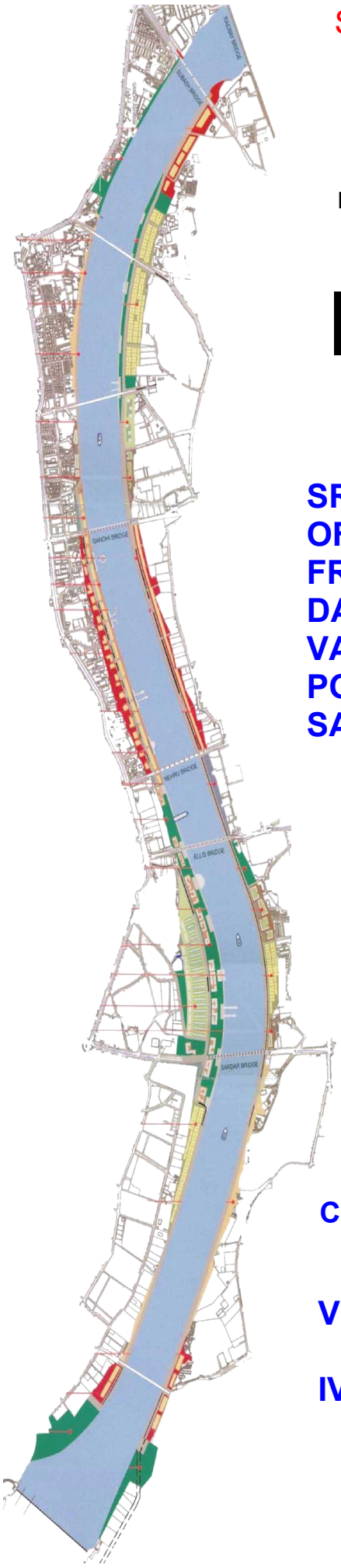
SABARMATI RIVER FRONT DEVELOPMENT



Sabarmati River Front Development Corporation Limited

2nd Floor, Riverfront House,
B/h H. K. Arts College,
Between Gandhi Bridge and Nehru Bridge,
Pujya Pramukh Swami Marg (River Front Road – West)
Ahmedabad - 380 009

BID DOCUMENT

SRFD PHASE 1 – CONSTRUCTION OF RESIDUAL SPACE ELEMENTS FROM VASNA BARRAGE TO DAFNALA ON EAST BANK AND VASNA BARRAGE TO TORRENT POWER ON WEST BANK OF RIVER SABARMATI

Contract Package: SRFDCL

VOLUME- 02

IV) Technical Specification

SECTION IV

TECHNICAL SPECIFICATIONS

SUB SECTION 4.1
TECHNICAL SPECIFICATION
FOR
CIVIL WORKS

GENERAL

The specifications to be followed for this work are the specification for road & bridges are published by the MORTH for relevant Items. This specification shall be supplemented by the technical specification as given here under in this document and also the provision in the relevant IRC & IS codes.

In case of any discrepancy or contradiction if any in the provision of above specification the order of the precedence shall be followed.

1. MORTH
2. IRC Provisions
3. Technical Specification in this Volume
4. IS Provisions
5. Sound Engineering Practice
6. Manufacture specification for special items

All work shall be carried out in confirmation with the above specifications. These specifications broadly cover all major aspects of the work involved. Minor details may not be specified here however if these are necessary for completion of work the contractor shall execute such minor items without any additions to the costs.

All work shall be executed in accordance with good engineering practices.

The Contractor shall remain responsible for workmen's compensation if any, when such case occurs, the contractor shall arrange for red lamps at night and fencing etc. shall be responsible for any damage of life and or property if any happen, during the execution of work. In case of dispute for unseen or overlooked items, the decision of Engineer in charge shall be final. The Contractor shall have to give site clean of all rubbish on completion of work and handover the bridge with final finishing as directed. All the rejected materials shall be removed from site within 24 hours by Contractor at his risk and cost.

The Contractor shall have to make his own arrangement for water required for the work.

If in the interest of SRFDCL, it is necessary to change either any site or the design of the proposed work the Contractor shall carry out the works and he will be paid at the rates quoted by him and no claim for extra for subsequent changes made, entertained.

The cubical contents of the cement bag shall be taken as per actual weight of bag and the Contractor shall have to prepare the concrete mixes using weigh batches.

Contractor will be fully responsible for compliance of the various provisions under Contract Labour Act, 1970 and the Rules framed there under.

Contractor is requested to procure their quarry materials required for construction work through legal sources i.e. only from the quarry lease holders permit holders or middleman who satisfies the contractor as to the legality of the source of purchase by him of these materials.

GENERAL DETAILS

All work shall be carried out in confirmation with these specifications. In general, provisions of Indian Standard, Indian Road Congress codes and other national standards shall be followed unless otherwise specified. These specifications are not intended to cover the minor details. The work shall be executed in accordance with best modern practices & all latest codes and standards referred to in these specifications shall be read in conjunction with the various other documents forming the contract, tender specifications, BOQ, contract drawings and other related documents.

Measurement and payments

a) The methods of measurement and payment shall be as described under various items and in Price Bid. Where specific definitions are not given, the methods described in MORTH will be followed. Should there be any detail of construction of materials which has not been referred to in the specifications or in Price Bid and drawings but the necessity for which may be implied or inferred there from, or which are usual or essential for the completion of the work in the trades, the same shall be deemed to be included in the rates quoted by the contractor in Price Bid.

b) Unacceptable work

All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the engineer in charge, the cost of repairs will be borne by the contractor and will be paid for the works actually carried out by him at reduced rates of the tendered rates, as may be considered reasonable by the engineer in charge, in the preparation of final or on account bills.

SPECIFICATION FOR CIVIL WORKS

1. The specification for various items of work shall be same as specified for such items in the MORTH SPECIFICATIONS FOR ROAD AND BRIDGE WORKS, latest published prior to 1 month before issue of tender.

2. The inclusions and exclusions from quoted rates are specified in the details of each item of work in the specifications and the Bill of Quantities. In case there is no specific mention of a particular detail, the mode of specification as prescribed in MORTH SPECIFICATIONS for such an item shall be followed.

3. In the event of contradiction between the MORTH specifications referred to above and this Contract document, the provisions of this Contract document shall prevail.

Applicable Standards
For
Civil Work

Section: A - Applicable Standards for Civil work

1	Conversion factors	IS:786
2	Method of measurement of building works	IS:1200
3	Code of practice for measurement of civil engineering works	IS:3385
4	Materials and workmanship for earthwork and excavation	IS:1200 (PART I)
5	Safety code for blasting and related drilling operations	IS:4081
6	Safety code for excavation work	IS:3764
7	Moisture content in sand for filling	IS:2720
8	Determination of moisture content	IS:2720 (PART II)
9	Determination of moisture content & dry density relation using light compaction	IS: 2720 (PART VIII)
10	Determination of dry density of soils in-place by the sand replacement method	IS:2720(PART XXVIII)
11	Determination of dry density of soils in-place by the core cutter method	IS:2720 (PART XXIX)
12	Anti termite treatment	IS:6313(PART I TO III)
13	Construction water	IS:456
14	Methods of sampling and test (physical and chemical water used in industry)	IS:3025
15	Ordinary (33 grade)/low heat Portland cement	IS:269
16	Ordinary Portland cement (43 grade)	IS:8112
17	Ordinary Portland cement (53 grade)	IS:12269
18	White Portland cement	IS:8042-E
19	Portland pozzolana cement	IS:1489
20	Rapid hardening Portland cement	IS:8041, IS:269
21	Portland (blast furnace) slag cement	IS:455
22	Hydrophobic cement	IS:8043
23	High alumina cement	IS:6452
24	Super sulphated cement	IS:6909
25	Oil well cement	IS:8229E
26	Standard for testing of cement	IS:650
27	Methods of physical tests for hydraulic cement	IS:4031
28	Specification for standard sand for testing of cement	IS:650
29	Coarse and fine aggregates for concrete	IS:383, IS:515
30	Gradation of coarse aggregates	IS:383(TABLEII)
31	Gradation of fine aggregates	IS:383 (TABLE III)
32	All-in aggregates	IS:383 (TABLE IV)
33	Method of tests for aggregates for concrete	IS:2386(PART I TO VIII)
34	Methods of determination the maximum qty. of deleterious materials in aggregate	IS:2386 (PART II)
35	Limiting values of the maximum quantities of deleterious materials in aggregate	IS:383 (TABLE I)
36	Flakiness index of aggregates	IS:2396 (PART I), IS:5640
37	Moisture content test for aggregates	IS:2386 (PART III)
38	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.	IS:432 (PART I & II)
39	Specification for plain hard drawn steel wire fabric for cement concrete	IS:1566

40	Specification for cold twisted steel bars for concrete reinforcement	IS:1786
41	Specifications for hot rolled mild steel and medium tensile steel deformed bars	IS:1139, IS:1739
42	Code of practice for bending and fixing of bars for concrete reinforcement	IS:2502
43	Mild steel binding wire	IS:280
44	Code of practice for welding of mild steel bars used for RCC	IS:2751
45	Code of practice for plain and reinforced concrete	IS:456
46	Code of practice for general construction of plain and RCC for dams	IS:457
47	Testing of reinforced cement concrete	IS:516
48	Method of tests for strength of concrete	IS:516
49	Methods of sampling & analysis of concrete	IS:1199
50	Code of practice for concrete structures for storage of liquids	IS:3370 (PART I TO IV)
51	Code of practice for composite construction	IS:3935
52	Code of practice for construction of reinforced concrete shell roof	IS:2204
53	Criteria for the design of RCC shell structures and folded plates	IS:2210
54	Specification for batch type concrete mixers	IS:1791
55	Specification for portable swing weigh batchers for concrete	IS:2722
56	Specification for roller pan mixer	IS:2438
57	Specification for concrete vibrators immersion type	IS:2505
58	Specification for screed board concrete vibrators	IS:2506
59	Specification for concrete vibrating tables	IS:222
60	Specification for pan vibrators	IS:3366
61	Specification for form vibrators for concrete	IS:4656
62	Code of practice for use of immersion vibrators for consolidated concrete	IS:3558
63	Air entraining agent	ASTM:6260
64	Criteria for design and construction of precast concrete trusses	IS:3201
65	Prestressed concrete	IS:1343
66	Specification for high tensile steel bars used in code of practice for pre-stressed concrete	IS:2090
67	Specification for plain hard drawn steel wire for pre-stressed concrete	IS:1785 (PART I)
68	Specification for plywood for concrete	
69	Shuttering work	IS:4990
70	Code of practice for steel tubular scaffolding	IS:4014 (PART I & II)
71	Specification for steel scaffolding	IS:2750
72	Safety code for scaffolds and ladders	IS:3696
73	Common burnt clay building bricks	IS:1077
74	Classification of burnt clay bricks	IS:3102
75	Burnt clay building bricks, heavy duty	IS:2180
76	Burnt clay facing bricks	IS:2691, IS:1077
77	Method of sampling and testing clay building bricks	IS:3495 (PART I - IV)
78	Mortar for brick work	IS:2250
79	Code of practice for brick work	IS:2221
80	Masonry works	IS:3466
81	Structural safety etc. Of building masonry walls	IS:1905
82	Load bearing hollow concrete blocks	IS:2185
83	Lime - cement - cinder hollow concrete blocks	IS:5498

84	Lime - cement - cinder solid blocks	IS:3115
85	Code of practice for construction of stone masonry	IS:1597 (PART I)
86	Stone tests	IS:1124
87	Code of practice for design and installation of joints in buildings	IS:3414
88	Joint sealing compound	IS:834
89	Pre-moulded bituminous joint filler	IS:1838
90	Timber door, window and ventilator frames	IS:4021
91	Material & workmanship for wood work	IS:883, IS:4021
92	Wooden flush door shutters (solid core type)	IS:2202 (PART I)
93	Timber panelled and glazed shutters	IS:1003 (PART I & II)
94	Method of tests for wooden flush doors, type tests	IS:4020
95	Plywood & tests	IS:303
96	General tests for wood work	IS:1659
97	Red lead for wood knot	IS:103
98	Oil type wood preservative	IS:218
99	Particle board	IS:3087
100	Transparent sheet glass for glazing & framing purposes	IS:1761
101	Resin bonded fiber glass	IS:3144
102	Putty for glazing	IS:420
103	Steel door frames	IS:4351
104	Steel window	IS:1361
105	Steel doors	IS:1038
106	Steel ventilators	IS:1081
107	Rolling shutters	IS:6248
108	Primer for steel doors, windows & ventilators	IS:102
109	Aluminium alloy for door/window frames	Dsgn Hea-WPO IS:733
110	Sections	IS:1948
111	Anodizing	BS:1616
112	Hydraulic lime & storage	IS:712
113	General tests for lime	IS:6932 (PART I TO X)
114	Field tests for lime	IS:1624
115	Lime mortar preparation	IS:1625
116	Slacked lime	IS:1639
117	Surkhi	IS:1344
118	Code of practice for application of lime plaster finish	IS:2394
119	Rough cast plaster	IS:1661(CLAUSE-165)
120	Specification for integral cement water proofing compounds	IS:2645
121	Water proofing asphalt/maxphalt	IS:702
122	Bitumen saturated layer	IS:1322
123	Bitumen felt	IS:1322
124	Bitumen	IS:702
125	Code of practice for laying and finishing of cement concrete flooring tiles	IS:1443
126	Material & workmanship for flooring	IS:1197, IS:1344
127	Code of practice for laying in situ terrazzo floor finish	IS:2114
128	Code of practice for laying in-situ cement concrete flooring	IS:2571
129	Mosaic tiles	IS:1237
130	Glazed earthenware tiles	IS:777
131	Marble chips & marble mosaic terrazzo	IS:2114

