Side hung windows shall generally have projecting -type hinges made of aluminium alloy and rivetted/ welded to the frames , and shall have stainless steel pins . Peg stays , handles and locking arrangement shall be of approved quality and design.

d) Sliding windows shall be 2 track or 3 track as specified . Shutters shall have approved quality rollers and neoprene gasket to ensure easy and noiseless operation and fully weather seal.

e) Hinged door shall be provided with approved quality floor springs , and aluminium push plates. Push plates shall extend the full width of the shutter , and shall be provided with tower bolts and approved quality lock.

f) Partitions profile are to be made from anodised aluminium rectangular tube section of 'INDAL' made measuring 63.50 mm x 38.10 mm x 2.5 mm (thick) complete with all

accessories. Partition panels are to be either 6 mm thick MODI GUARD FLOAT GLASS or with cement bonded particle board (BISON BOARD or EQUIVALENT) of 10 mm thick or as specified in the drawing.

All the members of all shutters have built -in grooves to take on snap on aluminium beading. Neoprene gaskets shall be provided to prevent direct contact between glass and aluminium and make the shutter completely weather seal. Lead lining is to be provided for doors, windows and partitions of X- Ray Room as per manufacturers specification .

g) The contractor shall measure each opening before fabrication. The employer shall not be responsible for any variation in the widths and heights of openings .

h) Frames shall be fabricated so that during fixing 6 mm clearance is obtained all round .

i) The contractor before fabrication shall submit shop drawings to the Engineer-in-Charge for prior approval.

j) Before erecting , frames coming in contact with masonry , plaster , concrete or dissimilar metals shall be coated with a coat of zinc chromate conforming to IS : 104 . The contractor shall cover the frames with a transparent lacquer or other protective materials to protect the member from contact with cement during installation.

k) Plain or tinted glass glazing , as specified shall be fixed.

i) Cement Bonded Particle Board partition panels should conform to IS : 14276 - 1995. The Boards used for partition should be resistant to weather , fire, termite and fungus . It should act as sound insulation and should be chemically stable and have smooth surface and good workability with normal wood working tools. The size and thickness of panels should be as specified in the Bill of Quantity. The board panels for partition wall should be constructed with steel stud or Aluminium Stud or Timber Stud as specified and fixing of Board to the Stud should be done as per manufacturers specification.

m) On completion , the contractor , shall wash the aluminium work with non- alkali soap and water.

Mode of Measurement and Payment :

a) Measurement shall be in Sq.m.

b) The rate for Doors , window and Glass partitions shall include for all materials including glazing , fabrication , transport to site, erection , cost of scaffolding , maintaining in position till completion of job and including all tools, tackle , plant and equipment and all other necessary works incidental to the completion of the work as per these specifications. For partitions with Bison panel in Aluminium frame the rate should also be inclusive all materials labour and tools and plants.

c) Doors shall be measured as follows :

Height , from sill to outer edge of top member of frame . Windows shall be measured from outside edge to outside edge of the frame .

(8) PRE-CONSTRUCTION ANTI-TERMITE TREATMENT

a) Treatment to the bottom surface (in case of Masonry Foundation) and the sides (upto a height of 300 mm) of the excavation with chemical emulsion by admixing 1.0% by weight of concentrated Chloropyrifos or equivalent emulsified with water as specified in Code IS-8944-1978 at the rate 5 litres per square metre area. The work shall be carried our as per Code IS-6313 (Part-2) –1981.

b) Treatment to the backfill of the Masonry foundation with chemical emulsion as described above at the rate of 7.5% litre per sqm. Of the vertical surfaces of the substructure for each side of the foundation. The work shall be carried out as per Code IS-6313 (Part-2)-1981.

c) Treatment to the top surface of the consolidated earth within plinth walls shall be treated with chemical emulsion as described above at the rate of 5 litres per sqm. of the surface before sand bed or sub grade is laid. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through holes upto 50 to 75 mm deep at 150 mm centre to centre both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion. The work shall be carried out as per Code IS – 6313 (Part-2) –1981.

d) Treatment at the junction of the wall and floor upto the level of filled earth surface by making a small channel 30 mm x 30 mm at all the junction of wall and floor (before laying the sub-grade) and rod holes made in the channel upto the ground level 150 mm apart and iron rod moved backward & forward to break up the earth and chemical emulsion , as described above , poured along with channel at the rate of 7.5 litres per sqm. Of vertical wall to soak the soil right to the bottom . The soil shall be tamped after operation. The work shall be carried out as per Code IS-6313 (Part-2) –1981.

e) Treatment to the external Perimeter of building with chemical emulsion by admixing 1.0% by weight of concentrated Chloropyrifos/ equivalent emulsified with water as specified in Code IS-8944-1978 including digging holes in the soil along and parallel to the wall upto a depth of such extent that chemical emulsion will be dispersed to a depth of 300 mm from Ground level by rodding with 12 mm dia M.S.rod at 150 mm internal 2.25 litres quantity of chemical emulsion per metre length shall be used. The work is to be carried out as per Code IS-6313 (Part-2) –1981.

POST CONSTRUCTION ANTI-TERMITE TREATMENT

a) Anti-termite treatment to the outside of foundation with chemical emulsion by admixing 1.0% by weight of concentrated Choloropyrifos or equivalent emulsified with water as specified in Code IS.: 8944 –1978 including cutting shallow channel by excavating soil along and close to the wall face upto a depth such extent that Chemical emulsion will be dispersed to a depth of 300 mm from ground level by rodding with 12 mm dia M.S. rod at 150 mm interval 2.25 litres quantity of chemical emulsion per metre length shall be used. The work is to be carried out as per Code IS: -6313 (Part-3)-1981.

b) Anti-termite treatment of the soil under floor with chemical emulsion or equivalent by admixing 1.0% by weight of concentrated Choloropyrifos or equivalent emulsified with water as specified in Code IS: 8944-1978 including drilling vertically 12 mm holes at the junction of floor and walls at 300 mm intervals to reach the soil below, using hand operated pressure pump to squirt chemical emulsion into the holes at the rate of one litre per hole. The holes shall be sealed after operation to match with existing floor. The work is to be carried out as per Code IS: - 6313 (Part –3) –1981.

c) Anti-termite treatment to the junction of woodworks and masonry walls with chemical emulsion by admixing 1.0% by weight of concentrated choloropyrifos or equivalent emulsified with water as specified in Code IS:-8944 –1978 including spraying at the points of contracts with the adjoining masonry by drilling 6 mm holes as a downward angle of about 45 deg. At the junction of woodwork and masonry and squirting chemical emulsion into these holes at the rate of half litre per hole. The holes shall be sealed after operation . The work is to be carried out as per Code IS-6313 (Part-3)-1981. The shutters are to be sprayed with emulsion on both sides. All wooden fixtures like almirahs, racks , etc. Also to be thoroughly sprayed with chemical emulsion.

LIST OF APPROVED DOOR/WINDOW FITTINGS, PAINTS, GLAZED TILES ETC.

Sl.No..	Materials	Make/Brand
1	Anodized Aluminium fittings etc. , socket ,bolt etc. (with extruded section)	Afsoruddin, Lohin or equivalent
2	Oxidised Iron fittings, hinges.	MOUZI Heavy type or equivalent.
3	Steel services.	Nettlefold or equivalent.
4	Putty for fixing glasses.	Ready mixed Shalimar or equivalent.
5	Steel Mortice Locks 7 Levers	Godrej or equivalent
6	Door Closure	Godrej or equivalent
7	Gravity hinges	Guimetal or as per I.S.I. specification
8	Glazed Tiles	Johnson & Jhonson's regency or equivalent
9	Paints	To be used as under : For wooden surfaces or Steel Surfaces – 1) Hi-gloss synthetic enamel or 1st quality Brolac/ Dulux/ Luxol 3 or equivalent Apcolite
10	Washable distemper	No.1 ACRYLIC Washable distemper of Shalimar or equivalent
11	Plastic Emulsion Paint	Shalimar Superlac Acrylic emulsion or similar approved Brand.
12	Cement based paint	Super Snowcem or equivalent
13	Wood or Steel Primer	Brand of Primer to be used matching with the brand of paint.

TECHNICAL SPECIFICATIONS FOR PILING WORK

A. Particular specification for Bored Cast-in-situ piles

Unless otherwise mentioned in the following paragraphs, stipulations of relevant section ofl.S.2911 shall be followed:-

1. The layout and number of piles shown in the Tender Drawing are based on allowable carrying capacity on the piles section as given in the drawing.

2. Boring equipment and accessories shall generally conform to I.S. 2911. Boring may be done by either rotary or percussion equipment or direct mud circulation method. In case of unstable soils the boring tools used should be such that suction efforts are minimized. Stabilization of the sides of the bore-hole shall be done by the use of bentonite slurry or casing. The size of cutting tool shall not be less than diameter of the pile by more than 75 mm.

3. The drilling mud shall be used at least from the level of sub soil water or from the level of bottom of M.S. liner depending upon site conditions and the hole shall than be always kept full with the fluid which should preferably be kept in motion. The density and composition of the fluid shall be such as to suit the requirements of the ground conditions and to maintain the fine materials from the borings in suspension. A 5% bentonite suspension would be generally suitable and its quality shall conform to specification given in Appendix 'A' of I.S. 2911 (Part l/Sec-2).

4. The bottom of the hole shall be cleaned very carefully before concreting work is taken up. The cleaning of the hole shall be ensured by careful operation by air lifting process, unless otherwise allowed by the Architect/Engineer.To lift the soil at founding level before concreting, bore hole shall be agitated by jetting with fresh drilling much with relatively higher pressure than that used during boring of air through tremie pipe. While boring by use of drilling mud, the specific gravity of the mud suspension in the vicinity of the bottom of bore hole shall be determined by suitable slurry sampler in the first few piles and at suitable interval of piles and recorded. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as concreting operation in order to keep the hole stabilized as well as to avoid concrete mixed up with thicker suspension of the mud.

5. In case of boring with casing, the casing should be used from the ground level. The casing shall be kept ahead of boring in cases where there is danger of caving-in due to subsoil water entering into the bore hole or where the soil is loose.

While boring below sub soil water level, precaution shall be taken so that no boiling of the bottom of the hole occurs due to difference in hydrostatic head.