132	Plain cement tiles & tests	IS:1237
133	Marble mosaic tiles	IS:1237
134	Marble slab	IS:1130
135	PVC flooring tiles & sheets	IS:3461, IS:3462
136	Broken marble mosaic tiles	IS:1257
137	Oxy-chloride	IS:658
138	Magnesium chloride	IS:657
139	C.I. grid tiles	IS:210
140	Pigment for terrazzo flooring	IS:459
141	Rivets	IS:1148
142	Electrodes for welding	IS:814
143	Code of practice for use of electric arc welding for general construction in steel	IS:813
144	Tests for welding works	IS:1181
145	Welding works	IS:816
146	Bolts and nuts	IS:1367
147	Tests for bolts and nuts	IS:1608
148	Structural steel sections & tests	IS:226
149	Structural steel plates	IS:2062
150	Defects in structural steel	IS:229
151	Dimension & properties of steel section	IS:808
152	Structural steel work	IS:226, IS:4948
154	Expanded metal steel sheet	IS:412
155	Mild steel wire gauze jali	IS:280
156	Welding procedure & edge preparation	IS:823
157	Washers	IS:2016
158	Storage of welding wire & electrodes	IS:816
159	Primer to structural surface for bolts	IS:2074
160	Chequered plates	IS:3502
161	Code of practice for painting of ferrous metal in building and allied finishes	IS:1477 (PART I & II)
162	Distemper and dry color	IS:427
163	Code of practice for painting concrete, masonry and plaster surfaces	IS:2395
164	Distemper and oil emulsion	IS:428
165	Enamel paints	IS:2933
170	Coat of zinc chromate	IS:104
171	French spirit polish	IS:348
172	GI sheets	IS:227
173	Ac sheets	IS:459
174	Ac sheet fixing	IS:730
175	Mangalore pattern tiles	IS:654
176	Fiber glass reinforced polyester	IS:4154
177	Galvanized steel for barbed wire	IS:278
178	Insulation of hot water pipes, tanks & heat exchanger	BS:476
179	GI pipes & MS tubes	IS:1239 (PART I)
180	Screw down bib cocks & stop cocks	IS:781
181	Vitreous sanitary fixtures(general)	IS:2556 (PART I)
182	Gun metal wheel, globe, check, gate & non return valves	IS:778

183	Wash basin	IS:2556 (PART IV), IS:771
184	European W.C.	IS:2556, IS:771
185	Solid plastic seat & cover	IS:2548
186	Orissa pan W.C.	IS:2556 (PART III)
187	Squatting pans & traps	IS:2556 (PART III)
188	Indian W.C. (wash down W.C.)	IS:2556 (PART II), IS:771
189	Urinals	IS:2556 (PART VI)
190	Half round channels	IS:2556 (PART VII)
191	Specific requirements of siphonic wash down W.C.	IS:2556 (PART VIII)
192	Ss sink/C.I./flushing tank brackets	IS:775
193	C.I. siphonic flushing cistern	IS:774
194	Lead pipes	IS:404 (PART I)
195	Sand cast pipes & fittings	IS:1729
196	C.I. spun soil pipes & fittings	IS:3939
197	Gully trap	IS:651
198	Glazed stone ware pipes & fittings	IS:651
199	High pressure/crydon ball valve	IS:1703
200	C.I. sluice valve	IS:780
201	Capstan head	IS:1795
202	Malleable iron fittings	IS:1879 (PART I TO X)
203	C.I. pipes	IS:1536, IS:1537
204	Molten (pig)lead	IS:782
205	C.I. manhole frames & covers	IS:1726
206	Concrete pipes	IS:458
207	Threads for screwed pipes	IS:554
208	Lead jointing	IS:718
209	Carbon steel for pipes	IS:9161
210	Low level ceramic cistern	IS:774
211	Bowl pattern flat back urinals	IS:2556 (PART IV)
212	Showers	IS:2064
213	Heavy C.I. pipes	IS:1729
214	Concrete mix design	IS:10262
215	Code of practice for construction of floor and roof with joists and filler blocks	IS:6061 (PART I)
216	Code of practice for construction of light weight concrete block masonry	IS:6042
217	Specification for load bearing light weight concrete blocks	IS:3590
218	Code of practice for construction of hollow concrete block masonry	IS:2572
219	Specification for concrete masonry units (hollow and solid concrete blocks)	IS:2185 (PART I)
220	Chemical composition of ordinary Portland cement	IS:4032
221	Sulphate resistant cement	BS:4027 & ASTMC-150 TYPE II
222	Specifications for circular hollow sections	IS:1161
223	Properties of rectangular & square hollow sections	IS:4923
224	Cold formed welded & seamless carbon steel structural tubing	ASTMA 500
225	Cold but not formed welded & seamless carbon steel structural tubing	ASTMA 501

226	Hot formed welded & seamless high strength low alloy tubing	ASTMA 618
227	Hot rolled structural steel hollow section	BS:4848/
228	(Part 1) Code of Practice for design and construction of pile foundation concrete piles cast-in-situ bored piles.	IS: 2911
229	Recommendation for detailing of Reinforcement in Reinforced Concrete Works.	IS: 5525
230	Guidelines for dewatering during construction	IS: 9759 : 1981

Note: For the reference of all Codes and Standards, the latest version of the above specified Standards shall be followed, Wherever, such Standards are not specified for the construction materials, equipment and method, the relevant Indian Standard Codes of Practice shall be followed, in the absence of Indian Standards corresponding British Standard Codes of Practice or relevant American Standards shall be followed.

List of Approved Makes
For
Civil Work

Section B - List of Approved Make for Civil Works

Sr. No.	Material / Item	Make
1	Cement OPC	UltraTech, ACC, Ambuja, J.K Laxmi, Wonder, Sanghi, Hathi, Siddhi, Binani
2	Cement - White	J.K. White, Birla White
3	Admixture for Concrete	Fosroc, BASF, Mapei, STP Limited, MYK Arment, Chryso India, CAC, Fairmate, Pidilite, Sika
4	Reinforcement Steel: Main Producers only	TATA, RINL (VIZAG), SAIL
5	Concrete Curing Compound	Fosroc, Mapei, MYK Arment, Pidilite, STP Limited
6	Shuttering plywood	Greenply, Archidply, Duroply, Century, Greenlam
7	FRP shuttering	Technos-n-plastos , swastik FRP & GRC
8	Mould release agent	Fosroc, Pidilite, BASF, Sika
9	PVC pipe	Prince, Astral, Supreme
	WATERPROOFING WORK	
10	Waterproofing compound	Fosroc, Mapei, Pidilite, STP Limited, Chryso India, Asian, Sika, Burger
	PAINTING WORK	
11	Paint - Acrylic Emulsion (Exterior) and Primer	Asian Paints, Akzo Nobel (Dulux), Jotun, Berger, Nerolac, Birla Opus, Indigo, Nippon
12	Water & Stain repellent coating	Killick Guard Speciality Products Limited, Konstruktion Chemie, Dow corning, Wacker, Akemi, MYK Laticrete, Ardex Endura, Saint Gobain-Weber
	METAL WORK	
13	Structure Steel & Hollow Section - Producers only	SAIL, TATA (TISCO), RINL, Jindal Steel & Power (JSPL), APL Apollo tube, JSW
14	Steel (MS) rolled section & plate	TATA, Jindal, SAIL, RINL
15	Anchor Fastener, Rebar, Chemical/ Mechanical fastener, Expandable fasteners	Hilti, Fischer, Wuerth, fosroc, Mungo, AFT, Axel India, ITW, Power, Split, Trixel, Kilmas, Buildex
16	Non shrink cementitious precision (anchoring) grout	Fosroc, Sika, Mapei, Pidilite, BASF, MYK Arment, Ultratech, Ardex Endura, STP Limited
17	Polyester Powder coating/ PVDF Coating	Jotun, AkzoNobel (Internpon), Asian PPG

	EXTERNAL DEVELOPMENT WORK	
18	Tiles/ Stone fixing Adhesive (Only High-performance, polymer-modified, non-slip adhesive)	Ardex Endura, MYK Laticrete, KeraKoll, Saint Gobain - Webar, Roff, Mapei, Fosroc, Pidilite, Samrock
19	Epoxy Grout/ Cementitious Grout for Flooring	Ardex Endura, MYK- Latricrete, KeraKoll, Saint Gobain-Weber, Mapei, Roff, Ultratech
20	ACP sheet for signage	Alstone, Viva, Eurobond, Aludecor, Alucobond, Alstrong
21	Signage	Cosign, Vista
22	Vinyl Sticker and lamination for signage	3M
23	WPC board/ plank	Hardyplast, aakruti, Alstone Green India Private limited, Winstom

NOTE:

i All materials and products shall conform to the relevant standards (IS, EN, BS, ASTM, ISO, AS/NZS) and shall be of approved make and design.

ii The Architect shall give the approval of a manufacturer only after a review of the sample/ mock-up. In case the same is not available in the market or in case of change in trade name, equivalent makes/ re-designated manufacturer then an equivalent approved make shall be used with the approval of Architect. The complete system and installation shall also be in conformity with applicable Codes & Standards and Tender specifications.

iii Architect and Engineer-in-charge reserves the right to choose any of the approved as per this list.

iv In case of products not indicated in this list, the name of the manufacturer shall be given by the Architect and Engineer-in-charge.

Cement Consumption

Section C - Cement Consumption

No.	Item	Ratio/ Grade	Consumption per Unit	
A.	**CEMENT CONCRETE (OPC 53 grade Cement)**			
	BBCC (Volumetric)	1:5:10	2.60	Bags/m^3.
		1:4:8	3.40	Bags/m^3.
	PCC (Volumetric)	1:6:12	2.30	Bags/m^3.
		1:5:10	2.60	Bags/m^3.
		1:4:8	3.40	Bags/m^3.
		1:3:6	4.30	Bags/m^3.
	PCC (Controlled concrete)	M7.5	3.40	Bags/ m^3.
	PCC (Controlled concrete)	M10	4.70	Bags/m^3
	PCC (Controlled concrete)	M15	5.50	Bags/ m^3.
	RCC (Controlled concrete Minimum cement content as per IS - 456:2000)	M15	5.70 (285 Kg)	Bags/m^3.
		M20	6.0 (300 Kg)	Bags/m^3.
		M25	6.5 (325 Kg)	Bags/m^3.
		M30	7.0 (350 Kg)	Bags/m^3.
		M35	7.5 (375 Kg)	Bags/m^3.
B.	**MORTARS**			
	Cement and Sand mortar			
		1:1	20.4	Bags/m^3.
		1:2	13.6	Bags/m^3.
		1:3	10.2	Bags/m^3.
		1:4	7.60	Bags/m^3.
		1:5	6.2	Bags/m^3.
		1:6	5.0	Bags/m^3.
		1:8	3.83	Bags/m^3.
C.	**MASONRY WORK**			
	Brickwork in Cement sand mortar **(Conventional)**			
		1:3	2.55	Bags/m3.
		1:4	1.90	Bags/m3.
		1:5	1.56	Bags/m^3.
		1:6	1.27	Bags/m^3.
		1:8	0.95	Bags/m^3.
	Stone masonry, Coursed			

	1:3	3.06	Bags/m^3.
	1:4	2.28	Bags/m^3.
	1:6	1.50	Bags/m^3.
	1:8	1.18	Bags/m^3.
Stone masonry Uncoursed			Bags/m^3.
	1:5	2.04	Bags/m^3.
	1:6	1.65	Bags/m^3.
Half Brick work **(Conventional)**	1:3	0.29	Bags/m^2.
	1:4	0.21	Bags/m^2.
	1:5	0.17	Bags/m^2.

D. PLASTERING

10 mm. thick plaster in Cement mortar, on ceiling & soffit of stair, chajjas etc.			
	1:3	0.12	Bags/m^2.
	1:4	0.1	Bags/m^2.
15 mm. thick single coat plaster in on walls			
	1:3	0.17	Bags/m^2.
	1:4	0.13	Bags/m^2.
20 mm. thick plaster in Cement mortar, on unfair side of brick in single coat			
	1:3	0.23	Bags/m^2.
	1:4	0.17	Bags/m^2.
20 mm. thick plaster in Cement mortar, on unfair side of brick in double coat (First coat 15mm in 1:4 and second coat of 5mm in 1:3)		0.18	Bags/m^2.
20 mm. thick Sand Face plaster (First coat 15mm in 1:4 and second coat of 5mm in 1:2)		0.22	Bags/m^2.
15 mm. thick Water Proof plaster in 1:3 Cement mortar		0.21	Bags/m^2.
Neat Cement finishing		0.044	Bags/m^2.

E. POINTING

Flush, Grooved or Struck in Cement Brick masonry			
	1:1	0.092	Bags/m^2.
	1:2	0.046	Bags/m^2.
	1:3	0.03	Bags/m^2.
	1:4	0.023	Bags/m^2.
Flush, Grooved or Struck in Cement Random Stone masonry			
	1:3	0.023	Bags/m^2.

F. FLOORING

	Precast Mosaic Tiles of 40mm thk. in cement mortar 1:6		0.30	Bags/m².
	20mm thk. Green Kotah/Granite Stone in flooring, skirting & dado of 50mm thk. in cement mortar 1:6		0.50	Bags/m².
	20 mm thick. Green Kotah/ Granite Stone in Risers and Treads		0.50	Bags/m².
	20 mm thick. Double Polished Kotah/Granite Stone		0.50	Bags/m².
	25mm thick. Rough Kotah, Dholpur, Red Mandana, Bansipahadpur stone etc. in flooring, skirting & dado of 50mm thk. in cement mortar 1:6		0.50	Bags/m².
	Glazed Tiles, Ceramic tiles, vitrified tiles flooring in 25 mm thick. Bedding of C:M 1:6		0.20	Bags/m².
	Glazed Tiles, Ceramic tiles, vitrified tiles dado in C:M 1:1		0.20	Bags/m².
	China mosaic with 25 mm bedding mortar in C:M 1:6		0.22	Bags/m².
	18-20mm Marble, Granite, Jesalmer Slab with avg. 50mm bedding mortar in cement mortar 1:6		0.50	Bags/m².
	I.P.S.	40 mm. thick	0.35	Bags/m².
		50 mm. thick	0.40	Bags/m².
		75mm. thick	0.55	Bags/m².
	115mm water proofing plaster		0.40	Bags/m².
	Brick-on-edge		0.12	Bags/m².
	Wet stone cladding in C:M 1:2		0.2	Bags/m².
	Chemical water proofing 3 coats		0.05	Bags/m².
	Sandwich platform		0.5	Bags/m².
G.	**MISCELLANEOUS**			
	Filling Zaris with			
	C.M.	1:3	5.0	Bags/ 100 m.
	C.C	1:2:4	3.2	Bags/100 m.
H.	**ROADWORK**			
	Precast exposed Curbs M20	1:2:4	35	Bags/100 m.
I.	**SANITARY WORK**			
	R.C.C Hume pipes jointed with Cement mortar 1:1			
		600 mm. dia.	6.4	Bags/100 m.
		450 mm. dia.	4.8	Bags/100 m.
		300 mm. dia.	2.2	Bags/100 m.
		230 mm. dia.	1.8	Bags/100 m.
		150 mm. dia.	1.2	Bags/100 m.
		100 mm. dia.	1.0	Bags/100 m.