6. Concreting of bore holes shall start *as* soon as possible after its completion. Should a bore hole, be left un-concreted for more than two hours, it shall be cleaned thoroughly as directed by the Architect/Engineer.before placing concrete. Concreting under water shall be done in one operation. Concrete shall be placed by means of a tremie pipe. It shall, however be ensured that concrete entering the tremie pipe does not get mixed in with the slurry and % kg. of granulated vermiculite shall be poured in the tremie pipe before pouring concrete as directed by the Architect/Engineer.

7. The tremie pipes and funnel shall be filled and lifted just 15 cm above bottom before releasing the concrete column to facilitate flushing out the bottom. The concrete levels in the tremie shall be checked every few feet in order to note the difference, if any, between the theoretical quantity that should have been placed and actual quantity that has gone in.This is to locate the position of over cut during boring.

In addition to the normal precautions to be taken in tremie concreting as per relevant section of IS: 2911 the following specifications shall be particularly applicable for the use of tremie concrete pipes:

a) The concrete shall be coherent, rich in cement (not less than 400 kg/cum) and of slump not less than 100 mm.

b) The hopper and tremie shall be a closed system embedded in the placed concrete, through which water cannot pass.

c) The tremie shall be large enough with due regard to the size of the aggregate. For 20-mm aggregate the tremie pipe shall be of diameter not less than 200 mm, aggregates more than 20 mm shall not be used.

d) The first charges of concrete shall be placed with a sliding plug pushed down the tube ahead of it or with a steel plate of adequate site of prevent mixing of concrete and water. However, the plug shall not be left in the concrete as a lump.

e) The tremie pipe shall always penetrate well into the concrete with an adequate margin of safety against withdrawal of the pipe is surged to discharge the concrete.

f) The pile shall be concreted wholly by tremie and the method of deposition shall not be changed part way up the pile, to prevent the laittance from being entrapped within the pile.

g) All tremie tubes shall be scrupulously cleaned after use.

Normally concreting of the piles shall be uninterrupted. In the exceptional case of interruption of concreting but which can be resumed within 1 to 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly from time to time to prevent the concrete around the tremie from setting. Concreting should be resumed by introducing a Irttle richer concrete with a higher slump for easy displacement of the partly set concrete.

If the concreting cannot be resumed before final set of concrete already placed the pile so cast may be rejected or accepted with modifications at the sole discretion of the Architect/Engineer.

In case of withdrawal of tremie out of the concrete, either accidentally or to remove a choke in the tremie, the tremie may be reintroduced in the following manner to prevent impregnation of laittance of scum lying on the top of (he concrete already deposited in the bore.

The tremie shall be gently lowered on to the old concrete with very little penetration initially. Avarmiculrte plug shall be introduced in the tremie. Fresh concrete of slump between 150 mm and 175 mm shall be filed in the tremie, which will push forward and will merge out of the tremie displacing laittance/scum. The tremie will be pushed further in steps making fresh concrete sweep away laittance/scum in its way. When tremie is buried by about 60 to 100 cm concreting may be resumed.

8. The top of conrete in a pile shall be brought 1 metre above the cut off level to permit removal of all laittance and weak conrete before capping and to ensure good concrete at the cut off level for proper embedment into the pile cap. Remaining length of bore is to be filled by silver sand.

When concrete is placed by tremie method, concrete shall be cast to the piling platform level to permit overflow of concrete for visual inspection or to a minimum of one metre above cut-off level. In the circumstances, where cut-off level is below ground level the need to maintain a pressure on the onset concrete equal to or greater than water pressure shall be observed and accordingly length of extra concrete above cut-off level shall be determined and allowed in works.

During installation of piles the sequence of construction shall be as directed by the Architect/Engineer.

9. In case defective piles are formed, they shall be removed or left in places whichever is convenient without affecting performance of the adjacent piles or the cap as a whole. Additional piles shall be provided at Contractor's cost to replace them as

directed by the Engineer and in this regard Engineer's decision shall be binding on the Contractor.

Any deviation from the designed location alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile and plinth beam if the deviations are beyond the permissible limit. All such alterations shall be done at Contractor's cost.

10. Pile shall be installed accurately as possible as per the designs and drawings. Pile shall not deviate more than 75 mm or one-tenth of diameter whichever is more. In case of piles having diameter more than 600 mm it will not deviate more than 100 mm from their designed position. In case of single pile in a column, positional tolerance shall not be more than 50 mm.

In case of piles deviating beyond these limits and to such an extent that the resulting eccentricity cannot be taken care of by a redesign to the pile cap or pile tiles, the piles shall be replaced or supplemented by one more additional piles by the Contractor at his own cost along with any additional cost for pile cap being over size. The decision taken in this regard by the Architect/Engineer, shall be final and binding on the Contractor.

11. Manual chipping shall be permitted after three days of pile casting. Pneumatic chipping of permitted by the Architect/Engineer.shall not be started before 7 days. In case, Portland Pozzalana Cement is used, shipping shall only be started as directed by the Architect/Engineer.

12. When working near existing structure, care shall be taken to avoid any damage to such structure. In the case of cased bored pile care shall be taken to avoid effect due to loss of ground.

In case of deep excavations adjacent to piles, proper shoring or other suitable arrangement shall be done to guard against the lateral movement of soil stratum or releasing the confining soil stress.

13. Main longitudinal reinforcement in the length of the piles as well as links or spirals shall be provided as shown in the drawing. Longitudinal bars shall preferably be in one length. Reinforcing cage shall be handled and installed carefully without damaging its shape.

All other requirements or reinforcement bars i.e. quality, workmanship, etc. shall be specified for reinforced concrete work in the relevant I.S. Codes.

14. During installation of pile the following date shall be recorded along with any other date as directed by the Architect/Engineer.. These dates shall be submitted to the Architect/Engineerin triplicate on completion of installation of each pile. Recording of date of

a) Sequence of installation of piles in a group.
b) Dimensions of the pile, including reinforcement details and mark of pile.
c) Details of mild steel lines were provided along with stiffener.
d) Depth bored and founding level along with a bore level indicating nature of stratum.
e) Time taken for penetration of every 15 cm during last 2 m depth before founding level.
f) Method of cleaning bottom of hole at founding level before concreting.
g) Time taken for concreting.
h) Cut-off level/working level/RL of top of concrete
i) Cement bag consumption, slump of concrete
j) Any other relevant important observation.

B. Pile Test

The Contractor shall quote separately for carrying out pile test for bored piles.

The test shall commence as per provision laid down in I.S. 2911 Part-(V 1979, latest revision. Before any load test being performed, the proposed set-up and the kentledge (load frame) shall have to be approved by the Architect/Engineer.

The Architect/Engineer .shall have the right to get test certificate regarding calibration of pressure gauge from the Government Laboratory, at the cost of Contractor.

For each pile failing to conform of the specified requirements, the Contractor shall at his expense, test further pile or piles as directed by the Architect/Engineer.. The cost of all additional piles, and all other work necessitated to failure or inadequacy of any test of pile to meet specified requirements shall be the responsibility of the Contractor.

The results of pile test shall be graphically represented to show the following relations:

i) Load vs. time
ii) Total settlement vs. time
iii) Load vs. total settlement (for loading and unloading)
iv) Load vs. net settlement

C. Procedure for Routine Load Test on Working Pile

i) Load to be applied by means of hydraulic jack with a pressure gauge with a remote control pump, reacting against suitable load frame;

ii) The reaction to be made available for the test should be 25% more than final test load proposed to be applied;

iii) The test load shall be applied in increment of about 20% of assumed safe load carrying capacity.

iv) Settlement should be recorded with minimum three dial gauges of 0.02 mm sensitivity for single pile and 4 gauges for pile groups. Each positioned at equal distance around the piles, and normally held by datum bars resting on immovable supports at least *5D* away from the periphery of test pile where 'D' is the diameter of pile;

v) Each stage of loading shall be maintained till the rate of movement of pile top is not more than 0.10. mm per hour in case of clayey soil or a maximum period of 2 hours whichever is greater. For this purpose, the type of soil met at the pile top shall be considered. The estimated safe load carrying capacity may be maintained for 24 hours and settlement should be observed every hour during this period;

vi) For each increment, application of load shall be as smooth as possible. Settlement observation shall be made at about 15 minutes interval;

vii) The loading shall be continued upto twice the safe load carrying capacity or the load which total displacement of pile top/cap equals the appropriate value specified below, whichever is earlier:

a. Safe load carrying capacity on single pile 2/3rd of the final load at which gross settlement is 12 mm.

b. 50% of the final load at which gross settlement comes to 10% of diameter of pile.

Safe load carrying capacity on group of piles :

a) 2/3rd of the final load at which gross settlement comes to 40 mm.

b) Final load at which gross settlement comes 25 mm.

viii) The load on the pile may be removed in one stage by releasing jack steadily after completion of the test and rebound observations should be made for atieast 2 hours.

D. <u>Records :</u>

The Contractor shall prepare in triplicate, a comprehensive record during the driving of piles, giving the following and other necessary data in a tabular form :

i) Serial No. of pile driven

ii) Data and time at which pile is driven

iii) Total depth of pile

iv) Strata chart in case of bored piles only

v) Any other data ordered by the PMC

vi) For cyclic test, loading record should be as per I.S. Code 2911 (Part IV), 1979 (latest revision).

Each of the three copies of such data prepared daily shall be signed by the Contractor or his authorised representative as well as the Architect/Engineer.. One copy shall be retained by the Contractor and the other submitted to the Architect/Engineer, for final record.

E. Standard of Acceptance

The piles shall be accepted satisfactory only when the work has been executed in accordance with this specification and the standards stated hereinafter to the satisfaction of the Architect/Engineer.

a) The pile shall not be out of plumb by more than 1.5%.

b) The toe of pile shall be at the approved bearing level in each case.

c) The total volume of concrete consumed for pile shall not be less than 10% and note more than 40% greater than the calculated volume. The calculated volume for this purpose shall be cross sectional area inside the casing multiplied by the length of pile.

The concrete shall show the specified strength as indicated by the cube test results.

d) The results of the load test carried out in accordance with the contract and with the specification for load testing shall be satisfactory.

F. Basic of Measurement of Piles :

The top eighty millimeters of each pile shall penetrate into the pile cap the bottom of which shall be regarded as cut off level and reinforcement shall further project into the pile cap as specified.