SW pipes jointed with Cement mortar 1:1			
	300 mm. dia.	12.94	Bags/100 m.
	230 mm. dia.	9.74	Bags/100 m.
	150 mm. dia.	6.56	Bags/100 m.
	100 mm. dia.	4.34	Bags/100 m.
Fixing wall hung type WC		0.1	Bag/no.
Fixing Urinal/s.		0.2	Bag/no.
Half Round Channel 100 mm.		15.86	Bags/100 m.
Fixing 100 mm. dia. SW Gully Trap		0.5	Bag/no.

Note: For the items not covered in above list, CPWD co-efficient shall be followed or proportionate from CPWD co-efficient, or actual consumption shall be checked in the beginning, during execution of item in consultation with EIC.

Material Specifications - Civil Works

Section D - MATERIALS SPECIFICATIONS – CIVIL WORKS

In the Technical specification document wherever "CPWD specifications" is mentioned, the same shall be considered as technical specifications from "CPWD specifications, volume 1 & 2 – 2009 published by DIRECTOR GENERAL OF WORKS, CPWD, NIRMAN BHAWAN, NEW DELHI". The Explanatory Notes and comments mentioned in the above referred book shall be ignored and shall not be considered as part of technical specifications.

1. In the specifications, "as directed" / "Approved" shall be taken to mean "as directed" / "approved" by the Architect and Engineer-in-charge.

2. Wherever a reference to any Indian Standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.

3. In "Mode of Measurement" in the specifications wherever a dispute arises in the absence of specific mention of a particular point or aspect, the provisions on these particular points, or aspects in the relevant Indian Standards shall be referred to.

4. All measurements and computations, unless otherwise specified, shall be carried out nearest to the following limits:

   Length, width and depth (height) – 0.01 Metre.
   Areas – 0.01 Sq.Mt.
   Cubic Contents – 0.01 Cu.Mt.

5. The distance which constitutes lead shall be determined along the shortest practical route and not necessarily the route actually taken. The decision of the Engineer – in – charge in this regard shall be taken as final.

6. Where no lead is specified, it shall mean "all leads"

7. Lift shall be measured from Ground Level.

8. Reference to specifications of materials as made in the detailed specifications of the items of work is in the form of a designation containing the number of the specifications of the material and prefix "M" e.g. "M-5"

9. Approval to the samples of various materials given by the Engineer – in – charge shall not absolve the contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Engineer – in – charge.

10. The contract rate of the item of work shall be for the work completed in all respects.

11. No collection of materials shall be made before it is not approved from the Engineer-in-charge.

12. Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign

matter and to ensure the preservation of their quality and fitness for the work.

13. Materials, if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.

14. No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of the various components of the structure.

15. All works shall be carried out in a workmanlike manner as per the best technique for the particular item.

16. All tools, templates, machinery and equipment for correct execution of the work as well as for checking lines, levels, alignment of the works during execution shall be kept in sufficient numbers and in good working condition on the site of the work.

17. The mode, procedure and manner of execution shall be such that it does not cause damage or over loading of the various components of the structure during execution or after completion of the structure.

18. Special modes of construction not adopted in general engineering practice, if proposed to be adopted by the contractor, shall be considered only if the contractor provides satisfactory evidence that such special mode of construction is safe, sound and helps in speedy construction and completion of work to the required strength and quality. Acceptance of the same by the Engineer-in-charge shall not, however, absolve the contractor of the responsibility of any adverse effects and consequences of adopting the same in the course of execution of completion of the work.

19. All installations pertaining to water supply and fixtures thereof as well as drainage lines and sanitary fittings shall be deemed to be completed only after giving satisfactory tests by the contractors.

20. The contractor shall be responsible for observing the rules and regulations imposed under “Minor Minerals Act” and such other laws and rules prescribed by Government from time to time.

21. All necessary safety measures and precaution (including those laid down in the various relevant Indian Standards), shall be taken to ensure the safety of men, materials and machinery on the works as also of the work itself.

22. Contractor shall submit the test reports for every material carried out at recognized laboratory technical institute or laboratory. Many certificates for such test shall not be considered. The testing charges of all materials shall be borne by the Contractor.

23. Approval to any of the executed items for the work does not in any way relieve the contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specifications

24. Contractor shall set up testing laboratory on site. Laboratory shall be equipped with minimum following equipments / instruments.

- Beaker-Measuring Cylinder

- Flakiness Index
- Elongation Index
- Aggregate Impact Value
- Oven
- Slump Cone
- Concrete cube testing Machine
- Concrete Test Cubes
- Vicat Apparatus
- 90 micron Sieve
- Mortar Cube Mould
- Plate Vibrator
- Micrometer Screw
- Varner Callipers
- Thermometer
- 5 kg- Weigh Scale /Balance
- Electronics Balance – 20 kg
- 300 kg- Weigh Scale /Balance
- Core cutter set
- Mortar Mixture
- Casagrande Apparatus
- Welding gauge
- Dye penetration material-set
- Pycnometer
- Proctor mould
- GI tray/ Ceramic tray
- Distilled Water
- Wire basket
- PH meter
- TDS meter
- IS 1852
- Electronic vernier
- Welding gauge
- Theodolite
- Auto Level/ Staff

25. In case of any discrepancy or contradiction if any in the provision of above specification the order of the precedence shall be followed.

Technical Specification in this Volume
IS Provisions
MORTH and CPWD Specification
IRC Provisions
Sound Engineering Practice
Manufacture specification for special items

26. Unacceptable work

All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost. In the event of such works being accepted by carrying out

repairs etc. as specified by the engineer in charge, the cost of repairs will be borne by the contractor and will be paid for the works actually carried out by him at reduced rates of the tendered rates, as may be considered reasonable by the engineer in charge, in the preparation of final or on account bills.

M-1 Water

1.1 CPWD specifications clause no. 3.1.1 shall be followed.
1.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

M-2 Lime

2.1 CPWD specifications clause no. 3.1.3 shall be followed.

M-3 Cement

3.1 CPWD specifications clause no. 3.1.2 shall be followed.
3.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

3.2.1 Reduction of strength of cement with passage of time
Reduction of strength at 28 days of concrete made from fresh and stored cement

Sr. No.	Storage Period of Cement	Strength Reduction
1.	Fresh	NIL
2.	3 months old	20%
3.	6 months old	30%
4.	12 months old	40%
5.	24 months old	50%

3.3 Stored cement can be used only upto the 3 months from the date of manufacture. After 3 months cement is to be used after prior permission of the consultant.

M-4 White Cement

4.1 The white cement shall conform to IS: 8042-E.

M-5 Coloured Cement

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

5.2 The pigments used for coloured cement shall be of approved quality and its quantity shall not exceed 10% of the cement used in the mix. The mixture of pigment and cement shall be properly ground to have a uniform colour and shade. The pigments shall have such properties as to provide for durability for colour under exposure to sunlight and weather.

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

M-6 Sand

6.1 CPWD specifications clause no. 3.1.4 shall be followed.
6.2 CPWD specifications chapter 3 Mortars - List of Mandatory Tests shall be followed.

M-7 Stone Dust

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

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

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

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

M-8 Stone Grit

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

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

IS Sieve Designation	% passing Through sieve	IS Sieve Designation	% by weight passing through sieve
12.50 mm.	100%	4.75 mm.	0-20%
10.00 mm.	85-100%	2.36 mm.	0- 5%

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

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

M-9 Cinder

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

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

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

IS Sieve Designation	% Passing	IS Designation	% Passing
20 mm.	100	4.75mm	70
10 mm.	86	2. 36 mm	52

9.4 Density of cinder shall be 900 Kg / cum or as approved by structural consultant.

9.5 Material shall be non-hazardous and suitable as per relevant IS code.

M-10 Lime mortar

10.1 CPWD specifications clause no. 3.2.1 shall be followed for lime mortar instead of cement mortar.

M-11 Cement Mortar

11.1 CPWD specifications clause no. 3.2.1 shall be followed.

M-12 Coarse Aggregate

12.1 CPWD specifications clause no. 4.1.1 shall be followed.

M-13 Murrum

13.1 Murrum or the selected earth shall be brought from outside, as indicated in the item. The selected earth shall be good yellow soil and shall be got approved from the Engineer-in-charge. In no case, Black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones, or brick bats. The clods shall be broken to a size of 50 mm. or less. It shall be of good binding quality and of approved quality obtained from approved pots/quarries of disintegrated rocks which contain silicones materials and natural mixture of clay of cal carious origin. Contractor shall make his own arrangement, at his own cost, for land for borrowing selected earth. The staking of the material shall be done as directed by Engineer-in-charge, in such a way as not to interfere with any constructional activities and in proper stacks.

M-14 Stone

14.1 The stone shall be of specified variety such as Granite/ Trap Stone/ Quartz or any other type of good hard stones.
The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with IS:1124. The minimum crushing strength of the stone shall be 200 Kg/cm^2. Unless otherwise specified.

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

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

M-15 Brick Bat coba

15.1 Brick Aggregate shall be obtained by breaking well burnt or over burnt dense bricks / brickbats. They shall be homogeneous in texture, roughly cubical in shape and clean. They shall be free from unburnt clay particles. Soluble salt, silt, adherent coating of soil, vegetable matter and other deleterious substances such aggregate should not contain more than one percent of sulphates and should not absorb more than 10% of their own mass of water, when used in cement concrete and 20% when used in lime concrete. It shall conform to IS : 306 – 1983 unless otherwise specified.

M-16 Chemical Admixture

16.1 CPWD specifications clause no. 4.1.2 shall be followed.

M-17 Steel for reinforcement

17.1 CPWD specifications clause no. 5.1.3 shall be followed except chairs, separators etc. will be measured and paid under this item.

M-18 Annealed/GI Binding Wire

18.1 The Annealed/GI wire shall be of 16 gauge (1.63 mm), 18 gauge (1.22mm) or 20 gauge (1 mm) or as specified in the item conforming to relevant latest IS.

18.2 It shall be free from rust, oil paint, grease, loose mill scale or any other desirable coating which may prevent adhesion of cement mortar.

M-19 Polyurethane Foam Filler

19.1 Polyurethane from filler shall be Capcell HD-100 of Supreme or equivalent. It should comply with ASTM–D-3575/ Highway clause 1015/ BS-5628 Part-3. It should be semi-rigid, UV resistant, high performance laminated closed cell polyethylene foam joint filler in sheet form.

19.2 The density of polyurethane shall be 100Kgs/ cum. The water absorption should be 0.08% max. The operating temperature of foam filler should be between -40 c to +100 c.

19.3 It should be bitumen free and chemical resistant. It should possess excellent recovery after compression.

19.4 If gap of expansion joint should be more than 50mm, use two board of required thickness joint with adhesive by manufacturer only.

M-20 Polysulphide Sealant

20.1 The polysulphide sealant shall be of Sika, Fosroc, Mccoy Soudal, Pidilite or equivalent as approved by the architect or engineer-in-charge. It shall conform to relevant IS codes.

20.2 It shall be a two-component polysulphide sealant. The mix ratio of both the parts should be as per manufacture's specification. It should not contain chloride or other corrosive substance.

20.3 It shall be pourable or gun grade.

20.4 It shall be used for sealing joints in water retaining structures, buildings, roofs, external walls, cladding, concrete highways, airport runways, bridges, parking and cargo areas and buildings. It shall have excellent adhesion to wide range of building materials like Aluminium, Stainless Steel, Glass, Concrete, Marble, Stone, Brick, Masonry block, Plaster, Ceramic and quarry tiles, Timber etc.

20.5 It should accommodate continuous and pronounced cyclic movements. Material should be low in shrinkage, UV resistance, water resistant to bio-degradation. It should be water resistant to occasional spillage of dilute acids, alkalis, petrol, aviation fuels, diesel, kerosene, lubricating oils etc. It should be non-toxic.

20.6 The density of the material should be 1.58 ± 0.03 Kg / ltr. The pot life should be more than 2 hrs. at 30ºC. Shore A hardness should be 16 to 22 after complete curing. Movement accommodation should be 25% for butt joints and 50% for lap joints. Joint size should be 5 to 50 mm. and depth to width ratio should be 1:2 (min). For joints with skew movement the ratio shall be 1:1

M-21 Expansion Joints – Copper Strips & Hold Fasts

21.1 The item provided for expansion joints in RCC frame structure, for internal joint as well as for exposed joints, with the use of necessary copper strip and holdfasts.

21.2 Copper sheet shall be 1.25 mm. thick and 125 mm width and shall be of U shape in the middle. Copper strip shall have holdfast of 3 mm. diameter copper rod 25 cm long soldered on the strip at intervals of about 30 cm. or as shown in the drawing or as directed. The width of each flange (horizontal side), to be embedded in the concrete work shall be 25 mm. Depth of `U' to be provided in the expansion joint, in the copper plate shall be of 25 mm.

M-22 Shuttering Material

All shuttering materials which are in contact with concrete surfaces, used material brought from other projects shall not be permitted.

M-22A Timber / Wooden Planks

22A.1 Timber / wooden planks and timber bracing, scaffolding shall conform to IS: 883. The shuttering shall be either of wooden planking of 30 mm. minimum thickness with or without steel lining or steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical ballies properly cross braced together, so as to make the centering rigid. In place of ballie props, brick work of adequate section built in mud mortar may be used to support the arch after approval of EIC.