The piles shall be measured in linear meter from the cut-off level to the bottom most point of the pile. The rate shall include the cost of driving the casing tube (if any), boring and placing in situ concrete including that in the portion inside pile cap. The rate shall also include for all labour and materials, if required, bailing out water from underground surface, withdrawing of the tube, breaking of boulders, old foundation, etc. met with before reaching the desired stratum, and everything necessary to have the pile in plumb and secure in position.

No payment will be made for piles driven out of plumb beyond the specific tolerance limits, or for imperfect or defective piles regarding which the judgments of the Engineer-in-Charge shall be final and binding on the Contractor.

G. Defective Piles

Any pile, which is shown to be defective under load test, shall not be accepted and the Architect/Engineer, will relate such failure to the acceptance of other piles in the area.

If an individual pile should fail to meet the requirements specifie4d in clause 'F' as stated above, such pile shall be deemed to be defective and the Architect/Engineer .may order such investigation to be made which he considers appropriate.

When any pile is found defective, the Contractor shall replace the pile at his own cost. » No. extra time shall be allowed for such relocation of piles due to obstruction/failure during boring operation.

The Contractor may carry out the piling work before excavation. In such an event, the portion of empty boring shall be filled with sand as per direction of Architect/Engineer. The cost of such empty boring and sane filling shall be included in the Contractor's rate.

H. Setting Out:

The positions of the piles are to be set out by the Contractor from cardinal points, which will be provided by the Architect/Engineer. The Contractor shall be responsible for all errors in setting out and shall rectify the same at his expense, to the satisfaction of the Arch itect/Engineer.

I. Safety of Existing Structure :

The Contractor shall take every precaution to avoid damage or subsidence or collapse of the existing structure and services in the vicinity as a result of pile driving. All claims arising on account of the damage caused to the existing structures and services in the vicinity as a result of pile driving and during the process of boring shall be duly covered by the Contractor by Insurance or borne by the Contractor.

The design prepared by the Architect/Engineer, is on the following basis : Cast-in-situ bored reinforced concrete piles.

The accompanying drawings and bill of quantities have been accordingly prepared.

J. Design and Concrete Quality :

The grade of concrete of all pile shall be minimum M-20 unless otherwise mentioned. The cement content of piling work shall be minimum 400 kg/cm with ordinary Portland Cement. Water cement ratio and slump shall be as per I.S. Specification for relevant piling work. Maximum size of coarse aggregate shall be 20 mm.

Grading and other requirement of coarse and fine aggregate, water and concrete shall be as specified for reinforced cement concrete work in the relevant I.S. Codes.

The average basic length of the piles shown in schedule of quantities is tentative and is to be assumed for cut-off level to the top of the pile.

K. Rates to include

1. Mobilization :
   Mobilization of piling rig/rigs with other necessary tools, planks & machinery at site, erecting the same for work, dismantling the same after completion of the work and transportation back from site including satisfactory clearance of the site.
2. Setting out the pile location as per drawing.
3. Providing the complete pile including the following :
   a) Driving the pile up to the design/accepted founding level including necessary chiseling through hard obstruction encountered, if any, provision of bentonite slurry, etc. casing pipes, etc.
   b) Disposal of spoils, slurry, soil - bentonite slurry, etc. satisfactorily.
   c) Pumping out water and slurry including drainage and disposal of same and necessary cleaning of the bore hole before concreting.
4. Removing/trimming the concrete from the projected pile head exposing, straightening and cleaning the reinforcement.
5. Shifting the rig and other equipment from place to place.
6. Provision of slurry tanks, etc.
7. Provision of all additional work for rectification measures of defective pile as per specification and as directed by the Architect/Engineer
8. Cleaning the site thoroughly and leveling the area after completion of the work or as directed wherever required.
9. Provision of all types of checking.
10. Provision of empty boring and filling with sand inside the bore hole.
11. Testing :
    Provision of approved temporary arrangements for load testing as necessary, loading, unloading, recording of results, supplying results in triplicate, cleaning the site after testing and all the necessary bye-work complete

TECHNICAL SPECIFICATION FOR WATER SUPPLY & SANITARY.

I. GENERAL:

1. The Contractor shall arrange with local Municipal Authorities for getting the water and sewerage connections. the actual connection charges to be paid to the local bodies will be reimbursed by the Employer.

2. No payment will be made to the Contractor for submission of plans to the Municipal Corporation and obtaining sanction of the same. The rates quoted by the contractor shall be considered to be considered o be inclusive of this item.

3. The rates are of complete items as fixed in position and over all costs- e.g. cutting of holes ,chases, etc., and also for provision of fixing arrangement viz., clamps ,brackets, wooden blocks etc. the rates shall also include restoration to original condition of all damages to walls, floors etc., during the process of fixing sanitary installations , water supply and drainage . all debris of plumbers excavation , etc., shall be removed without any extra charge. the plumbing work/or the building work effected by the plumber work shall be left thoroughly cleaned to the satisfaction of the Engineer-in-charge.

4. Unless specified to the contrary, all material should conform to ISI specification and be of best quality and make as approved by the Engineer- in-charge. Testing shall be undertaken for various pipe lines and as may be directed by the Engineer- in - charge.

5. All G.I pipes (except concealed pipes and underground pipes) and brackets and fixtures and manhole covers shall be painted with 2 coats of synthetic enamel paints.

6. All concealed and underground G.I pipes and specials shall be painted with 2 coats of Bituminous paint.

7. All painting work shall be carried out to the satisfaction of the Engineer-in-charge and cost thereof shall be covered in the rates of all the respective items.

8. The Plumbers shall obtain the drainage completion certificate and the certificate of adequate water supply from the Municipality and shall abide by the rules and regulations prescribed by them or other authorities concerned , wherever necessary.

9. In case of concealed G.I pipe work , the chases in floors and walls shall be made as approved by the Engineer-in-charge. the pipes shall be secured tightly to the walls with clamps. The chases shall be filled with cement concrete 1:2:4 (1 cement: 2 coarse 4 hard jhama aggregate 20mm nominal size). Payment shall be made for cutting chase3s filling in the cement concrete and making them good as per relative item in the Bill of quantity.

10. The cast iron pipes shall be laid exposed on all with M.S. holder bat clamps made from 32mm thick. M.S. flats of approved design and required size. A clear minimum gap of

25mm between the wall and the pipe shall be left. All the clamps shall be embedded in cement concrete blocks sized 20cm x 20 x 10 cms. in 1:2: 4 mix (1 cement :2 coarse sand : 4 hard jhama aggregate - 20mm. nominal size) . the holes in walls and RCC work shall be made at point approved by the Engineer -in-charge and shall be made by the contractors. Payment shall be made as per relative item in the Bill of Quantity.

11. All plumbing and sanitary fixtures, pipes and pipe fittings, traps etc., which are to be embedded into the concrete or masonry work or other building work shall be placed in position and embedded for concealed at the time of casting of concrete and during the work shall be placed in position and embedded for concealed at the time of casting of concrete and during the work of construction. In case where chasing or cutting of concrete , masonry , or other structural or constructional work is unavoidable ,the location of such fittings, pipe lines and traps etc., shall be chalked out at the various places and the cutting, chasing or disturbing of the construction work shall be proceeded only after the due approval of the supervising authority in charge.

12. All cuttings, chasing and fixing work shall be completed before commencement of any plastering , tiling or finishing work.

13. Galvanised iron pipes and pipe fittings shall be of medium quality.

14. **SAMPLES:**

Sample of the materials proposed to be used shall be submitted for approval of the Engineer-in-charge before taking up the work in hand.

15. **MATERIALS, WORKMANSHIP & SAMPLES** :

All the materials and workmanship are to be of the best possible description and to the entire satisfaction of the engineer -in-charge and the contractors shall immediately remove from the site any materials and /or workmanship which, in the opinion of the Engineer-in-charge , is defective or unsuitable and shall substitute proper materials and /or workmanship forthwith.

16. The contractors shall ,if required by the Engineer-in-charge, arrange to test material and/or portions of the works at his own cost in order to prove their soundness and efficiency. If after any such test, the work or portion of works is found in the opinion of the Engineer-in-charge to be defective or unsound , the contractor shall pull down and re-execute the same at his own cost. DEFECTIVE materials shall be removed from the site within 7 days from receipt of such order.

17. Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specifications irrespective of any particular edition of such specifications being mentioned in the specifications or schedule of quantities.

18. The rates quoted shall be for all heights and depths.

19. Bidders should note that the quantities in the Bill of quantities are approximate and are subject to variation.

II. MATERIALS :

General : a) All materials shall be of best of their kind and shall conform to the latest Indian Standard specification .

b) A set of specification samples of all approved materials shall be kept in the office of the Engineer-in-charge ,cost of which is to be borne by the contractor.

1. SANITARY WARES :

All sanitary wares and fittings shall be of first class quality white vitreous China as manufactured by Parryware, Hindustan Sanitary Wares, Neycer , CERA or equivalent.

Stainless steel sinks and draining board shall be of best quality stainless steel of "Neelkant" or equivalent.

2. CAST IRON SOIL PIPE :

All cast iron soil pipes shall be of standard make. The thickness and specification shall conform to Indian Standard specifications IS : 3389/1970 and IS : 1029/1964. All piles shall be coated with Dr. Angus Smith's solution.

Pipes and fittings shall be true to shape smooth cylindrical, their inner and outer surfaces being as nearly as practicable concentric.

Pipe when tested for soundness by striking with a light hand- hammer shall emit a clear ringing sound. The pipes shall be free from cracks, laps, pinholes or other imperfection and shall be neatly dressed and carefully felted.

The fittings shall be of easy clean type. The access door fittings shall be designed so as to avoid dead spaces in which filth may accumulate. Door shall be provided with(3mm) rubber insertion packing and when closed and bolted ,these shall be water tight.

Pipes and fittings shall be supplied without ears. Each pipe fittings shall have the trade mark of the Manufacturer and nominal size suitably marked on it.

M.S. stays and clamps shall be made from 1/16" (!.6mm) thick M.S. flat of 1.1/4" (30mm) width bent to the required shape and size to fit tightly on the socket, when tightened with screw bolts. Lead to be used for the jointing of the pipes shall be refined lead of best quality.

Floor traps shall be of approved make, 'P' or 'S' type with minimum of 2" (50mm)water seal. These shall be provided with 5" dia.(125mm) CP brass grating of approved make.

3. **G.I PIPES AND FITTINGS** :

All pipes shall be of galvanised iron heavy quality of TATA make unless otherwise specified. All fittings shall be of 'R' brand or other equivalent make bearing ISI certification mark. The pipes shall be seamless screwed of socketed conforming to the requirement of IS : 1239-1985. These shall be of the diameter (nominal bore) specified. The pipes and sockets shall be cleanly finished, well galvanised in and other defects. All screw threads shall be clean and well cut. the ends shall be cut cleanly and square with the axis of the tube.

Full Way Valves :

these shall be of gun metal heavy quality or 'Leader' or equivalent conforming to IS : 778-1971 specification and tested to 21 kg. per sq. cm. for 2 minutes.

Brass Bib Cocks :

These shall be of gun metal heavy quality of 'Leader' or 'Annapurna' or equivalent approved quality conforming to IS specification.

Ball Valve :

The ball valves shall be of high pressure or of Pressure as specified. The ball valve shall be of brass and the float of copper sheet. The minimum gauge of copper sheet used for making the float sheet shall be of 26 SWS (0.580mm) for float of upto 4.1/ 2" dia.(114mm) size. the body of the ball valve shall be capable of withstanding a pressure of 200 lbs. per sqm.(14 kg. per sqm.) . the ball valve shall conform to IS specification No. 1708-1962.

4. **DRAINAGE- STONE WARE PIPES :**

All pipes shall be of best salt glazed variety conforming to IS specification. The pipes shall be free from visible defects such as fire cracks or hair cracks. the glaze of the pipe shall be free from blisters. The pipes shall conform to IS : 651-1965.

C.I Pipes :

These shall be spun iron pipes (class 7A) conforming to Indian Standard specification IS : 1536/1976.

TESTING OF MATERIALS AND WORKS :

As and when required by the Engineer-in-charge , the Contractor shall arrange to test materials and /or portions of works at his own cost to prove their soundness and efficiency.

if after tests, any materials ,work or any portions of work are considered defective or unsound by the Engineer-in-charge , the contractor shall remove the same from the site.

(A) SANITARY INSTALLATION :

1. The W.C. Pans shall be of white Viterous China (58mm) Orissa Pattern fitted with 'P' or 'S' trap of viterous China with effective 2" seal and 2" vent as per IS : 771-1963 & IS:2556 (Part II & VII) , 1967.

Fixing :

The W.C. Pan shall be laid in floor sloped towards the pan in a workman like manner , care being taken not to damage the pan in the process of fixing. It shall be fixed on a base of cement concrete 1: 3: 6 mix. (1 cement : 3 coarse sand : 6 stone ballast 40 mm and down gauge) taking care that the cushion is uniform and even without having any hallows between the concrete and pan. the joint between the W.C. pan and the trap shall be made with cement mixed with water proofing compound and made leakproof.

Flushing Cistern For Ipwc :

The flushing of W.C. pan shall be done by pull and let go flushing cistern of cast iron mosquito proof of 13.61 litres capacity together with cover , C.I chain and pull of specified quality , ball valve with copper flat and necessary unions etc., for connection with inlet and outlet pipes and overflow. It shall be valveless syphon type(IS: 774-1964).

Brackets :

The cistern shall be fixed on cast iron or rolled steel cantilever brackets which shall be firmly embedded in the wall or fixed by using wooden plugs and screws or by rawl plugs to the satisfaction of the Engineer- in charge.

Overflow :

The cistern shall be provided with 15 mm (1/2") P.V.C. overflows pipe with fittings which shall terminate into mosquito proof coupling of approved Municipal design with 0.5 mm dia. perforation.

Flush Pipe :

The outlet of flush pipe from the cistern shall be of 32 mm (1.1/2") P.V.C pipe or galvanised iron pipe a specified in the schedule of quantities, this shall be connected to the pan by means of an approved type of joint.

Stop Cock :

This shall be of ‘Leader’ make or as of specified in the schedule of quantities.

2. **ANGLO INDIAN TYPE W.C. PAN :**

The W.C. Pan shall be of white Vitreous China and shall be of Hindustan sanitary ware ‘Parryware’ or equivalent approved make , these shall be fixed to floor with rawl plugs and brass screws.

Seat & Lid :

These shall be of black plastic hygienic seat and lid or as specified with rubber buffers, CP brass hinges and screws of ‘Commander’ or ‘Bestolite’ or equivalent approved make.

Flushing Cistern For Epwc :

Unless otherwise specified in the schedule of quantities, these shall be low down PVC (10gallons) capacity with internal fitting and PVC brass flushing handle. These shall be connected to the W.C. Pan with 32 mm. (1.1/2’’)dia. PVC flush bend with unions complete in all respects. Cistern shall have 15 mm. (1/2’’) dia. PVC overflow pipe.

3. **URINAL :**

The urinal basin shall be flat back of white vitreous China of specified size. It shall be fixed in position by using wooden plugs and screws at a height of 650 mm. from the floor level to the top lip of the urinal. Each urinal shall have 40 mm. dia. outlet with C.P. brass hinged domed grating.(IS : 2556 (Part VI)-1697.

Trap :

Each basin shall have 40 mm. dia. C.P. brass 'P' or 'S' trap complete with unions of approved make. This shall be further connected to 40 mm. lead of G.I. waste pipe as specified in the schedule of quantities ,including wiped plumber joint complete with unions.

Flushing Cistern For Urinal :

These shall be automatic flushing cisterns of cast iron or as specified in the schedule of quantities complete with valveless syphon fittings conforming to IS : 774-1960. this shall be supported on brackets of standard pattern and fixed to rawl plugs, embedded in he wall with brass screws.

Angle Valve :

The cistern shall be fed with 15 mm. (1/2") C.P. brass inlet tube and angle valve of EGO make complete with C.P. brass union unless otherwise specified in the schedule of quantities.

the capacity of the flushing cistern and size of the flush pipe for the number of urinals shall be as follows :-

No. of Urinals	Capacity of Flushing Cistern	Main	Size of distribution
1.	5 Litres	-	15 mm
2.	10 Litres	20 mm.	15 mm.
3.	10 Litres	25 mm.	15 mm.
4.	15 Litres	32 mm.	15 mm.

The main and distribution pipes fittings and clamps shall be of C.P brass unless otherwise specified in the schedule of quantities , distribution pipes shall feed the urinals with C.P. brass spreaders of approved make.

Painting :

In case of cast iron flushing cisterns ,painting shall be done as specified in the Bill of quantity.

LAVATORY BASIN / LABORATORY SINK / DOCTOR'S SINK /BED SINK :

Lavatory Basin :

These shall be of white vitreous China with single or two three holes as specified in the schedule of quantities and as per manufacturers specification. These shall be supported on a pair of C.I brackets of approved design. These shall be supported on a pair of C.I brackets of approved design. These should conform to the provisions of IS : 775- 1962.

Fittings :

Each basin /sink shall have single or pair of pillar tap/special taps for the type of the sink specified and other fittings as specified , of 'ESSCO' or equivalent make 32 mm (1.1/2") C.P. brass waste (CP) . C.P. brass angle valve with inlet connection of C.P. brass chain and rubber plug.

Waste Connection :

Waste pipe shall be of 1.1/2" dia. (32 mm.) P.V.C. of approved make complete with unions. This shall discharge into a floor trap.

Puff Pipe :

This shall be galvanised iron termination with a brass perforated cap screwed on it.

5. **STAINLESS STEEL SINKS AND DRAIN BOARD FOR LABORATORY/ PATHOLOGY :**

These shall be of specified size of pressed stainless steel 2 mm. thick sheets and shall have 1.1/4" dia. C.P. brass 'P' or 'S' trap (32 mm.).

Fixing :

These shall be supported on C.I cantilever brackets or placed on wooden or marble counter. The joint between the masonry or wood shall be fixed with mastic filler to make it absolutely water tight. The draining board shall be sloped towards the sink in order to drain out all the water in the sink.

Fitting :

Sinks shall be provided with 1/2"(15 mm C.P. brass valve) mixing fitting 'ESSCGO' or equivalent make complete with swinging spout.

Waste Connection :

The waste pipe shall be of PVC 1.1/2" (32 mm.) dia. discharging upto floor trap. The rates shall include the cost of all materials and labour involved in all the operations described above.

Bed Pan Sink :

Should be of mosaic of size 600 mm. x 450 mm. x 250 mm. with C.I brackets, 'P' trap ,high level 100 litres capacity C.I. cistern with C.I bracket, discharge pipe , C.P. hot and cold water mixture inlet pipe and spray nozzle complete. Two coats of painting to be applied over cistern & C.I. bracket.

(B) **TOILET REQUISITES** :

Mirror :

Mirrors shall be of 5.5 mm. thick plate glass 'Atul' or approved equivalent make. The glass shall be uniformly silver plated at the back. Silvering shall have a uniform protective coating of red lead paint. The mirror shall have fibre glass frame of approved quality and colour. The mirror and its backing shall be fixed on the wall face to wooden cleats with C.P. brass screws and washers.

Glass Shelf :

The shelf shall be of glass of approved quality with edges rounded off. The size of the shelf shall be as specified. The shelf shall have aluminium guard rail with rubber washers in positions resting on glass plate and C.P. brass brackets with shall be fixed with C.P. brass screws to wooden plugs firmly embedded in the wall.

Toilet Paper Holder :

Toilet paper holder shall be of white Vitreous China or as specified. It shall be recessed in wall.

C.I Spun Soil Waste And Vent Pipes And Fittings :

All soil, waste and vent pipes and fittings shall be of cast iron conforming to the latest Indian standard specifications for heavy grade C.I. pipes. The pipes shall have spigot and socket ends, with bead on spigot and shall be without ears. The standard weights and thickness of pipes shall be given below with a tolerance upto 4 per cent.