22A.2 The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration, live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout

22A.3 If at any stage of work, during or after placing concrete in the structure, the form work sag or bulge out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge and Architect, before the reinforcement bars are placed in position.

22A.4 The props shall consist of ballies having 100 mm. minimum diameter, measured at mid length and 80 mm. at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plate 40 mm. thick and minimum bearing area of 0.10 m^2. laid on sufficiently hard base.

22A.5 Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

22A.6 The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planned on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

22A.7 As far as possible, clamp and ties shall be used to hold the forms together and use of nails and spikes shall be avoided.

22A.8 The surface of timber shuttering that would come on contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacture may be applied in place of soap solution. In case of steel shuttering, either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances, black or burnt oil shall be permitted.

22A.9 The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) as per structural drawing or as directed by engineer-in-charge, so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the project length structural drawing or as directed by engineer-in-charge.

M-22B Concrete Shuttering Plywood (laminated or non laminated)

22B.1 Plywood shall conform to IS 4990. It shall be made from strong and selected hard-woods. It shall be bonded with high quality Phenol Formaldehyde synthetic resin adhesive, hot pressed and then shall be further treated with a permanent type of preservative by vacuum-cum-pressure impregnation.

22B.2 Due to the bonding with Phenol Formaldehyde, it shall be moisture and weather proof. The use of selected hard-woods renders hard and wear-resistant faces and thereby it shall be reusable several times. It shall be highly resistant to rot, termites and other wood inhabiting insects. Due to complete penetration of the preservative, it shall be exceedingly durable.

22B.3 It shall have high impact strength and therefore shall be used successfully in place of timber planks and steel sheets. It shall protect the concrete from rapid temperature changes and shall provide optimum conditions for setting of the concrete. As it shall possess remarkable design flexibility, it shall be ideal for curved formwork.

22B.4 Besides it shall be used as centering, shuttering and formwork of concrete columns, beams, slabs, walls, tanks, bridges, fly-overs, silos etc. It shall also be used for structural applications like external walling, roofing, flooring, curtain walls, work-site offices, in cabins of trucks, rail coaches etc.

M-22C Steel Shuttering and Steel Plates

22C.1 Steel shuttering plates shall conform to IS 8500, IS 2062, and IS 1977. Steel sheeting and steel plates should be free from crimps, twists, offsets, warps, etc. Their surface should be neat, clean and smooth. Before placing concrete, steel forms shall be thoroughly cleaned off of all rust, dust and loose materials. Colourless oil or grease of approved quality shall be applied before placing steel.

22C.2 The size of rolled steel sections, tubular steel section used for framing and bracing of steel plates should be sufficient to withstand the weight of concrete without forming crimps, twists, offsets, warps, etc. in the steel plates. Also, the gauge of steel sheeting used should not be less than 2 mm.

22C.3 Minimum two bracing angles should be provided along with angle framing while making the steel plates. It should be riveted for non-exposed concrete or welded for exposed concrete finished concrete. Minimum two rivets should be provided at all Four Corners and at junction of angle framing and bracing.

22C.4 If the plates are to be welded, steel sheet and angle framing/bracing should be welded from sides and at back. Welding on sides should be buffed to make the sides smooth. Also, intermittent welding should be done to keep steel sheet and angle framing/bracing in one plane

M-23 Brick

23.1 CPWD Technical specifications clause no. 6.1 shall be followed

M-24 Bricks for exposed work

24.1 Bricks for exposed work shall be first class brick conventional bricks with size of 228 X 107 X 75 mm. Bricks are to be laid such that ten layers of brick laid in mortar shall form masonry of 1 m. height.

24.2 The weight of the bricks should be 3 Kgs water absorption for each brick shall not more than 12% of the total weight of the brick.

24.3 These bricks are manufactured from good quality plastic earth, which is free from saline deposits. They are of good uniform colour. They are well burnt, giving a hard ringing sound when two bricks are struck together.

24.4 They should have straight edges and even surfaces. They are free from cracks, flows, nodules of free lime wrap age and organic matter.

24.5 The bricks shall have plane rectangular faces with parallel sides and sharp straight right-angled edges. Bricks should have uniform colour and even texture.

24.6 When immersed in water for an hour, they do not absorb water more than 1/6th of their weight. On drying, these bricks do not show any sign of efflorescence.

24.7 Average Compressive strength of the bricks shall be more than 65 Kg / cm² either wire cut or hand moulded as directed by the Architect or engineer-in-charge.

24.8 Unless otherwise specified machine moulded bricks shall be used. Selected hand moulded hand bricks are to be used if it is specified. As far as possible total requirement of facing bricks for a work shall be arranged from the same kiln. Bricks with chipped edges and corners shall not be used.

M-25 Calcium Silicate Bricks

25.1 The bricks shall conform to IS 4139. The Calcium silicate bricks shall be sound, compact and uniform in shape. Bricks shall be free from visible cracks, warpage, organic matter, large pebbles and nodules of free lime. Bricks shall be solid and with or without frog. The bricks shall be made of finely grounded sand siliceous rock and lime. In addition, a limited quantity of fly ash conforming to IS 3812 may be used in the mix. These bricks are also known as Fly Ash Sand Lime bricks in the construction industry.

25.2 The bricks shall be machine moulded and have smooth rectangular faces with sharp corners and shall be uniform in size, colour and shape. The size of bricks shall be 228 mm x 110 mm x 72 mm or as approved by the Architect. The compressive strength of bricks shall be minimum 150 kg/$m^{2.}$ and the bricks shall have very high strength to weight ratio. The bricks shall have very good resistant capacity to atmospheric conditions, optimum building properties in relation to heat insulation, sound insulation, absorption of water and fire protection.

25.3 Calcium silicate products shall conform to the appropriate IS standards and there shall be no change required in civil application techniques while using such products in the place of traditional clay bricks.

M-26 Glass Brick

26.1 It shall be KIG Indonesia or equivalent as approved by the Architect and Engineer-in-Charge.

26.2 It shall be free from any defects like, cracks, air bubbles, uneven surface, breaks etc. During handling and laying, its edges shall not be damaged. All edges and corners of all faces shall be sharp and well shaped. It shall be of size and colour as specified in the item or as approved by the Architect. The glass bricks shall be of uniform size and tolerance of +2 mm. shall only be allowed in dimensions of glass brick. Spots of colour other than that of bricks or in bricks shall not be allowed. The weight of each brick shall be about 2.75 kg.

26.3 The transmission of direct light through brick shall not be less than 40%. The glass brick shall have good thermal insulation. It shall be sound proof and vibration absorber having adequate compressive strength. If bricks with groove or projections shall be used, the groove or projections shall be uniform and regular in size & shape.

M-27 Cement Concrete Hollow Block

27.1 Hollow concrete blocks shall be of size such that they can be bonded with brick masonry, if necessary. The blocks are generally referred by their nominal sizes which include the block and an allowance for joints. The block shall have one or more large holes or cavities which either pass through the block or do not effectively pass through (in case of closed cavity) and shall have the total solid material between 50 to 75% of the total volume of the block, calculated from the overall dimensions. In case of solid blocks, the solid material shall not be less than 75% of the total volume of the block.

27.2 The shell thickness of the blocks shall be not less than 65 mm., in any part, however based on the strength requirements, the thickness can be varied between 20 mm. to 50 mm., as follows:

Nominal block face width.	Shell thickness minimum.	Web thickness minimum.
100 or less	25	25
Over 100 to 150	25	25
Over 150 to 200	30	25
Over 200	35	30

All the above dimensions are in mm.

27.3 The volume of concrete shall not be less than half the gross volume of the block. The total width of the cavities shall not be less than 2/3rd of the overall thickness of the block. The maximum variation in the length of the blocks shall not be more than $\pm$ 5 mm. and maximum variation in height and width shall not be more than $\pm$ 3 mm.

27.4 Hollow blocks are manufactured by special machines. Casting is done in a single operation. Concrete shall be thoroughly compacted in the moulds with blunt end steel rods or vibrators or by using vibrating tables. Ordinary concrete mix 1:2:4 of very low water/cement ratio is used and shall be mixed as described in the section no. 2.00 of plain and reinforced concrete. Additives or admixtures shall be used such as a) Accelerating, water-reducing and air-entraining admixtures, b) Water-proofing agents, etc. High compressive strength and very dry consistency enables to remove the blocks for curing, immediately after casting. In case of manual compaction, the mixture shall be placed into the mould, in layers of about 50 to 75 mm. and each layer is thoroughly tamped until the whole mould is filled up and struck off level with a trowel. In case of mechanical compaction, the mould shall be filled up to overflow, vibrated or mechanically tamped and struck off level. Steel wire may be embedded in each block while casting. Rapid hardening cement may be used. After demoulding, the blocks shall be protected until they are sufficiently hardened to permit handling without damage. The blocks shall be thoroughly cured for atleast 14 days and shall be dried out for a period of 4 weeks, before placing. They shall be stacked with voids horizontal to facilitate thorough passage of air. The blocks shall be allowed to complete their initial shrinkage before placing. Water absorption shall not be more than 10% by mass.

27.5 Hollow blocks have better thermal properties than solid blocks. Further hollow blocks made from light weight concrete have still better insulation against heat. They shall conform to the following three grades:

Grade A - They shall be used as load bearing units and shall have a min. block density of 1500 Kg/m^3. They shall possess min. average compressive strength of 35, 45, 55 and 70 Kg/cm^2. respectively, for its sub-category, at 28 days.

Grade B - They shall be used as load bearing units and shall have block density less than 1500 Kg/m^3. but not less than 1000 Kg/m^3. They shall possess min. average compressive strength of 20, 30 and 50 Kg/cm^2. respectively, for its sub-category, at 28 days.

Grade C - They shall be used as non-load bearing units and shall have block density less than 1500 Kg/m^3. but not less than 1000 Kg/m^3. They shall possess min. average compressive strength of 15 Kg/cm^2. at 28 days.

Grade D - Solid Concrete Blocks - They shall be used as load bearing units and shall have block density not less than 1800 Kg/m^3. They shall possess min. average compressive strength of 75 to 100 Kg/cm^2. respectively, for its sub-category, at 28 days.

27.6 They shall have a variety of surface textures ranging from very fine close texture to a coarse open texture, by proper selection, grading and proportioning of the aggregates. Further the texture shall be developed by treating the surface while the units are still green. Colour shall be rendered by adding non-fading mineral pigments.

27.7 Well made units shall not require plaster, in case of unimportant buildings. Two or three coats of cement paint shall be sufficient to render the masonry resistant to rain water. However, if plaster is intended, the

unit shall have a sufficiently rough surface to afford good key to the plaster. Water-proofing admixtures shall be used in the plaster.

M-28 Cement concrete Solid Block

28.1 A block shall be considered to be solid if the solid material is more than 75% of the total volume of the block calculated from over all dimensions.

28.2 The size other than those specified in the item description may be used with the approval of the Architect and engineer-in-charge.

28.3 The blocks may be machine made. The concrete mix the mixing of concrete, the manufacturing of blocks, curing and drying shall be accordance with para-6 to 10 of IS: 2185-1967.

28.4 Faces of blocks shall be flat and rectangular. Surface finish shall be render smooth or plastered with CM 1:3 (1 cement: 3 coarse sand) as directed. The payment for the rendering shall be included in this item.

28.5 The average compressive strength of 8 blocks, when determined in the manner described in IS: 2185-1967, shall not be less than 50 Kg/cm^2 of gross area. The lowest strength of an individual block shall not be less than 75% of average compressive strength of the 8 blocks.

28.6 Concrete blocks shall be stored and stacked properly in such a way to avoid any contact with moisture at site. They shall be stock plied on planks or other supports free from contact with ground and covered to protect against wetting.

M-29 Stone (For Rubble Masonry)

29.1 CPWD specifications clause no. 7.1.1, 7.1.2 shall be followed.

M-30 Perlite Aggregate

30.1 The Perlite shall be from Amol Dicalite or equivalent as approved by the Architect and Engineer-in-charge.

30.2 Perlite shall conform to ASTM C-332-61.

30.2 Perlite is naturally occurring siliceous volcanic rock, which when heated in excess of 870 C expands four to twenty times its original volume and its transformed into lightweight glass like particles containing countless sealed cells. This unique structure accounts for its superior insulating characteristic.

30.3 It is light weight aggregate which when combined with Portland cement and water produces an ultra light concrete that is used for insulating roof decks, lightweight floor fills, insulating structural rock decks, curtain wall systems and for variety of permanent insulating applications.

30.4 It shall have sintering temperature and melting point about $2300^{O}F$ and $2400^{O}F$, respectively. The specific heat and specific gravity of minerals shall be 0.2 and 2.6 respectively. The mineral should possess pH value of 7.0 and cation exchange rate 90 to 100 milli equivalent per 100 grams. The thermal conductivity K shall be 0.43-0.45 Btu.

30.5 The mineral should be incombustible and capable to withstand temperature upto $1100^{O}C$ to give effective insulation. It shall be insoluble and inert to organic solvents having cold crushing strength at least 250 Psi. The air contraction at maximum service temperature shall be less than 1%.

M-31 Water Proofing Compound

31.1 The water proofing compound shall conform to IS 2645-latest version. It should be chloride free, corrosion inhibitor, Hydrophoper and water reducer. It shall be compatible with all types of cement. It should be able to reduce water absorption and dampness. It shall be highly water-tight against water

head pressure. It shall be able to reduce efflorescence, salt petering, and fungus growth. It shall be of approved make as approved by Architect.

31.2 It should be non-flammable, non-toxic and eco-friendly. It should be able to reduce shrinkage. It should be able to increase plastic workability.

M-32 Ex-foliated Vermiculite

32.1 Ex-foliated Vermiculite should be of approved make as directed by the engineer-in-charge.

32.2 Ex-foliated Vermiculite shall be 100% natural, non-fibrous, light weight material. It can be used for thermal insulation, acoustic treatment and fire resistance.