Nominal dia	Barrel	Socket		Thick-ness	Approximate Mass in Kg. for effective length in Metres of				
(ON)	(DE)	(DI)	(P)	(E)	3.00	2.50	1.830	1.750	1.500
50	57-3.0	73-3.0	60.10	3.5	14.4	11.3	9.2	8.5	9.2
75	33-3.0	99-3.0	65.10	3.5	20.0	16.8	18.8	12.7	12.2

100	109-3.5	126-3.0	70.10	4.0	30.0	25.6	21.0	19.2	18.4
150	161-4.0	179-3.0	75.10	5.0	56.0	47.0	38.5	35.5	34.0
					0.5	0.25	0.15		
					2.9	1.9	1.4		
					4.3	3.5	2.1		
					6.5	4.0	3.2		
					12.0	5.0	5.8		

These shall be free from cracks and other flaws. The interior of pipes and fittings shall be clean and smooth and painted inside and outside with Dr. Angus Smith's solution of other approved anti-corrosive paint.

The access door fittings shall be of proper design so as not to form any cavities in which filth may accumulate. Doors shall be provided with 3 mm. (1/8") rubber insertion packing and when closed and bolted they shall be fully water tight.

Fixing :

The pipes and fittings shall be fixed to walls by using proper holder bat clamps , the pipes shall be fixed perfectly vertical or in a line as directed. The spigot end and the shoulder of the socket leave no annular space in between. All soil pipes shall be carried up above the roof and shall have HCI terminal guard. Connections between main pipe and the branch pipes shall be made by using proper branches and bends invariable with access-doors for cleaning. All vertical pipes should be covered on top with a wire down. The pipes and fittings should be firmly attached to the wall at least 5 mm. clear of the wall & should be strongly supported at the foot upon a bed of concrete.

Lead Caulked Joints :

The annular space between the socket and spigot will be first well packed in with spun yarn leaving 25 mm.(1") from the lip of the socket for lead . the joint may be leaded by using proper leading rings or if they are not available , by wrapping a ring of hemp rope covered with clay round the pipe. The lead shall be rendered thoroughly fluid and each joint filled in one pouring. Before caulking , the projecting lead shall be removed by flat chiesel and the joint caulked round with proper caulking tools and a hammer of 1 to 1.1/2 kg (2 to 3 pounds) in weight in such a manner as to make the joint quite sound. After being well set, the joint is to be flush , neat and even the sockets.

Testing :

All HCI pipes and fittings including joints will be tested by a smoke test and left in working order after completion. The smoke test shall be carried out as stated under. No extra payment will be made for the tests. Smoke shall be pumped into the brains at the

lowest end from a smoke machine which consists of a blow and burner. The materials usually burnt are greasy cotton waste which form clear pungent smoke which is easily detectable by sight as well as smell if leaking at any point of drain. the contractor will have to rectify all defects traced in such tests at his own expense to the complete satisfaction of the Engineer-in-charge.

Floor Traps :

The traps shall be of self cleaning design provided with 25 mm. (1") puff pipe where the length of the waste is more than 1.5 M (5''-0'') of the floor trap, is connected to a waste stack with bends. The other specification for these shall be the same as those for HCL soil and vent pipes and fittings.

Waste Connections :

Waste from lavatories, floor traps , sinks and baths shall separately discharge over the gully trap on the ground floor and shall be separately connected to waste stack on higher storeys.

Every starting manhole will have a 100 mm. (4") HCI vent terminating at 1 Metre (3 feet) above parapet of nearest buildings.

Anti- Syphonage Pipes :

Anti-syphonage pipe shall be HCI pipes with lead caulked joints. The main anti-syphonage pipe shall be 50 mm. (2") internal diameter or as specified.

Painting :

All the exposed HCI pipes and fittings shall be painted with two coats of synthetic enamel paint of approved quality, manufacture, colour and shade to match the surroundings. The cost of such painting should be included in the Contractor's rates for pipe work.

The surface of pipes and fittings to be painted shall be cleaned thoroughly , Red lead or other primer shall be painted as specified and allowed to dry. the finishing shall be done by painting 2 or more coats with paint in an approved colour and shade.

C. **LEAD PIPES :**

All lead pipes shall be hydraulic drawn and of equal substance throughout. When not supported on bearer, all lead pipes shall be supported by strong lead tracks at least 40 mm. (1.1/2") wide soldered on to the pipes at suitable intervals. They should conform to IS : 404.

Wiped Solder Joints:

All joints of lead pipes shall be wiped solder joints and described :-

The pipe ends to be jointed shall be cleaned with wire brush and freed from oxide if any. Chalk shall then be rubbed to kill the greasy nature of the lead. After this, plumbers black shall be applied. The length of the joints given below then be marked on the pipe. A fine shaving of lead shall be removed from this lengths with a shave hook. Tallow shall be then smeared over the prepared surfaces.

The molten solder , an alloy composed of 3 parts of tin and 7 parts of lead , shall be poured in a thin stream from laddle moved in an elliptical direction over the joint position including a portion of the soilded pipe at each end beyond the mark. When sufficient solder has been poured the joint shall be wiped with a pad of wiping cloth with long continuous movements in one direction only so as to leave neatly formed elliptical shaped joint. Surplus solder remaining on the joint shall be removed with a tool called draw off.

The length of the wiped solder joining shall be as follows :-

SIZE OF PIPE	**LENGTH OF JOINT**	
	Minimum	**Maximum**
15 mm (1/2”)	60 mm (2.1/2”)	70 mm (2.1/4”)
20 mm. (1/4”)	65 mm. (2.1/2”)	70 mm (2.3/4”)
25 mm .(1”)	70 mm. (2.3/4”)	75 mm (3”)
32 mm (1. 1/4”)	70 mm (2.3/4”)	80 mm (3.1/4”)
40 mm. (1/2”)	70 mm (2.3/4”)	80 mm (3.1/4”)
50 mm (2”)	70 mm (2.3/4”)	90 mm (3.1/2”)
75 mm (3”)	75 mm (3”)	90 mm (3.1/4”)
100 mm (4”)	80 mm (3.1/4”)	90 mm (3.1.2”)

The joints shall be water tight , air tight and shall be free from tears, burns strings , ribbeds or dropenings.

Lead Pipe Connection :

The joints between lead pipe and C.I or stoneware pipe shall be made under :-

One end of the brass ferrule or thimble shall be slipped into or over the lead pipe and jointed to it by means of a wiped solder joint. The other end of the ferrule shall then be inserted into the socket of the cast iron or stoneware pipe. In the case of former , the joint shall be made with molten lead (lead caulked) and in case of the latter with cement mortar as in stoneware pipe drains.

The joints between outgo of a WC pan and lead pipe shall be made as under :-

The lead pipe shall be slipped into a brass socket and jointed to it by a wiped solder joint.

Painting :

All exposed lead pipes shall be painted as in HCI pipes and fittings. the cost of such painting should be covered in the Contractor's rates for the lead pipes.

D. WATER SUPPLY :

1. G.I. PIPES AND FITTINGS :

The pipes shall be of galvanised steel, welded and seamless screwed and socketed and shall conform to latest Indian Standard specifications for medium quality.

The details of pipes regarding nominal bore thickness and weight in lbs. per R. ft. are follows :-

Nominal bore Sizes	Thickness of pipes. S.W.G.	Weight of pipe in lbs. per Rft.	
		'B' Class	'C' Class
15 mm (1/2'')	12	0.831	0.987
20 mm (3/4")	11	1.132	1.425
25mm (1")	10	1.664	2.027
32mm (1.1/4")	9	2.375	2.840
40 mm (1.1/2")	8	3.015	3.550
50 mm (2")	8	3.836	4.530
65 mm (2.1/2")	7	3.375	6.375
75 mm (3")	7	6.354	7.545

The pipes shall be tested to a pressure of 50 kg/sqm. (700 lbs. per sq. inch). these shall have threads and the sockets, paralleled threads.

Laying & Fixing :

Where pipes have to be cut or re-threaded ,ends shall be care-fully filled out so that no obstruction to bore is offered.

In jointing the pipes , the inside of the sockets and the screwed end of the pipe shall rubbed over with white lead and few turns of hemp yarn wrapped round the screwed end of the pipe which shall then be screwed home in the socket with a pipe wrench. Care must be taken that all pipes and fittings are kept at all times free from dust and dirt during fixing.

Internal Work :

For internal work, G.I pipes and fittings inside and outside the walls shall be fixed either visible (not in chase) by means of standard pattern holder bat clamps keeping the pipe 12 mm (1/2") clear of the wall every where or concealed as specified in Bill of Quantity .

When it is imperative to fix the pipe in front of house or in any conspicuous position where it looks unsightly chasing may be adopted.

All pipes and fittings shall be fixed truly vertical and horizontals or as directed by the Engineer - in- Charge.

External Work :

For external work G.I pipes and fittings shall be laid in trenches. the width of the trench shall be the minimum width required for working the pipes laid underground level . they shall not be less than 60 CMS (2 feet) from the ground level, and wrapped with gunny cloth dipped in hot bitumen. The work of excavation and refilling shall be done in accordance with the instruction of the Engineer- in- Charge.

Painting :

All internal G.I pipes and fittings shall be painted with two coats of synthetic enamel paint of approved quality manufacture, colour and shade as specified under HCL pipes and fittings. the cost of such painting shall be included in the Contractor's rates.

Testing :

All G.I pipes and fittings shall be tested to a pressure of 7 kg. per sqm. (100 lbs. per sq. inch) to ensure that pipes have proper threads and that proper materials (such as white lead and hemp) have been in jointing . All leaky joints must be made leak-proof by tightening at Contractor's expense.

2. **BRASS WATER FITTINGS** :

All water fittings shall be of standard manufacture and shall be in all respects comply with the latest Indian Standard Specifications. the brass fittings shall be fixed in the pipe line in a workmanship like manner. Care shall betaken to see that joints between fittings and pipes are made leakproof . the fittings and joints shall be tested to pressure of 21 kg per sqm. (300lbs. per sq. inch) unless otherwise specified. The defective fittings and the joints shall be repaired or replaced.

3. **SHOWER ROSE :**

The shower rose shall be of specified quality with flat bottom of specified diameter with uniform perforations. the inlet size shall be 15 mm. (1/2") or 20 mm (1/4") as specified . A stop cock of the requisite size shall be provided to control the inlet water supply to the shower rose.

E. **DRAINAGE :**

a) **STONE WARE PIPE** :

Pipes : All pipes must be new and perfectly sound, free from fire cracks and imperfection of glazing, cylindrical straight and of standard nominal diameter, length and depth of socket. They shall be hard burnt stoneware of dark grey colour and thoroughly salt glazed inside and outside. They should conform IS: 651-1965.

b) **TRENCHES FOR S.W PIPE DRAINS** :

Excavation : The trenches for the pipes shall be excavated to lines and levels as directed. The bed of the trench shall be truly and evenly dressed throughout from one change of grade to the next.