32.2 Vermiculite shall be formed by hydration of certain basaltic material. Vermiculite shall be natural mineral that expands with the application of heat.

32.3 It shall be possible to reduce the heat transfer. Heat energy can be transferred by conduction, convection, radiation. The material shall be such that it should maintain acceptable temperature throughout the building and makes the building well-insulated as per manufacture's specification.

32.4 It shall be hydrated laminar natural mineral having, Aluminum-Iron, Magnesium Silicates as content and shall consist of thin flat flakes, containing innumerable microscopic voids and layers. It shall have physical properties like chemical inertness, light weight, fire and rot proofness, porosity, non-abrasive nature, flakiness etc.

32.5 It shall have centering temperature and melting point about 1260ºC and 2400^{O}F, respectively. The specific heat and specific gravity of minerals shall be 0.2 and 2.6, respectively. The mineral should possess pH value of 7.0 and cat ion exchange rate 90 to 100 milli equivalent per 100 grams. The thermal conductivity K shall be 0.43-0.45 Btu. It shall have bulk density 6 Kg.c.ft.

32.6 It shall be mixed with cement in 6:1 ratio by volume and requisite water or as per manufacture's specification.

32.6 The mineral should be incombustible and capable to withstand temperature upto 1100^{O}C to give effective insulation. It shall be insoluble and inert to organic solvents having cold crushing strength at least 250 Psi. The air contraction at maximum service temperature shall be less than 1%.

M-33 Precast Terrazzo Tile

33.1 Terrazzo tile shall generally conform to IS: 1237. Unless otherwise specified tiles shall be supplied with initial grinding and grouting of wearing layer. The size of the tiles shall be as per the drawing. Half tiles for use with full tiles shall be such as to make two half tiles when joined together, match with the dimensions for the full tile.

33.2 Tolerance on length and breadth shall be as per plus or minus one millimeter and tolerance on thickness shall be plus 5 mm. The range of the dimensions in any one delivery shall not exceed 1 mm on length and breadth and 3 mm on thickness.

33.3 The tiles shall be manufactured in a factory under pressure process subjected to hydraulic pressure of not less than 140 kg per square centimeter shall be given the intial grinding with machine and grouting of the wearing layer before delivery to site. The wearing layer shall be free from projections, depressions, cracks, holes, cavities and other blemishes. The edges of the wearing layer may be rounded.

33.4 The proportion of cement to aggregate in the backing of tiles shall be not leaner by 1:3 by weight. Where colouring material is used in wearing layer, it shall not exceed 10 percent by weight of cement used in the mix.

33.5 The finished thickness of the upper layer shall not be less than 5 mm for size of marble chips from the smallest upto 6 mm and also, not less than 5 mm for size of marble chips ranging from the smallest upto 12 mm, and not less than 6 mm for size of marble chips varying from the smallest upto 20 mm.

M-34 Chequered Tile

34.1 The size of the tiles shall be as shown in the drawing or as required Architect or engineer-in-charge.

34.2 The centre to centre distance of chequers shall not be less than 2.5 cm and not more than 5 cm.

34.3 The overall thickness of the tile shall not be less than 22 mm. The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not less than 3 mm. The chequered tile shall be terrazzo or cement tile as specified in the description of item. The thickness of the upper layer, measured from the top of the chequers shall not be less than 6 mm.

34.4 The terrazzo tiles shall be given the first grinding with machine before delivery to site.

34.5 The tiles shall conform to the specifications for plain cement concrete or terrazzo tiles in respect to the method of the manufacture and the mix of the backing and wearing layers.

M-35 Ceramic Tile

35.1 The tiles shall be of approved make and shall generally conform to IS: 777. They shall be flat and true to shape and free from blisters crazing, chips, welts, crawling or other imperfections detracting from their appearance. The tiles shall be tested as indicated in Appendix of IS: 777.

35.2 The size of the tiles shall be square or rectangular as shown in the drawing or as required Architect or engineer-in-charge.

35.3 The thickness of the tiles shall be 6 to 9 mm depending upon the size and manufacture. The length of all four sides shall be measured correct to 0.1 mm and average length breadth shall not vary more than $\pm$ 0.8 mm from specified dimension. The variation of individual dimension from average value of length/breadth shall not exceed $\pm$ 0.5 mm. Tolerance in thickness shall be $\pm$ .5 mm.

35.4 The top surface of the tiles shall be glazed and glaze shall be either glossy, mat or as specified. The underside of the tiles shall not have glaze more than 5 percent of the area in order that the tile may adhere properly to the base. The edges of the tiles shall be preferably free from glaze. However, any glaze if unavoidable shall be permissible only upto 50 percent of the surface area of the edges.

35.5 They shall be extremely strong, breaking strength of the tile shall be 350 kg/ cm2. They shall offer good abrasion resistant i.e. can withstand upto 5000 grindings. They shall be scratch resistance, their hardness on the Moh's scale shall be 6.8 to 7. They shall be resistant to all acids and alkalies except hydrofluoric acid. In addition, they shall be bacteria free and fire proof, as they are fired at @ 11600C. They shall have very high acoustic damping factor and their specific gravity shall be 0.12, making them good insulators. Their resistance to thermal shocks shall be upto 10 cycles and their co-efficient of linear thermal expansion shall be 9 from ambient temperature to 1000C.

35.6 Ceramic tile for Industrial purposes, shall have a hardness of 8.6 on the Moh's scale and shall be non-skid, hard wearing, long lasting and acid and alkali resistant. They shall adequately meet the IS : 4457.

35.7 In Rectified ceramic tile sizing and squaring is done in tile.

M-36 Vitrified Tile

36.1 Vitrified floor tiles shall be of approved make, as approved by the Architect and Engineer-in-charge. They shall conform to the relevant IS Codes. (IS15633 & IS13612)

36.2 They shall be monolithic and available in smooth, mirror-polished and anti-skid finishes. They shall have a size tolerance of + 0.5%, in length and width and + 5% in thickness. Allowable warpage shall be + 0.2%. Allowable squareness wedging shall be + 0.5%. Their water absorption rate shall be less than 0.5%. They shall offer hard-working and hard-wearing floors for homes, public buildings, apartments and airports. The tiles shall be of ASTM or DIN standards.

36.3 They shall be extremely strong, breaking strength of the tile being 1600 Kg/cm2, flexural strength 3500 Kg/cm2. and bonding strength of 2500 Kg/cm2. They shall offer abrasion resistance to < 175 mm3. They shall be scratch resistance; their hardness on the Moh's scale shall be min. 7. They shall be able to resist thermal shock upto 10 cycles and shall have a density of greater than 2 gm/cc. They shall have greater than .4 co-efficient of friction for polished/unpolished surfaces.

M-37 Cement based Polymer Adhesive

37.1 Tile adhesive complies with the BS: 5980 with latest edition. The adhesive shall be polymer modified cement-based adhesive. The adhesive should be able to fixing tiles, natural stones in exterior and interior use including swimming pool.

37.2 Adhesive should be able to improve adhesion, reduce water permeability and widen application. It should be able to fixing upto 6 mm thickness.

37.3 It should possess low shrinkage and should be flexible to accommodate physical and thermal movements.

37.4 It should be able to use for indoor and outdoor application.

M-38 Grouts

M-38A Cementitious grout

38A.1 The grout shall be of high quality, water resistant, cement-based powder grout for grouting ceramic tile, vitrified tile, industrial tile, stone etc.

38A.2 It should be available in all colours to match the tile colour. It should have high strength for maximum load bearing. It should be non shrink, non-bleeding and non segregating at fluid consistency.

38A.3 It should not contain any chlorides and or additives which may contribute the corrosion of the structure.

38A.4 It should be weather resistant, non cracking, non shrinking. The compressive strength, linear shrinkage, tensile strength and flexural strength should be according to the IS codes.

M-38B Epoxy Grout

38B.1 It should be hygienic, hard wearing, impervious, epoxy resin based ceramic tile grout with a high degree of resistance to chemical attack, abrasion and impact.

38B.2 The grout should not transfer taints to food stuffs and should not permit the entry of bacteria or dirt and easily maintained in a sterile condition.

38B.3 It should be available in all colours to match the colour of the tile colour. It should attain very good early strength. It should possess good chemical resistance to acid, alkalies etc.

38B.4 It should possess good tensile and flexural strength and it has a very good dynamic load resistance.

M-39 Floor Hardener

39.1 CPWD specifications clause no. 11.3.1 shall be followed.

39.2 The Concrete floor hardener shall be of best quality and from manufacturer like Ironite, BASF, MYK or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the EIC. It shall conform to the relevant IS Code.

39.3 It shall be applied on the concrete floors when concrete is green. It should be applied as per the manufacture's specification. Floor hardener makes the permanently hardened concrete floor, with increased abrasion resistance, increased surface density, and increased resistance to chemical attack and to eliminate dust accumulation. Precautions shall be taken while using the product, to avoid contact with eyes and open wounds and to work in good ventilation. After application, the affected parts shall be washed copiously.

M-40 Polypropylene Fibres

40.1 Polypropylene fibres shall conform to ASTM C 1116 Type III 4.1.6. Polypropylene fibres should be of NINA concrete or equivalent as approved by engineer-in-charge. Polypropylene fibres should inhibit and controls the formation of cracking in the concrete.

40.2 It should reinforce the concrete against impact forces, shattering forces. It should make the concrete abrasion resistance and should reinforce the concrete against water migration.

40.3 It should provide the concrete better durability. It should be able to reduce the plastic shrinkage and settlement cracking.

40.4 It should protect rebar from corrosion and should prevent explosive spoiling of concrete due to fire.

M-41 Marble Chips

41.1 The marble chips shall be of approved quality and shade. It shall be hard, sound, dense, and homogeneous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering.

41.2 The marble chips to be used should be as per the grading as decided by the Architect.

41.3 The marble chips shall be machine crushed if not specified in the item description. They shall be free from foreign matter, dust etc. The marble chips shall conform to IS : 2114.

M-42 China Mosaic

42.1 China mosaic shall be from broken pieces of white glazed tile. The size of the broken pieces of white glazed tiles shall not be more than 12-20mm.Triangular china mosaic pieces shall not be used. Rectangular or square pieces shall only be used. The broken pieces shall be soaked in water for 24 hr before using for the execution.

M-43 Rough Kota Stone

43.1 The kota stones shall be of selected quality, hard, even, sound, dense and homogeneous in texture free from cracks, decay and weathering and flaws. They shall be hand or machine cut to the requisite thickness. They shall be of colour as indicated in the drawings or as instructed by engineer-in-charge.

43.2 The slabs shall have the top (exposed) face rough before being brought to the site, unless otherwise specified. The slabs shall conform to the size required. Before starting of the work the contractor shall get the samples of the slabs approved by engineer-in-charge.

43.3 Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth and so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.

43.4 The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

M-44 Polished Kota Stone

44.1 Polished kota stone shall have same specifications as Rough Kota stone, except as mentioned below.

44.2 The stones shall have machine polished surface. When brought on site, the stone shall be single polished or double polished, depending upon its use. Single polished kota stone shall have single face of the stone polished whereas, double polished kota stone shall have both the faces polished. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, sink, veneering, sills, steps, etc., where machine polishing after the stones are fixed in situ is not possible, shall be polished more than once for the desired finish, before fixing.

44.3 When brought at site, the colour of the stone shall be fairly uniform. It shall be ensured that the stones to be used in a particular work, shall not differ much in shade or tint, from the approved sample.

M-45 Marble Stone

45.1 Marble shall be hard, sound, dense and homogeneous in texture with crystalline texture as far as possible. It shall generally be uniform in colour and free from stains, cracks, decay and weathering.

45.2 Marbles are metamorphic rocks capable of taking polish, formed from the re-crystallization of lime stones or dolomitic lime stones and are distinguished from limestone by even visibly crystalline nature and nonflag by stratification. The surface shall be machine polished to an even and perfect plane surface and edges machine cut, true and square. The rear face shall be rough to provide key for the mortar.

45.3 Marble slabs are to be laid as per pattern of engineer-in-charge. The slab shall not be thinner than the specified thickness, at its thinnest part. A few specimens of the finished slab to be used, shall be deposited by the Contractor in the office, for reference.

45.4 Except as above marble slab shall conform to IS: 1130.

M-46 Dholpur Stone

46.1 Dholpur sand stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone slab shall be hard, even, sound, durable and tough free from cracks, decay and weathering.

46.2 The size of the slab shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work with the permissible tolerance of + 2 mm.

46.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished. The stones to be used for sills, steps, brackets, coping, facias, bands, pillars, fabricated railings, jali work etc., where machine polishing after the stones are fixed in situ, is not possible, shall be double polished or as required.

46.4 All angles and edges of the stone slab shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone slab shall be true and plane.

46.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect, for a particular work. It shall be ensured that the stones to be used in a particular work shall not differ much in shade or tint, from the approved sample. No white, black or any other colour spots shall be there. Cheetah or tiger skinned stones shall not be allowed under any case.

M-47 Granite Stone

47.1 Granite shall be of approved color and quality. It shall be got approved by the Engineer-in-charge and Architect, prior to procurement. The stone shall be hard, even, sound and regular in shape and generally uniform in color. It shall be without any soft veins, cracks or flaws.

47.2 The thickness of the stone shall be as specified in the item.

47.3 All exposed faces shall be double polished to render truly smooth and even reflecting surface. The exposed edges and corners shall be rounded off, as directed. The exposed edges shall be machine cut and shall have uniform thickness.

M-48 Red Mandana Stone

48.1 Red mandana stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone shall be without any veins, cracks and flaws. The stone shall be even, sound and durable, regular in shape and of uniform colour.

48.2 The size of the stone shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of + 2 mm.

48.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished.

48.4 All angles and edges of the stone shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone shall be true and plane.

48.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect. It shall be ensured that the stones to be used shall not differ much in shade or tint, from the approved sample

M-49 Jaisalmer Yellow Stone

49.1 Jaisalmer stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone shall be without any veins, cracks and flaws. The stone shall be even, sound and durable, regular in shape and of uniform colour.

49.2 The size of the stone shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of + 2 mm.

49.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished.