The gradient is to be set out by means of bending rods and should the required depth be exceeded at any point the trench shall be refilled by means of cement concrete of the specification of the bed concrete , at the contractor's own expense. the bed of the trench if in soft or made up earth shall be well watered and rammed and depressions thus formed filled with sand or other suitable materials as directed by the Engineer-in charge before laying the bed concrete.

If rock is met with, it shall be removed to 15 cms. (6") below the level of the pipe and the trench will be refilled with concrete, sand or other suitable material as directed by the Engineer-in-charger to bring it to required bed level. the excavated materials shall be kept away from the edge of the trench at a distance equal to 1 Metre (3 ft.) or equal to half the depth of the trench which -ever is greater.

The trench shall be kept free from water. Shoring and timbering shall be provided wherever required.

The trench width shall be the nominal diameter of the pipe plus 36 cms. (15") but it shall not be less than 52 cms. (21") in case of all kinds of soils excluding rock and not less than 92 cms.(3 feet) in case of rock.

Wherever the drain runs deeper , the width of the trench in the upper reaches may be increased as per the directions of the Engineer-in charge.

Road Crossings :

All road crossings shall be excavated half at a time , the second half being commenced ,after the pipes have been laid in the first half and the trench refilled. The trench at the existing road crossings shall be filled in with mud concrete for the full depth except for the 15 cms (6") layer ,which shall be filled with cement concrete 1:2: 4 or as directed.

Protection Of Existing Services :

All pipes , water mains , cables etc., met within the course of excavation shall be carefully protected and supported. Such mains will be hung from timbers placed across the trench.

Care shall be taken not to disturb the electrical and communication cables, removal of which if necessary shall be arranged by the Engineer- in - charge.

Lighting And Watch :

The open trenches shall be provided with requisite fencing and watchman to guard against accidents. Red flags during day and red light during night shall be provided at the ends and at intervals along the sides of the trenches.

Sign boards with necessary wording such as "SLOW, ROAD CLOSED" etc. shall be provided at least 30 metres ahead of road crossing where the work is in progress. The precautions will be continued till the surface is restored.

Temporary bridges or planks shall be provided over the trenches for keeping open the access to private or public property.

Refilling :

Refilling in trenches for pipes shall be commenced as soon as the joints and concrete have been passed. The refilling on the top and around the drain shall be done with great care and in such a manner as will obtain the greatest amount of compactness and solidity possible . For this purpose the earth shall be laid in regular layers of 15 cms (6") watered and rammed at each layers. All surplus earth shall be disposed off as directed by the Engineer - in- Charge.

c) **CONCRETING :**

All C.I. pipes shall be laid on a bed of 15 cms. (6 ") thick cement concrete as specified with projection on each side of the pipe to the full width of the trench.

The pipes with their crown level at 1.22 Metre (4 ft.) depth and less from ground shall be covered with 15 Cms. (6") thick concrete above the crown of the pipe and slipped off to give a minimum thickness of 15 Cms. (6 ") alround the pipe.

Pipes deeper than these shall be concreted upto haunches level with the top of the pipe.

d) **LAYING AND JOINTING S.W. PIPES** :

Laying :

The pipes shall be carefully laid to the levels and gradients shown on the plans and sections. Great care shall be taken to prevent sand etc., from entering the pipes. The pipes between two manholes shall be laid in straight line without vertical or horizontal undulations.

The pipes will be laid "socket up" the gradient . The body of the pipe shall for its entire length rest on an even bed.

Jointing :

The cement mortar joints shall be cured at least for seven days.

Testing :

All joints shall be tested to a head of 61 Cms. (2') of water above the top of the highest pipe between two manholes.

The lowest end of the pipe shall be plugged watertight . Water shall then be filled in manhole at the upper end of the line . The depth of water in the manhole shall be 61 cms. (2 ') plus the diameter of the pipe. The joints shall then be examined. Any joint found leaking or sweating shall be remade or embedded into 15 Cms. (6") layer of cement concrete (1: 2 : 4) in length and section re -tested, at the Contractor's expense until satisfactory results are obtained.

e) **GENERAL** :

Storm Water Drains :

When S.W. pipes are used for storm water drainage, no concreting will be necessary. The cement mortar for jointing will be 1;1 or that as specified in the Schedule of Quantities. Testing of joints also will not be required.

Precaution :

To avoid logging of drains , both ends shall be kept plugged until the construction of manholes is completed in every respect. On completion , care shall be taken that each plug is removed and the face of the drain made smooth.

Measurements:

The measurements for providing , laying and jointing S.W. pipes shall be recorded for the finished length of the pipe line i.e. , from inside of done manhole to the inside of other manhole.

f) **S.W.GULLY TRAPS :**

This must be new, perfectly sound free from fire cracks and other imperfections of glazing of standard nominal diameter and other dimensions . It shall be made of hard burnt stoneware of dark grey colour and thoroughly salt glazed inside and outside.

Each gully traps shall have a C.I. piping 15 x 15 Cms. (6" x 6") and one water tight C.I. cover with frame 30 x 30 Cms. (12" x 12") (inside dimensions) with machine seating faces or as specified.

Excavation :

The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Engineer-in- Charge.

Fixing :

The gully trap shall be fixed on cement concrete foundation 70 Cms. (2'3") square and not less than 10 Cms. (4") thick.
The mix for the concrete will be 1 :5 : 10 (1 Cement : 5 Sand : 10 Stone ballast) 40 mm (1.1/2" gauge) or as specified. The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipes.

Masonry Chamber :

After fixing and testing the gully and branch drain , a brick masonry Chamber 30 x 23 Cms 9 12" x 9") (inside in first class brick in cement mortar 1:5 shall be built with 11 Cms. (4.1/2") thick alround the gully trap from the top of the bed concrete upto ground level . The space between the Chamber walls and the trap being filled in with cement concrete of the specifications of bed concrete . The upper portion of the Chamber i.e. above the top level of the trap shall be plastered inside with cement mortar 1:3 (1 cement : 3 sand) finished with floating coat of neat cement. The corners and bottom of the Chamber shall be rounded off so as to slope towards the grating.

C.I. Cover :

C.I. cover with frame 30 x 23 Cms. (12" x9") or as specified with mechanical seating faces shall then be fixed on the top of the brick masonry with cement concrete 1 : 2 : 4 and rendered smooth. The finished top of cover shall be left 15 Cms. (6") above the adjoining ground level so as to exclude the surface water from entering the gully trap.

F) **MANHOLES , GULLY CHAMBER ETC. :**

1. **Manholes :** (The size of Manholes) : The size specified shall be in the internal size of the manhole. The work shall be done strictly as per drawings and specifications. The following specifications shall be adopted.

Excavation: the manhole shall be excavated true to dimensions and levels, shown on the plan or as directed by the Engineer-in-Charge.

Brick Work : The brick work shall be with best quality brick in cement mortar 1:6 , brick work in arches shall be with 1st class brick in cement mortar 1:6 , brick masonry round the pipes shall also be with 1st class brick in cement mortar 1;6 , the joints shall be made thoroughly leakproof.

Bed Concrete : The manhole shall be built on a bed of 15 Cms. (6") thick cement concrete (6 : 3 : 1) with jhama Khoa over a layer of brick flat soling.

Plaster :

Inside of the walls be plastered with 12 mm. (1/2") thick cement plaster 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement.

In wet ground , 12 mm. (1/2") thick cement plaster of the above specifications shall be done on the outside surface of the walls also. This plaster shall be waterproofed with addition of 1 kilogram of 'Accoproof" to50 kilogram (1bag) of cement with addition of any other equal and approved water proofing compound. The plastering shall be done upto 30 cms.(1 foot) above the wet soil line. Extra shall be paid for plastering the outside surface wherever directed.

Pointing :

Pointing shall be done with cement mortar 1:2.

Benching :

The channels is and benching shall be done in cement concrete 1:2:4 and rendered smooth with neat cement.
The following sizes of the channels shall be adopted for the benching :-

Size of the Drain	Depth at the Centre	Depth at sides i.e. , at walls
100 mm. (4")	15 Cms (6")	25 Cms (10")
150 mm. (6")	20Cms (8")	30 Cms(12")
250 mm. (9")	28 Cms(11")	38 Cms (15")
300 mm. (12")	35 Cms(14")	45 Cms (18")
400 mm (15")	43 Cms (17")	53 Cms (21"
450 mm. (18")	50 Cms (20")	61 Cms(24")

R.C.C. Work :

R.C.C. work for slabs or lintels shall be in cement concrete 1:2:4 with steel reinforcement as per details. Plain concrete ,if used for fixing manhole covers , shall be of the above specifications.

Foot Rests :

These shall be of M. S square rod 22 mm. (7/8") or as specified and shall be galvanised or painted with coal tar. These shall be embedded in masonry in cement mortar at least 23 Cms. (9") while the brick work is in progress. These shall be fixed 30 Cms. (1foot) apart vertically and staggered laterally and shall not project more than 11 Cms., (4.1?2") from the wall.

C.I. Manhole Covers :

The C.I covers shall be of tough homogeneous cast iron of heavy or light type as specified . the sizes specified , are the clear internal dimensions. The approximate weights of the various types of manhole covers with frames and their internal size will be as per specification in schedule of quantities & conform to IS : 1726-1966. Variations in weight ton the extent of 6 percent on either sides shall be permissible. the covers used in manhole on sewer lines shall invariably bear the work 'SEWER' on the top and those used for storm water drains shall bear the word 'S.W.D.' .These markings shall be done during casting of the covers.
The frame of manhole cover shall be embedded firmly in the R.C.C slab or plain concrete as the case may be on the top of the masonry.
After the completion of the work , manhole covers shall be sealed by means of thick mortar greased. All exposed surfaces of the frames and covers shall be painted with coal tar. The cost of such paintings should be included in the Contractor's rates for the manhole cover.

Plain Manhole :

90 cms. x 45 cms. (3' x 1'-6"). This type of manhole is generally constructed within compounds for house drainage only. Due to shallowness and narrowness the manhole is provided with cover with bigger opening to facilitate cleaning and repairs. Cover of size 90 Cms. x 45 Cms. (3' x 1"-6") shall be used.