49.4 All angles and edges of the stone shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone shall be true and plane.

49.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect, for a particular work. It shall be ensured that the stones to be used in a particular work shall not differ much in shade or tint, from the approved sample. No white, black or any other colour spots shall be there. Cheetah or tiger skinned stones shall not be allowed under any case.

M-50 Cobble Stone

50.1 Cobble stones shall be of best quality, as approved by the Architect and Engineer-in-charge and shall be obtained from reliable source. The make will be approved by the Architect and the source of supply shall not be changed without prior approval of the Architect. The stone shall be without any veins, cracks and flaws. The cobbler stones shall be even, sound, durable and regular in shape and of uniform colour

50.2 The size of the cobbler stone shall be as specified in the items or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with permissible tolerance of + 2 mm.

50.3 The stone shall have machine polished surface. When brought on site the stone shall be single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The cobbler stones to be used for walkways, roadways, parking, floors, docks, roofs, public squares etc., where machine polishing after the fixing of stones, is not possible, the stones to be fixed shall be double polished or polished more than once, as required. All angles and edges of the cobbler stone shall be true and plane.

M-51 Precast Cement Concrete Tile

51.1 The plain cement tiles shall be of general-purpose type. Cement used in the manufacture of the tiles shall conform to relevant IS code. Pigments are not used in this tile.

51.2 The tiles shall be manufactured from a mixture of cement and natural aggregates, using pressure process. During the manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg/cm2. The proportion of cement to aggregate, in the backing of the tiles shall be not less than 1:3 by weight. The wearing face though the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. size. The proportion of cement to aggregate, in the wearing layer of the tiles shall be three parts of cement to one part chips, by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of the wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist condition, continuously atleast for 7 days and subsequently, if necessary, for such long period, as would ensure their conformity to requirements of IS : 1237, regarding strength, resistance to wear and water absorption.

51.3 The wearing face of the tiles shall be plane, free from projections, depressions and cracks and shall be reasonably parallel to the backing of the tile. All angles shall be right angles and all edges shall be sharp and true.

51.4 The tiles shall generally be square in shape, with a size specified in the item. The thickness of the tiles shall be 25 mm. Tolerance of length and breadth shall be + 1 mm. Tolerance of thickness shall be + 5 mm.

51.5 The tiles shall satisfy the test as regards transverse strength, resistance to wear and water absorption as per IS : 1237

Testing Standards :

A. Water Absorption :
Sampling :
6 tiles out of every 3000 tiles are taken for testing.
Results :
Absorption permissible, shall be at the most 10%.

B. Transverse strength test :
Sampling :
12 tiles out of every 3000 tiles are taken for testing.
Results :

When wet :- 80 Kg/cm2.
When dry :- 120 Kg/cm2.

C. Abrasion test :

Sampling :
6 tiles out of every 3000 tiles are taken for testing.
Results :
Average abrasion shall not be more than 3.5 mm.

M-52 Interlocking Paver Block

52.1 The Paver block shall conform to IS 1237:1980. The variation in length of any side shall not exceed + 2 mm. The variation in thickness shall not be more than + 3 mm.

52.2 The average abrasion value of the same shall not be more than 2.00mm & for individual it shall not vary more than 2.5mm.

52.3 The water absorption shall not be more than 5%. The compressive strength of the tile shall be as per item description.

M-53 PVC (Poly Vinyl Chloride Sheet/Tile)

53.1 PVC sheets/tiles for PVC/ Vinyl floor covering shall be of approved make as approved by the Architect and Engineer-in-charge. It may be in form of sheets or tiles or rolls as specified. It shall consist a thoroughly blended composition of thermoplastic binder, filler and pigments. The thermoplastic binder shall consist substantially of one or both the following.

a) Vinyl Chloride Polymer
b) Vinyl Chloride Copolymer

The polymetric material shall be compounded with suitable plasticizers and stabilizers.

53.2 The preferred thickness of PVC tiles for normal floor covering shall be 1.5 to 4 mm. Dimensional stability shall be 0.3% The thickness of the PVC sheets shall be measured with micrometer or Ratechet type or a dial guage graduated to .02 mm. The micrometer shall have flat bearing surfaces of at least 6.5 mm diameter at both contact points. For sheets and rolls the thickness of the specimen shall be measured at twenty scattered points.

53.3 The width of rolls shall be as per manufacture's specification and length shall not be less than 20 meters. The measurement shall be carried out with a traveling microscope or suitable scale graduated to .02 mm. Each tile shall be measured for length and width at the three quarter point in each direction

53.4 The following tolerance shall be allowed

a)	Thickness -	± 0.15 mm
b)	Width	
	i) 300 mm square tile	± 0.2 mm
	ii) 600 mm square tile	± 0.4 mm
	iii) 900 mm square tile	± 0.6 mm
	iv) Sheets and rolls	± 0.1 percent

53.5 It shall offer colour fastness to daylight as per the relevant IS : 3462. Allowance for curling shall be 0.6 mm. It shall be flexible and shall not break, crack or show any signs of failure.

53.6 It shall offer above average resistance to mild and diluted acids, alkalies, soaps and detergents. It shall have high abrasion resistance. At normal temperature, it shall develop an indent of 0.15 mm., after one minute and 0.20 mm., after ten minutes. It shall offer insulation resistance as per the IS : 2259. It shall have a sound reduction factor of 3db for 2 mm. thickness and 2db for 1.5 mm. thickness. It shall have self extinguishing property and water absorption at room temperature for 24 hrs. shall be 0.1%.

53.7 It shall be available in various designs and shall be recommended for floors and walls, in homes, institutions, commercial establishments, clinics and hospitals.

M-54 Linoleum

54.1 Linoleum shall conform to IS : 653. Linoleum shall be of thickness as specified in the description of item. Linoleum shall be of either plain, moire jaspe or marble type or a combination of the above types as shown in the drawing or as per direction of engineer-in-charge.

54.2 Linoleum shall be stored in a clean, dry and well ventilated place without exposure to direct sunlight.

54.3 The contractor shall get approve the samples by the architect or engineer-in-charge.

54.5 Linoleum used shall be of a thickness adequate for the conditions of surface and situation. The following thickness generally shall be used are

a) For Public buildings, cinemas, restaurants, ships and the like - 6 to 6.7 mm
b) For offices, shops and the like depending upon the intensity of traffic - 3.2 to 4.5 mm
c) For residential house - 3.2 mm

M-55 Acid Resistant tile

55.1 Acid and Alkali resistant tiles should be able to withstand most corrosive of chemicals without as much as stain on acid resistant tile.

55.2 The tiles should be perfect for the floors of chemical, petrochemical, oil, pharmaceutical, food and textile industries.

55.3 The tiles should be of approved make. The sample of the tiles should be approved by the Architect before procurement and the after laying of sample tile same should be approved by the Architect before laying of all the tiles.

55.4 The tiles should cater the specifications as per IS 4457. It should be heavy duty as per the project's requirement.

55.5 It shall have a very high load bearing capacity with cold crushing strength as 1500 Kg/cm^2. and shall withstand a load of 3000 Kg/cm^2 in the compression strength test. The tiles shall have extremely low porosity because of their monolithic body structure. The water absorption shall be less than 1% and the tiles shall remain free of stains due to lubricants, oils, grease etc. The tiles shall be non-glazed and anti-skid, having a matt finish. They shall be available in special ribbed surface, also. The tiles shall be tough, have high surface hardness, 9 on the Moh's scale and shall offer extremely high resistance to wear and abrasion. They offer good resistance to acids and when tested, the loss of weight shall be around 0.25%

M-56 Blended Marble tile / slab

56.1 Marble tile / slab is an engineered wood or composite marble is aesthetically like natural marble.

56.2 It shall be composed of 80% to 95% of finest grains of quality selected marble aggregates, bonded together with 4% to 8% special resins, along with palette of colourants. It shall therefore offer a wide range of colour compared to natural marble. It shall be manufactured so, that its design goes right through the tile, insuring lasting designs.

56.3 It shall be available in pre-cut, pre-polished, chamfered and grooved upto sizes of 600 mm. x 600 mm. Sizes upto 2400 mm. x 1200 mm. shall also be supplied. It shall have indispensable mechanical strength,

Test	Dry	Wet
Compressive strength in Kg/cm^2.	1340	1317
Flexural strength in Kg/cm^2.	308	453
Modulus of Rupture in Kg/cm^2.	462	453

It shall offer flexibility, high wear resistance, impact resistance and on testing shall be 1.5 kgcm/cm., hardness on the Moh's scale shall be 3 to 4, abrasive wear index shall be 22 and total water absorption shall be around 0.13%. It shall not be easily affected by the freeze and thawing cycling.

56.4 It shall be non-porous and shall be used in all types of weather. It shall be used for internal and external surfaces. It shall be easily cut with a normal hand cutting machine, if required and shall be laid in the same manner as natural marble stone.

M-57 Glass Mosaic Tile

57.1 Glass mosaic tile shall be of approved make as directed by Architect. They shall confirm to relevant IS codes.

57.2 Tiles shall be water proof, weather proof and chemical proof. Tile should be resistant to thermal shocks. They should retain their original colour and were not cracked or damaged during in any way during construction.

57.3 They shall be available in the form of sheet pasted on paper for easy-fixing. They shall be non-slippery, non-porous, non-sensitive and non-conductive. They should offer good resistance to temperature changes, chemical effects, impact and pressure and surface abrasion. They shall be weatherproof and 100% fire proof. They shall be light weight and could be fixed on any surface and in any shape. They shall be available in all colours and shall be permanent in colour. They shall be antistatic and easy to clean.

57.4 For the properties mentioned below it shall conform to mentioned code.

1. Chemical Resistance - EN 122 / ISO 10545: Part 13
2. Colour Resistance to fading - DIN 51094
3. Water Absorption - ISO 10545: Part 13
4. Thermal Shock Resistance - ISO 10545: Part 9

M-58 Rubber Tile

58.1 The rubber tile shall be of approved make such as REPHOUSE, Nora or equivalent.

58.2 The tiles should be manufactured by polymerically rubber and cork particles.

58.3 Rubber tiles should have premium acoustical underlay which provides optimum sound and vibration resonance absorption as well as excellent thermal insulation properties.

58.4 It should be environmentally safe and is not health hazardous. It should exhibit excellent dynamic properties and should remain permanently elastic.

58.5 It should have excellent sound absorption and thermal insulation properties.

58.6 It should be available in a variety of thickness, widths, density and multi build up layers to suit most construction needs.

M-59A Solid Wood Flooring

59A.1 Solid wood represents a homogeneous construction of wood. Solid wood should be seasoned well and pre finished with minimum 7 coats of formaldehyde-free acrylic lacquer.

59A.2 The lacquer used for polishing shall be UV-cured so that it does not get dusty, stain or scratch easily.

59A.3 It shall be available in oil and lacquer both type of polish

M-59B Engineered Wood Flooring

59B.1 Engineered hardwood flooring shall be robust flooring comprised of 4 layers or as per manufacture's specification.

59B.2 Top layer shall be of 5 coats of hard-wearing lacquer above the genuine wood surface layer. Below the genuine wood surface layer middle layer of plywood or particle board shall be there. At bottom stabilizing layer shall be there as per manufacture's specification.

59B.3 It shall be available in oil and lacquer both type of polish.

59B.4 The lacquer used for polishing shall be minimum 5 coats of UV curved formaldehyde free lacquer

M-59C Laminated Wood Flooring

59C.1 Laminated flooring shall be available in 8 mm to 12 mm thickness. Laminated wood floor is made up of three layers. Bottom layer is stabilizing layer made up of special paper, middle layer or core layer made of HDF board, top most layer made of decorative and overlay in melamine resin.

59C.2 The decorative paper is what it gives the laminate flooring its individual appearance. Three layers shall be pressed with direct pressure laminate process in which decorative covering layer and stabilizing layer are pressed together onto the core layer made of HDF board.

M-60 Structural Steel

60.1 CPWD specification clause no. 10.1.1 shall be followed.

M-61 Rolling Shutters

61.1 The rolling shutters shall conform to IS: 6248. Rolling shutters shall be supplied of specified type, with accessories. The size of the rolling shutters shall be as specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide, for shutters upto 3.5 m. width and not less than 1.25 mm. thick and 80 mm. wide, for shutters 3.5 m. in width and above, unless otherwise specified.

61.2 Guide channels shall be of mild steel, deep channel section and roll pressed or built-up (fabricated), with joint less construction. The thickness of the sheet used shall not be less than 3.15 mm.

61.3 Hood covers shall be made of MS sheets, not less than 0.90 mm. thick. For shutters having width of 3.5 m. and above, the thickness of MS sheet for the hood cover shall be not less than 1.25 mm.

61.4 The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on strong MS or malleable CI brackets. The brackets shall be fixed on or under the lintel as specified with rawlplugs and screws bolts, etc.

61.5 The rolling shutters shall be of self rolling upto 8 m2. clear area, without ball bearing and upto 12 m2. Clear area, with ball bearing. If the rolling shutters are of large area, then gear operated type shutters shall be used as per approved manufacturer's specifications.

61.6 The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

61.7 The shutters shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

M-62 Welded steel wire fabric

62.1 Welded steel wire fabric for general purpose shall be manufactured from cold drawn steel wire "as drawn" or galvanized steel conforming to IS: 226 or as specified in the item with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to IS: 4948. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be dust proof. The type of mesh shall be oblong or square, as directed in the item description. The mesh sizes and sizes of wire for square as well as oblong, welded steel wire fabric shall be as directed. The steel wire fabric in panels shall be in one whole piece, in each panel, as far as stock sizes permit.

M-63 Expanded Metal Sheets

63.1 The expanded metal sheets shall be free from flaws, joints, broken strands, laminations and other harmful surface defects. Expanded metal steel sheet shall conform to IS 42 except the blank sheets need not be with guaranteed mechanical properties. The size of the expanded metal and dimensions of strands (width and thickness) shall be as specified. The tolerance on nominal weight of the expanded metal sheets shall be ± 10%.

63.2 Expanded metal in panels shall be in one whole piece, in each panel as far as stock size permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion

M-64 Oil Bound Washable Distemper

64.1 CPWD specification clause no. 13.19.1 shall be followed.

64.2 Oil Emulsion (Oil Bound Washable Distemper (IS: 428) of approved brand and manufacture shall be used. The primer used for distemper shall be of same make as paint. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacture. Only sufficient quantity of distemper required for day's work shall be prepared.

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

64.4 All the paints shall meet following requirements
a) Paint shall not show excessive setting in a freshly opened full can and shall easily be re-dispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, levering, caking or colour separation and shall be free from lumps and skins.
b) The paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.
c) The paint shall dry to a smooth uniform finish free from roughness grit, unevenness and other imperfections.

64.5 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 engineer-in-charge. Empty tins shall not be removed from the site of work, till this item of work has been completed and passed by the engineer-in-charge.

M-65 Water Bound Distemper

65.1 It shall be from Asian, Berger or equivalent as approved by Architect. It shall conform to relevant IS codes.

65.2 It can be in powder form or liquid form as per the manufacture's specification. If it is in powder form it can be prepared by adding warm water in the proportion recommended by the manufacture.

65.3 It shall be applied by the conventional distemper brush to all plastered surface. It shall be applied by the conventional distemper brush to all plastered walls, ceilings and woodwork. Priming coat shall be applied before applying the paint.

M-66 Plastic Emulsion Paint

66.1 Plastic emulsion paint shall conform to IS: 5411 of approved brand and manufacture and of the required shade shall be used.

66.2 The plastic emulsion paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These paints are to be used on internal surfaces except wooden and steel.

M-67 Cement Paint

67.1 The cement paint shall be (conforming to IS: 5410) of approved brand and manufacture.

67.2 The cement paint shall be brought to the site of work by the contractor in its original container in sealed condition. The material shall be brought by the contractor at a time in adequate to suffice for the whole work or atleast for a fortnight's work. The material shall be kept in joint custody of Architect and engineer-in-charge. Empty tins shall not be removed from the the site of work, till this item of work has been completed and passed by the engineer-in-charge.

67.3 It shall be manufactured from selected range of raw materials and a special cement, so the it shall be suitable for both indoors and outdoors. It shall be suitably used on concrete renderings, cement/sand renderings, cement/lime/sand renderings, asbestos sheets, fiber boards, brickwork, etc. It shall offer matt finish. It shall require no primer and shall be water thinnable. It shall offer a covering capacity as per manufacture's specification, depending on the surface and shade used. It shall preferably not be applied under direct sunlight to avoid patchy effect.

M-68 Textured wall finish

68.1 It shall be of acrylic polymer based texture of Jotun, Sherwin Williams / Asian / NITCO / ICI / Berger as approved by Architect or engineer in charge. It shall conform to relevant IS codes. Thickness and finish shall be as per manufacturer's specification.

68.2 It shall be of two components, or one component as specified by the Architect or engineer-in-charge. It shall be apply by trained and approved applicators. The single coat shall be 1.5 mm thick as specified in the item description. It shall be weather and fade resistant, water and damp resistant, durable and highly washable. It shall be acid and alkali resistant, high abrasion resistant, non-toxic and shall be capable to taking any shape. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other materials, to get homogenous layer.

68.3 It shall be water thinnable to avoid water contamination, incombustible and flexible. It shall be good fire resistant, anti-fungal, good impact resistant having adhesion strength more than 8 kg./cm^2. There shall not be any development of hair line cracks and no peeling off shall occur, after the maximum drying time of 4 hours and curing period of 2 days.

M-69 Silicone paint

69.1 It shall be of the best quality like Wacker, GE Silicone, Pidilite, Dow Corning or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

69.2 It shall be prepared by mixing Silicone and Epoxy. It shall be applied on dry as well as damp surfaces. It shall be non-toxic and odourless, so shall be suitable for drinking water structures also. It shall render the surface impervious to water and shall prevent water penetration. It itself shall penetrate into the structure and shall form a strong film on the pores of the structure surface, making the surface water-tight, non-toxic and erosion free.

69.3 It shall be water thinnable. Before use, the hardener of the Siliconate Epoxy shall be mixed with resin and thinned with water, in the proportions described by the manufacturer. It shall be applied with a suitable spray gun with a fine nozzle. An overlap of 25 to 30 cm. shall be preferred. It shall be semitransparent but on drying it shall become transparent.

M-70 Synthetic Enamel Paint

70.1 Synthetic Enamel paint shall conform to IS : 2933. It shall be from Nerolac, Berger, Asian Paints or equivalent. It shall offer variety of finishes like Glossy, Semi-glossy, Pearl lustre and Matt finish.

70.2 It shall be applied either by brush, roll or spray. It shall have a covering capacity of as specified by the manufacture, depending on the surface to be painted. It shall be used both on metal and wood surfaces.

70.3 It shall have a viscosity of application of 30 to 40 seconds, if brush or rollers are used and 20 to 25 seconds, if spraying is done. The drying time shall however vary with the ambient temperature and humidity.

M-71 Acrylic Paint

71.1 It shall be from Asian Paints, ICI, Berger, Nerolac or equivalent as approved by the Architect. It shall conform to the relevant IS Codes.

71.2 It shall be used on both interiors and exteriors on all different types of plaster, wooden surfaces, stone, brickwork, asbestos cement sheets, hard and soft boards, etc. as specified in the drawing. It shall render rich smooth finish and shall provide a tough film that forms a suitable protection against all elements.

71.3 It shall be water thin able. On interior surface it shall be applied after one coat of cement primer and in case of exterior surface it shall be applied on waterproof cement coating. On a new but highly absorbent surface, a thin coat of the paint shall be applied by adding two parts of water by volume to two parts of Acrylic Emulsion by volume. On previously painted surfaces, one coat of the acrylic paint shall be applied by thinning four parts of the emulsion with one or two parts of water. It shall be applied by brush, roller or spray. It shall have a covering capacity as per manufacture's specification, depending on the surface and shade used. It can be washed to remove the day-to-day dirt, after the surface has been painted, minimum for a month. It should be non-flammable. For the best performance of paint proper washing and cleaning of all algal and fungal growth at regular intervals at six months is required.

M-72 French Polish

72.1 Pure Shellac conforming to IS : 16 varying from pale orange to lemon yellow colour free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm of Shellac to 1 litre of spirit. Suitable pigment shall be added to get the required shade.

72.2 Ready made polish conforming to IS : 348 can also be used. The French polish so prepared shall Conform to IS : 348.

M-73 Lacquer Polish

73.1.1 Lacquer polish of ASIAN or TARALAC with thinner of same company shall be used.

73.1.2

73.1.3 Surfaces to be polished shall be properly grinned with sandpaper and all grains of the wood shall be filled by sealer coat over that multiple layers of approved company's Laquar to be applied up to hot water resistance.

M-74 Wax Polish

74.1 The Wax polish of required tint and shade shall be prepared with the below mentioned ingredients and other necessary materials.
(a) 2 parts Bees wax conforming to IS: 1504-196
(b) 1.5 parts boiled linseed oil conforming to IS : 75
(c) 1 part of Turpentine conforming to IS: 83
(d) 0.5 part Varnish conforming to IS: 337

74.2 Pure bees wax free paraffin or stearine adulterants shall be used. The bees wax and boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved the mixture shall be cooled till it is just warm and turpentine and varnish added to it in the required proportions and entire mixture shall be well stirred.

M-75 Melamine Polish

75.1 The melamine polish shall be of best quality and make such as Asian Paints or equivalent, as approved by the Architect and Engineer-in-charge. It shall be transparent or opaque, as specified by the Architect or engineer-in-charge.

75.2 It shall give silken, smooth finish. The Melamine polish shall have shade and shine, either satin or glossy, as approved by the Architect. It shall be two component polish consisting of a base and hardener. It shall be capable of protecting wood from moisture, heat, cold, scratches, stains, cigarette burns etc. It shall have excellent covering capacity. It shall be applicable to all wooden surface of every shape. It shall be applied using brush or spray gun. It shall require lesser time to dry and there shall be no cracks or pealing off of the polish. There shall not be any undulation on the finished surface nor cracks at joints. It shall be of any desired shade as approved by the Architect. It shall have excellent colour, shall be free flowing and shall have good levelling properties. It shall be durable and flexible to absorb cracks. It shall have resistant to scrubs, light rays, heat etc. complete as per architect or engineer-in-charge.

M-76 Polyurethane paint

76.1 It shall be from Asian, ICI, Jotun or equivalent as approved by the Architect.

76.1.1 It shall be a three coat application. It can be done either by using a brush, spray or a roller. It shall be available in variety of decorative finishes i.e. in almost all shades and in glossy and matt finishes. It shall offer the following properties

(a) Adhesion to concrete / metal surface
(b) Sealing effect against heavy rain
(c) Good Water vapor diffusion
(d) Weather resistance, color stability, gloss retention and chalk resistance
(e) Resistance to disinfectants, chemical, fire, radiation, acid gases, abrasion and wear
(f) Low soil adhesion
(g) Scratch and Mar resistance
(h) Have long life and excellent gloss

76.2 It shall absorb UV radiation and shall be easily cleaned of radioactive contamination. The ultraviolet part of the solar radiation shall not affect the coating and thereby shall be long lasting

M-77 Powder Paints

77.1 Powder paints shall of superior quality such as Asian, Nerolac or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS specifications.

77.2 Powder coatings should be a blend of resins, curing agent and pigments which are melt mixed (extruded) and pulverized into finely divided particles. It should be solvent free.

77.3 It shall be available in the following types:

Epoxy Powder
It is practical coatings for pipes, water and gas valves, steel furniture and indoor appliances. It is suited for surface subjected to high stress and chemical effects.

Epoxy polyester powder
This is a system for economical operation with a high degree of chemical resistance. The manufacturers of household appliances, automobile parts, shelving systems, electrical cabinets and steel furniture use it

Pure Polyester Powder
This is best suited for articles such as aluminum extrusion, which are exposed to exterior environment. This powder has excellent U.V. resistance.

Polyurethane powder
Polyurethane gives excellent flow & Finish and protects the surface from Ultra Violet rays.

M-78 Mangalore Pattern Roof Tiles

78.1 The Mangalore pattern tiles shall conform to IS : 654 for Class AA or Class A type, as specified in the item. The tiles are to be made from clay, place it in a mould and cut to the measurement. Sample is to be got approved from Architect. Necessary tests are to be carried out as per IS code.

M-79 Aluminum Sheets

79.1 It shall be of the best quality and from reputed manufacturer like Jindal, Hindalco or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS: 1254, in all respects. The aluminum alloys used in the manufacture of the sheets shall conform to IS: 737.

79.2 The sheets shall be extremely light with high-strength-to weight ratio. having a density of about 2.70 gms/cm^3. It is corrosion resistant in almost any kind of environment. Even in highly-corrosive industrial environments, it should be resistant to fumes and vapours of organic compounds and to chemicals like ammonia, carbon-dioxide and acids like hydrochloric acid, nitric acid and sulphuric acid. This corrosion-resistant property gives the metal a long life and keeps it looking good throughout its life The sheets shall be non-fragile and shall be exceptionally durable. As aluminum reflects a high proportion of the radiant heat, the sheets provide excellent insulation when used for cladding/roofing. The sheets shall be non-combustible, non-flammable and non-sparking. As aluminum is elastic, the sheets shall offer high resistance to denting and shall be shatter-proof. Co-efficient of linear expansion of aluminum is 0.000024 per ^oC and therefore the lateral expansion of the sheets shall be readily accommodated in the corrugations. The sheets shall offer no health hazard and shall be totally hygienic. Aluminium is a good conductor of heat, its high reflectivity of radiant heat and light (75 to 80 per cent when new, 60 per cent after several years) keeps the interiors of an aluminium building from five to eight degree celsius cooler in summer while its low emission rate cuts heat loss during winter.

79.3 It shall be available in trapezoidal and rounded corrugations and shall be extensively used for various Industrial buildings, Warehouses, Aircraft hangers, Power plants, Storage sheds, Bunk houses etc. It shall be innovatively used as interior partitions, wall panels, false ceiling etc.

M-79B Aluminium Section

79b.1 Aluminum sections used for fixed/ openable windows, ventilators, partitions, frame work & doors etc. shall be suitable for use to meet architectural designs to relevant works and shall be subject to approval of the Engineer-in-Charge for technical, structural, functional and visual considerations. The aluminium extruded sections shall conform to IS 733 and IS 1285 for chemical composition and mechanical properties. The stainless steel screws shall be of grade AISI 304.
The permissible dimensional tolerances of the extruded sections shall be as per IS 6477 and shall be such as not to impair the proper and smooth functioning/operation and appearance of door and windows.
Aluminium glazed doors, windows etc. shall be of sizes, sections and details as shown in the drawings. The details shown in the drawings may be varied slightly to suit the standards adopted by the manufacturers of the aluminium work, with the approval of Engineer-in-Charge. Before proceeding with any fabrication work, the contractor shall prepare and submit, complete fabrication and installation drawings for each type of glazing doors, windows, ventilators and partition etc. for the approval of the Engineer-in-Charge. If the sections are varied, the contractor shall obtain prior approval of Engineer-in- Charge and nothing extra shall be paid on this account.

79b.2 Anodising
Standard aluminium extrusion sections are manufactured in various sizes and shapes in wide range of solid and hollow profiles with different functional shapes for architectural, structural glazing, curtain walls, doors, window & ventilators and various other purposes. The anodizing of these products is required to be done before the fabrication work by anodizing/electro coating plants which ensures uniform coating in uniform colour and shades. The extrusions are anodized up to 30 micron in different colours. The anodized extrusions are tested regularly under strict quality control adhering to Indian Standard.

79b.3 Powder Coating

79b.3.1 *Material:* The powder used for powder coating shall be Epoxy/polyester powder of make approved by the Engineer-in-Charge. The contractor shall give detailed programme for powder coating in advance, to facilitate the inspection by Engineer-in-Charge or his authorized representative.