Plain Manhole :

1.2 X 0.9 M (4" x 3") . This type of manhole is constructed for main drainage work for depth less than 2.4 Meters (8").

When the manhole is built on the footpath ,this shall be provided with 45 Cms. (18") internal diameter light type C.I cover , when it is built within the width of the road under traffic, it shall be provided with 53 Cms. (21") internal diameter heavy type C.I cover.

Levels Of Invert :

Sewers of unequal sectional area should not joint with level invert in a manhole. The invert of the smaller sewer at its junction with main shall be at least 2/3rd dia. of the main above the invert of the main . The branch sewer should deliver sewage in the manhole in the direction of main flow and the junction must be made with ease so that flow in the main is not impeded.

Measurements :

The depth of the manhole wall be reckoned from the invert level of the channel to the top level as to the C.I cover . The depth shall be measured correct to nearest 25 mm.

House Connections :

No drain from house fittings e.g. gully trap or soil pipe etc., to manhole shall exceed a length of 6 Meters (20 feet) unless it is unavoidable.

2. **DROP CONNECTIONS :**

In case where branch pipe sewer enters the manholes on main pipe sewer at a higher level than the main sewer , a drop connection should be provided.
C.I . Inspection bend shall be fixed in position at right angle to the drop pipe at the level of the inlet branch drain. The plain C.I shoe at the bottom shall be fixed in the benching cement concrete 1:2:4 (1 cement : 2 sand : 4 stone ballast 3/4" gauge) so as to discharge into the channel. the joints shall be lead caulked as per specifications for the cast iron pipes for water supply.)

C.I. PIPE DRAINAGE :

1. **C.I. DRAINAGE :**
C.I. pipe drainage shall be adopted in the case mentioned below :-

a) When the drain passes under a structure.

b) When the drain passes under a road which is subject top heavy traffic and where the covering cushion is not considered sufficient.

c) When the drain passes through a place where it is subjected to vibrations.

d) In hilly places where the slopes are very steep.

e) When drainage lines run on the surface or above ground.

2. **TRENCHES :**
Specifications for trenches for stoneware pipe drains will apply in this case.

3. **PIPES :**
The pipes used shall conform to the Indian Standard specifications for class "A" pipes.

4. **FITTINGS :**
C.I. trap with hopper , C.I inspection bends C.I. inspection Chambers etc., shall conform to Indian Standard specifications for C.I fittings.

5. **LAYING :**

For laying C.I pipes and fittings , specifications for C.I water mains will apply .

The joints for pipes and fittings shall be lead caulked joints under water supply. the joints shall be leakproof.

All inspection doors etc., shall be provided with felt washers and strong brass bolts and nuts.

Testing :

Testing of joints for C.I pipes and fittings shall be done by smoke test as specified under C.I pipes and fittings.

Masonry Chamber :

C.I inspection chambers and bends for underground shall be enclosed in masonry chambers.

LIST OF APPROVED WATER SUPPLY , SANITARY MATERIALS.
(Conforming to I.S.I. Specifications).

Sl. no.	**Materials**	**Make /Brand**
1.	G.I. Pipe	Tata
2.	G.I. Specials	'R' Brand or equivalent
3.	Brass Fittings	Annapurna , Neta or equivalent
4.	Gun Metal Valve	Gem : ESSCO or equivalent
5	Sanitary ware	NETA or equivalent
6.	PVC Flushing Cistern	Parryware : Hindustan Sanitary ware, Naycer or equivalent
7.	E.W.C. Seat	Parryware or equivalent
8.	Polythene , flexible Connections	Commander or equivalent
9.	C.I. Pipe /Fittings	Kohinoor - Deluxe or equivalent
10.	C.I / Fittings	Conforming to I.S.I or equivalent specifications
11.	C.I. Frames and covers	Conforming to I.S.I or equivalent specifications
12.	Mirror	Atul or equivalent

NOTE :

In case of non- availability of any particular brand of material or equivalent as specified in the Bill of Quantities bidder could also supply any other equivalent approved brand or material or equipment conforming to the latest I.S specifications.

WATER SUPPLY :

TUBE WELL :

1. SCOPE OF WORK .

The work comprises of sinking and developing 80/100 mm. dia. tubewell with 80/100 mm. dia. brass sheet jacketed strainer (Rex popular /Rex special quality) , 80/100 mm. dia. I.S.I brand medium grade G.I pipe upto a suitable depth dimension including 150 mm. dia. I.S.I brand medium grade G.I. housing pipe all as specified in the Bill of Quantity , including all other apartment works including supplying and fixing approved quality pumps as described and setforthin. the Bill of Quantities together with all additional or varied works which may, hereafter , be required.

2. METHOD OF SINKING .

The tube well shall be sunk by water jet method. The pipes and strainers shall be lowered after full boring is done in such a way that the strainers remain in the water bearing strata. The minimum of 3 metres length of 100 mm. G.I. Pipe with a cap shall be provided below the strainers. The suitability of water bearing strata will be judged by the Engineer from the sample of sand obtained during boring. the perforated cap is to be sealed from top with suitable plug and suitable marble/glass balls after the completion of work.

3. Most careful records of each day's sinkage of the tubewell and of the strata passed through shall be kept by the Contractor. These records shall be furnished to the Engineer on a tracing cloth together with samples of strata, properly marked , in a wooden box with glass cover and looking arrangement.

4. WATER BEARING STRATA.

Suitable water bearing strata at 50 M.- 150 M. from ground level is expected in this area but as guarantee can not be given to its accuracy, the Contractor shall allow in his tender to sink the well to any depth the Engineer may direct in order to obtain the required yield consistent with its suitability for drinking and cooking purposes.

5. STRAINERS.

The strainers shall be brass sheet Jacketed Strainer of approved quality. 100 mm. dia. in 6” feet length.

6. Should it be considered necessary at any time to reduce the total quantity of work to be carried out under the contract , the Contractor will be cancelled. No claim to any payment or compensation whatsoever on account of any profit or advantage which might have been derived from the execution of work in full but which he might not derived in consequence of the full amount of work not having been carried out.

7. PUMP , MOTOR AND ACCESSORIES.

Supply and installation of submersible pumping set, conforming to I.S.: 8034 of 1976 or latest , of reputed manufacturer for lifting water from 100 mm. /150 mm. dia tube well. the pump should have the capacity of lifting water 140/150 litres per minute against a total lead of 35 m - 40 m with 50 mm. dia. outlet . This also covers supply and installation of suitable capacity starter for motor, with single phase preventer , timer and water level guard. Arrangement for proper suspension of pump inside well and covering of well afterwards with M.S. Steel cover are to be provided.

7.1 PUMP.

Pump should have closed grain cast iron casting without blow holes, sand holes etc. with bronze impellers, stainless steel motor and pump shaft and shaft sleeves, wearing ring, pump coupling and pivot. The column pipe shall be of black steel of heavy gauge. Suitable arrangement for tieing up of pump with clamp and steel wire roper or nylon rope shall be provided as and additional safety for falling of pump.

7.2 MOTOR.

Motor should be suitable for 400 + 10% volts , 3phase, 50 cycles/ sec. supply system , 2900 r.p.m. with continuous rating . It should be totally enclosed , copper wound , squirrel case induction motor, water cooled and water lubricated and shall conform to I.S : 9283 of 1979 or latest. The thrust bearing should be of tilting type shoes, water lubricated with lifting thrust pads. The thrust pads should be made of copper metal alloy with water lubrication and proper bearing properties. The thrust plate resting on pads should have appropriate surface to ensure proper lubrication with water. Adequate heavy duty sealing arrangement and also a sand guard should be provided in the motor to prevent tube well impurities from entering the motor bearings.

7.3 CONTROL GEAR.

The control gear should be automatic push button manual operation with triple pole hand re-set adjustable Thermal or Solemid type overload relay in definite range, under voltage release , single phase preventor, suitable ammeter and timer. Control gear should be suitable for operation with the timer according to adjustment.

7.4 ACCESSORIES.

The following accessories are to be supplied with pump set conforming to relevant I.S.S.:-

a)	Column pipe	25 Metre	NB:- Rate for column pipe per Metre is also to be quoted separately)
b)	Delivery sluice valve	One	
c)	Pressure gauge	One	

d)	Triple pole hand operated isolator	One	
e)	Triple pole hand operated isolator	One	
f)	Weather proof flexible 3 core copper wire of suitable size	40 -60 Metre	(Rate to be quoted in per metre length).
g)	Automatic water level controller	One	
h)	Steel wire rope or Nylon rope 25 mm. dia	30 Metre	(Rate to be quoted in per metre length).

Manufacturer's test certificates of materials whatsoever applicable , along with curve of pumps are to be furnished.

7.6 GUARANTEE

The set to be guaranteed for trouble free operation for a period of 12 months from the date of installation. Any defect may be development or be noticed during that period shall be repaired by supplier free of charge at site of installation.

DRILLING & DEVELOPMENT OF DEEP TUBEWELLS :

TUBEWELL DRILLING :

1. **Scope of the work** : The work comprises of drilling & development of deep tubewell upto a desired depth and all other allied works as described and set forth in the specification and schedule of work together with additional or varied works together which may be required in accordance with relevant clauses or contract.

2. **Selection of sites and preliminaries** :

   A. The work will be executed anywhere in West Bengal. the intending tenderer may, if required, visit and study the site of work as to the nature and location of work from an aspects before execution of agreement. Pin - pointed sites for drilling the tubewell will be made available to the contractor by the Engineer -in-charge have access to two site of work with his plants and machineries . The contractor will have to make his own arrangement , if necessary, to carry his machineries upto the pin-pointed sites for drilling purpose. If this necessiate any approach road, temporary culverts, causeway etc. the same shall be done by the contractor himself at his own cost, & no extra payment or compensation thereof shall be payable to contractor on these account. Pin-pointed sites allocated to the contractor will not normally be charged, but in case sit is necessary, The department, reserves two right to do so. The contractor shall have no claim for such change of site.

   B. it will be contractor's responsibility to procure water for drilling operations and drinking & other purposes of his working personnel.

   C. Sufficient land shall be made available to the contractor for the operation, tide the final yield test of a tubewell is done. After the completion of the work, the contractor shall remove all plants and machinery & supplies and shall dress and level the ground as directed by the Engineer-in-charge.

   D. The contractor shall have to furnish in writing to the Engineer-in-charge , a programme of drilling of tubewell within a week aft after taking over the pin-pointed site .

3. **Variation in Tendered Amount** :

   The quantities of work given in the schedule are approximate and subject to variation, depending upon the ground strata and other conditions under which the works are actually carried out. Any variation thereof , shall not form the basis of disputes regarding the rates to be paid or give rise to any claim for compensation.

4. **Materials and Transport** :

   The contractor shall make his own arrangement for transportation of all materials supplied by the dept. or by the contractor, to the site. The materials to be supplied by contractor

must be of best quality and the samples of which are subject to approval of the Engineer-in-charge.

All temporary construction at site for work and dismantling of the same after the work, will be done by the contractor, at his own cost. The surplus or rejected materials, if any, should be removed from site of work by the contractor at his own cost after completion of work or as directed. All surplus materials issued by the dept. should be returned by the contractor to the departmental store , as directed by the Engineer-in-charge.

5. **Drawing & Records** :

Most careful records of each day's drilling and of the strata passed through shall be kept by the contractor . Samples of underground for formation shall have to be collected by the contractor from the discharge at every 3.00 metros and at every charge in the nature of strata. The collected samples are to be kept in suitable samples boxes with depth record and necessary description .

Electrical resistivity logging is to be run in the completed bore and the field data is to be processed and the inferences there on are to furnished by a competent geo-hydrologist.

These records alongwith an assembly chart of tubewell shall be given to the Engineer-in-charge or his representative at site for record. The cost of the Resistivity Test only will be paid to the contractor. No other costs on this account will be paid.

6. **Testing Instruments** :

The contractor shall supply and always maintain in good condition at site. The Orifice meter and other testing instruments of approved make including steel tube and such other instruments and appliances as are necessary for proper control of work during it execution. The contractor shall provide necessary equipments for sieve analysis of the sample of sand & perform sieve analysis of the sand of the selected aquifer and submit report to the Engineer-in-charge at his own cost.

7. **Fees payable by the Contractor** :

All quarry fees, royalties, Octoroon, duties, taxes etc. payable on any material brought for use at work site shall be borne by the contractor.

8. **Method of Drilling** :

i) The tubewell shall be sunk either by casing boring /reverse circulation rig or be direct rotary rig, preference should however be given to the use of Direct Rotary Rig.
ii) In case of drilling with direct rotary rig, the circular of the pilot bore should not be less than 225mm ;
to increase the pilot bore the designed diameters for Housing pipe , well pipe etc. reaming operation shall be done as provided in the schedule.

Tubewell Assembly :

A. The tubewell assembly shall comprise of following items of E.R.W. plain pipes ISI specification in lengths of 5..5 metres to 12 metres at random, mainly between 9 metres to 12 metres , ends levelled suitable for welding . Test pressure 60 atmosphere and as per break-up given in the schedule of quantities :-

i) Housing pipe -
ii) Blank pipe -
iii) Fibre glass strainer -
iv) Standard Reducer -
v) Bottom plug -
vi) Centre guide -
vii) Housing clamp -
viii) Top Cap -

B. **Housing pipe** : - The Housing pipe shall be kept generally 0.60 metre above ground floor level but may be more in submerged low lying areas as directed by the Engineer-in-charge.

C. **Strainer** : - Fibre glass strainer 1.80 metres to 2.40 metres in length shall be supplied to the contractor from any Departmental store, Contractors shall be responsible for the safe transport of the same to the work-site and shall lower the same in the bore of the tubewell, Contractor, before taking delivery of the strainer shall satisfy himself that there are in good condition. any complain regarding the quality or condition of the same at any later date shall not be entertained. The rate of lowering strainers shall be inclusive of all labour , materials and carriage of the same to work site.

D. The reducer , bottom-plug , centre guides, Top cap and housing clamps shall be used according to design and drawing as approved by the Engineer-in-charge.

During drilling operation the representative of the Engineer-in-charge shall remain present at site and take log records of strata encountered and the final log chart shall bear the signature of the representative of the contractor and the Engineer-in-charge.

After drilling the bore and examining the log chart the contractor shall design the tubewell assembly & the design shall be submitted for approval to the Engineer-in-charge.

It is only thereafter that the contractor shall start lowering the assembly inside the drilled bore, representative of the EIC shall always remain present during lowering of the tubewell assembly and he shall have to submit a written document both signed by himself and by the contractor to the EIC that assembly as per design has been lowered in his presence. In case of any difference of opinion about the design of the tubewell assembly the decision of the EIC shall be final.

Depending on the sub-stratum formation the tubewell assembly may have to be composed with non-standard length of pipes , both for housing and tubewell pipes. The contractor will be paid according to the actual length of pipe used in the assembly and lowered in the bored hole.

Gravel treatment of tubewell :

After the tubewell assembly has been lowered in the bore hole , gravel has to be inserted in the annular space between the well pipe and the bore hole.

The contractor shall make arrangements for gravel treatment with clean and washed gravel with uniformity co-efficient of 'two' or less and in that context 90 % of the gravel to be retained on the sieve mesh corresponding to the slot opening to be used in the tubewell.

The gravel filling should be started from the bottom of the bore hole and should be continuously worked upto 30 metres above the top level of the strainer. Thereafter, the gravel filling should be done from that point upto the ground level.

The contractor shall be paid for gravel treatment in forms of cubic metre of gravel right from the bottom of the borehole upto ground level irrespective of the position of the tubewell assembly.

11. **Verticality** :

The housing pipe shall be placed verticality inside the borehole and a tolerance of not more than 25 mm in 30 Metres in case of housing pipe will be permitted as deviation from the plumbs . Vertically test must be arranged by the contractor with standard equipment at his cost.

12. **Development of tubewell and yield test** :

Unless otherwise mentioned elsewhere of the tender document , the operation shall be as follows :
The contractor shall develop the tubewell by Air compressor and also by pumping with oversize turbine pump of 2 cusec capacity as per direction of EIC . The following procedure shall be strictly adhered to during development.

i) Air surging by Air compressor of not less than 320 cfm in capacity shall be intermittent and not continuous. air shall be sent for 10 minutes at a stretch followed by an equal period of shut down.

ii) After renewal of the silty materials an oversight turbine pump of the contractor shall be lowered into the tubewell & burging by pump shall be conducted in the same manner as in the case of Air compressor to remove any remaining silty materials. Pumping shall be prolonged before the aquifer performance test in conducted, so that the well may be cleared of all finer materials to give the maximum yield of water with a minimum draw down.

iii) The development shall be considered as complete when the exported discharge of water is fin the range of 10,000 gph to 20,000 gph (variation depending on the physical characteristics of the sub-station formation) is obtained from the tubewells and the water is free from sand at the operational test run with a tolerance of 10 PPM of sand by volume in a sample collected after an hour of continuous run.

The EIC or his authorised representative shall remain present during the process of development and shall have to issue a written completion certificate to the contractor that the development has been made as per clause 12 (iii)

13. **Final Test** :

After the tubewell has been satisfactory developed the contractor shall arrange to conduct and record the following tests and measurement at his own cost and equipment.

a) Static water level measurement by direct method before starting of pumping.

b) Discharge measured by use of orifice gauge or "V" notch weir after the development is completed;

c) The variation of water level during i.e. draw-down measured by use of depth gauge or directly with tape ;

d) Quantity of sand by use of standard measure glass as per clause 12 (iii) ;

e) Final measurement of tubewell assembly by sounding method . These tests have to be conducted under the supervision of EIC or his authorized representative ;

14. **Successful and unsuccessful tubewell** :

a) A successful site will be stipulated by the existence of at least 30 metres of good granular aquifer material on an average with slight marginal variations to be indicated by the EIC or his representative . In case of stipulated thickness of aquifer , the site will be treated as abandoned and only drilling cost will be paid ;

b) Department , however, reserves the right to order for lowering the tubewell assembly in to the borehole where the length of aquifer is less than 30 metres particularly in dry areas where any a quantity of discharge below minimum is considered beneficial for drinking purpose.

15. **Supervision** :

All works such as drilling, recording of formation log, designing of tubewell and its lowering . developing , gravel packing and conduction all tests as specified therein before must be conducted strictly under the supervision of the EIC or his authorized representative.

16. **Mode of Measurement** :

the contractor shall be paid an actual measurement of finished work on the basis of quoted rates. A minimum yield of 47,100 lph with maximum depression of 4.5 metros is to be

guaranteed by the contractor provided coarse or medium sand is tapped upto 30 metres. In cases the length of good water bearing strata as defined above is less, the guaranteed yield proportionately decrease . If inspite of full length of strata topped , the yield is less than the specified yield , deduction shall be made from the bill @ 100/- per 4500 lph upto 50% of the specified yield, beyond which it is rejected . In the event of the tubewell being rejected, the contractor shall be paid for the drilling charges only as per schedule of rates, and the pipe shall extruded by the contractor free of charges. In case any pipes are left in the wall, its cost will be recovered from the contractor. However , the EIC can waive off the deduction if he is satisfied that the contractor has taken due precautions and the snapping is not on account of negligence on the part of the contractor.

17. In course of execution of work, if it is felt by the EIC that additional works, not covered by the schedule of works have to be taken up, contractor shall take such additional works on written order of the EIC and the rates of such item should be treated as supplementary rates and should be worked out by the contractor and the EIC with final concurrence of the Superintending Engineer.

18. **Time Period** :

Time is the essence of the contract and the work has to be completed in all respect within the specified time from the date of work order.

19. **Warranty** :

For a period of 3 (three) months after the completion and acceptance of the work, the contractor shall be responsible for any defects which may under proper use, develop from faulty construction, design or workmanship of the work including defects in materials supplied by the contractor , erection and installation , the contractor shall remedy all such defects at his own cost when called upon to do so.

20. 75% payment will be made after the tubewell has been installed and satisfactory yield test has been given and its water has been accepted as being potable and bacteriological safe. 15% will be paid on satisfactory completion of the work in all respects i.e. after the removal of plants and materials from the work-site (both of contractor & the department) while 10% retained as security deposit which will be paid after the maintenance period is over. All damages as must be made good and the site is restored to its original condition after completion.

21. All rates quoted shall be inclusive of all taxes.