79b.3.2 *Pre-treatment:* Each aluminium alloy extrusion or performed section shall be thoroughly cleaned by alkaline or acidic solutions under the conditions specified by chemical conversion coating supplier and then rinsed. A chemical conversion coating shall be applied by treatment with a solution containing essentially chromate ions or chromate and phosphate ions as the active components as applicable. The amount of the conversion coating deposited depends on the type used by the conversion coating chemical supplier. The conversion coating shall be thoroughly rinsed either with the solution specified by the conversion coating chemical supplier or with de-mineralized water and then dried at the temperature for the time specified by the conversion coating chemical supplier. The contractor shall submit the detail specifications and application procedure for application of conversion coating for approval of Engineer-in-Charge. The metal surface after the conversion coating pre-treatment and prior to the application of the coating shall be free from dust or powdery deposits.

79b.3.3 *Process:* The polyester powder shall be applied by electrostatic powder spray method. Before start of powder coating the contractor shall submit detail specification for application of polyester powder from manufacturer of the polyester powder for approval of Engineer-in-Charge. The powder coating shall be applied as per the specification approved by Engineer-in-Charge.

79b.3.4 *Thickness:* The thickness of the finished polyester powder coating measured by micron meter shall not be less than 50 micron nor more than 120 micron at any point.

79b.3.5 *Performance Requirements for the Finish*
(i) *Surface appearance:* The finish on significant surfaces shall show no scratches when illuminated and is examined at an oblique angle, no blisters, craters; pinholes or scratches shall be visible from a distance of about 1 m. There shall not be any visible variation in the colour of finished surfaces of different sections and between the colours of different surfaces of same section.

(ii) *Adhesion:* When a coated test piece is tested using a spacing of 2 mm between each of the six parallel cuts (the cut is made through the full depth of powder coating so that metal surface is visible) and a piece of adhesive tape, approximately 25 mm x 150 mm approved by the Engineer-in-Charge is applied firmly to the cut area and then removed rapidly by pulling at right angles to the test area, no pieces of the finish other than debris from the cutting operation shall be removed from the surface of the finish.

79b.3.6 *Protection of Powder Coated / Anodizing Finish :* It is mandatory that all aluminium members shall be wrapped with self adhesive non-staining PVC tape, approved by Engineer-in-Charge.

M-80 PVC Sheet

80.1 PVC sheet should be of Finolex or equivalent as sample approved by Architect and engineer-in-charge. PVC sheet should be corrosion resistant and chemical resistant. It should resists actions against chemicals like mineral acids, alkalis, plating solutions, pickling solutions, paper making chemicals, most inorganic compounds, alcohols, aliphatic hydrocarbons, glycols, amines and phenols in both liquid and vapour form.

80.2 It should be hygienic, virtually maintenance free, UV resistant, highly flexible so that it can be bent perpendicular or parallel to corrugation. It should be light weight than it can be easily handled and transported.

80.3 It should possess excellent thermal insulation and rust proof to make it ideal for coastal region.

80.4 It should be fire retardant. It should be as per the sample approved by engineer-in-charge. It should be such type that it can be used in heavy industries, factories and warehouses, agricultural and food processing industries and for coastal construction

M-81 Fibre Glass

81.1 It shall be of the best quality such as Glass poll, Malibu or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to BSS : 4154.

81.2 It shall be a combination of glass fibre mat and polyester resin, suitably modified to resist ultraviolet degradation. It shall disperse light rays, allowing uniform diffused light penetration. It shall absorb the heat rays and so helps to save electricity. It shall be available in (1) Clear grade - where light transmission shall be 87% to 90%. (2) Natural white/green/blue/yellow/red - where light transmission shall be 60% to 70%. It shall be available in lengths of 1.5 m. to 3 m. The width shall be equivalent to that of asbestos/galvanized and aluminium corrugated sheets. It shall have a thickness of 1.2 mm. with a tolerance of $\pm$ 0.2 mm

81.3 It shall have a coefficient of linear expansion of .000012 per ^{o}C. Its heat distortation temperature shall be approximately 75□C. It shall have thermal conductivity of 0.22 Kcal/mh^{O}C. It shall have impact strength of 14.5 Ft, hardness of 40 - 50 Barcol and Brinell 26. It shall have a tensile strength of 600 - 800 Kg/cm^2 and compressive strength of 1200 - 1400 Kg/cm^2. On soaking for 24 hrs, at 25^{O}C, its water absorption shall be 0.24%. It shall have effective resistance to most chemicals except strong acids.

81.4 It shall be suitably used for industrial and residential roof coverings, where light transmission is desired. It shall also be used to cover swimming pools, gardens and terraces, if desired. It shall be normally self cleaning type but when used in industrial areas, it shall be cleaned with water and soap.

M-82 Polycarbonate Sheet

82.1 Polycarbonate sheets for versatile glazing shall of the best quality such as GE, Lexan or equivalent, as approved by the Architect and Engineer-in-charge. It shall meet all the requirements of BS: 6262. For impact performance, it shall meet the BS: 6206 requirements and for anti-bandit requirements, it shall conform to BS: 5544.

82.2 It shall be as transparent as glass, but shall have half its weight. It shall be tough and yet flexible. It shall have strong impact strength and shall offer thermal and sound insulation. It shall resist the effects of weather, shall be unbreakable and shall provide protection against forced intrusion. It shall be used for roof glazing, door and window glazing as well as privacy glazing, on many different types of buildings. As light weight, it shall be feasible to use it on wider spans. It promotes natural light and shall impart an impression of spaciousness.

82.3 It shall have tensile strength greater than 70 N/mm^2. Its flexural modulus shall be 2500 N/mm^2. and flexural yield strength shall be 100 N/mm^2. It shall have impact strength (falling dart) greater than 200 Nm. It shall have indentation hardness - H358 10 of 98 N/mm^2. and H358 60 of 93 N/mm^2. Its coefficient of linear expansion shall be 0.00067 per ^oC and thermal conductivity shall be 0.21 W/m.K. It shall have a specific gravity of 1.2 gm/cc. and water absorption @ 24 hrs. 23^OC shall be 10 mg. Its elongation at break shall be greater than 100%. It shall have a higher coefficient of thermal expansion. It shall allow light transmission of between 82% and 90%, depending on the thickness of the sheet. It shall not transmit UV radiation upto 385 Nm. It shall resist the effect of chemicals. It shall have self-extinguishing, low flame spread characteristics and low fire propagation indices.

M-83A Corrugated GI Sheet

83.1.1 CPWD specification clause no. 12.1.1, 12.1.2 shall be followed.

M-83B Pre painted (colour coated) galvanize sheet:

83.1B PPGL sheet shall be of tata colour bond or equivalent and as per manufacturer's specification.

M-84 Deleted

M-85 Teak Wood

85.1 CPWD specification clause no. 9.1 and 9.2 is to be followed.

M-86 Plywood

86.1 The plywood for general purpose shall conform IS : 303.
Plywood is made by cementing together thin boards or sheets of wood into panels. There are always an odd number of layers, 3,5,7,9 ply etc. The plies are placed so that grain of each layer is at right angles to the grain in the adjacent layer.

86.2 The chief advantages of plywood over a single board of the same thickness is that, plywood offers more uniform strength, along its length and width and also offers greater resistance to cracking and splitting with change in moisture content.

86.3 Usually synthetic resins are used for gluing, phenolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates, which maintain a temperature of 90^0C to 140^0C and a pressure of 11 to 14 Kg/cm^2, on the wood. The time of heating may be anything from 2 to 60 minutes depending upon the thickness.

86.4 When water glues are used the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are used as adhesive, the finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount of moisture has been absorbed.

86.5 According to IS : 303, the plywood for general purpose shall be of the grades namely BWR, WWR and CWR, depending upon the adhesives used for bonding the veneers, and it will be further classified into six types namely AA, AB, AC, BB, BC and CC based on the quality of the two faces, each face being of three kinds namely, A,B and C. After pressing, the finished plywood should be reconditioned to moisture content not less than 8% and not more than 16%.

86.6 Thickness of plywood boards: Plywood boards are available in thickness ranging from 3 to 25 mm. Tolerance in thickness shall be ± 10% for boards upto and including 5 mm; ± 7% for boards from 6 to 9 mm and ± 5% for boards above 9 mm thickness. The boards shall be of uniform thickness and the surfaces of the boards shall be sanded to a smooth finish. Number of plys in plywood boards shall be as per Table:

Thickness in mm	No of ply	Thickness in mm	No of ply
3,4,5,6	3	12,15,16,19	9
5,6,8,9	5	19,22,25	11
9,12,15,16	7		(Above 11 Ply as ordered)

Types of plywood :

M-86A Water Proof (Weather Proof) Plywood :

86A.1 The plywood shall be of approved make and as approved by the Architect and Engineer-in-charge. It shall conform to IS : 710 and to the relevant Defence and Navy specifications.

86A.2 Plywood shall be made from veneers of hard wood timbers and bonded with high quality BWP type Phenol Formaldehyde Synthetic Resin Adhesive and hot pressed at high temperature and pressure, and further treated with a fixed type of preservative by vacuum-cum-pressure impregnation, to produce thin boards or sheets of wood panels. There are always an odd number of layers. The plies shall be placed, so that, grain of each layer is at right angles to the grain in the adjacent layer.

86A.3 Plywood shall be waterproof, weather proof, boilproof, and highly durable even against strenuous vulnerable uses. It shall resist the attack of termites, cockroaches, wood burrowers, fungus, mould, rot, decay and other wood destroying insects and marine organisms.

86A.4 The tensile strength of the plywood shall be minimum 600 kg/cm$^{2.}$ and bending strength above 400 kg/cm^2. The swelling of plywood in water should be almost negligible. Specific gravity of plywood should be 0.7 to 0.75, having screw and nail holding strength normal to face, atleast 250 kg. and 60 kg., respectively.

86A.5 The moisture content shall be less than 10% and the plywood shall have high fire resistance and shall be free from any cracks, wraps, split etc., and shall have uniform strength all over the panel surface. It shall be used for marine structures, leather tanning tables, wall panelling, and underlayment for kitchen and other furniture, subjected to heat and moisture.

M-86B Commercial Ply:

86B.1 The plywood shall of approved make, as approved by the Architect and Engineer-in-charge. It shall conform to IS 303.

86B.2 Plywood shall be made from hard wood timbers, finished with selected species of timber, suitable for veneers and bonded with strictly controlled and evenly spread adhesives.

86B.3 It shall be smooth and strong and shall be free from warping, cupping and twisting.

M-86C Prelaminated - Standard and Veneered:

86C.1 **Decorative Plywood**

86C.1.1 It shall be obtained from manufacturer as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Code.

86C.1.2 Plywood shall be made from hard wood timbers, finished with selected species of timber, suitable for veneers and bonded with strictly controlled and evenly spread adhesives. It shall be smooth and strong and shall be free from warping, cupping and twisting.

86C.2 **Decorative Veneers**

86C.2.1 Decorative veneered plywood shall be manufactured using veneers of the best quality timbers like Teak, Rosewood, Walnut, Laurel, White Cedar and many others.

86C.2.2 They shall be available in flitch form as well as in lay-on form, in sizes suitable to the furniture industry. They shall be available either flat or quarter sliced, varying in thickness from 0.2 mm. to 1.5 mm. Lengths shall vary upto 4 m.

M-86D Block Boards

86D.1 They shall be manufactured from well-selected and seasoned hardwood timbers, used in sturdy construction. They shall be usually bonded with Urea Formaldehyde, however against specific requirements, Phenol Formaldehyde bonded boards shall also be available.

86D.2 They shall be strong, weather and water proof and shall be ideally used for high quality furniture and exterior applications.

M-87 Glass

87.1 All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes, blisters, and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of the glass panels shall be uniform. The specifications for different kinds of glass shall be as under:

87.2 **Sheet Glass**

87.2.1 In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 7.5 Kg/m^2. for panes upto 600 mm. x 600 mm.

87.2.2 For panes larger than 600 mm. x 600 mm and upto 800 mm. x 800 mm., the glass weighing not less than 8.75 Kg/m^2. shall be used. For bigger panes upto 900 mm. x 900 mm., glass weighing not less than 11.25 Kg/m^2. shall be used.

87.2.3 Sheet glass shall be patent flattened glass of best quality and for glazing and framing purposes shall conform to IS : 1761. Sheet glass of the specified colours shall be used, if so shown on the detailed drawings or so specified for important buildings and for panes with any dimensions over 900 mm., plate glass of specified thickness shall be used.

87.3 **Plate Glass**

87.3.1 When plate glass is specified, it shall be `Polished patent plate glass' of best quality. It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection. The plate glass shall be of thickness mentioned in the item or as shown in the detailed drawing or as specified. In absence of any specified thickness, the thickness of plate glass to be supplied shall be 6 mm. and a tolerance of 0.20 mm. shall be admissible.

87.4 **Obscured Glass**

87.4.1 This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figure, ribbed or fluted, or frosted, as may be specified or as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

87.5 **Wired Glass**

87.5.1 Glass shall be with wire netting embedded in a sheet of plate glass. Electrically welded 13 mm. Georgian square mesh shall be used. Thickness of glass shall not be less than 6 mm. Wired glass shall be of the type and thickness as specified.

87.6 **Double Glazed units**

87.6.1 Double glazed unit shall comprise of two glasses of appropriate thickness and absolutely machine-cleaned on both sides, with an air gap of 12 mm .in-between. The space between the two glasses is kept totally dry, avoiding any condensation by sealing the space with elastomeric sealant. Thus in all, it is an insulating glass unit of around 20mm. thickness.

87.6.2 It shall be suitably used for any kind of Doors and Windows, in all areas of work and residences. It shall be absolutely and clearly transparent, giving the following advantages:

1) Total light penetration, but with dust and heat insulation.
2) Noise insulation.
3) 25% saving in electricity due to heat insulation.
4) Crystal clear transparency.

M-88 PVC Water stops

88.1 The PVC waterstop shall be of approved make, as approved by the Architect and Engineer-in-charge.

88.2 It shall have optimum resilience, high elasticity & stretch strength, immune to corrosion, excellent weather resistance. They shall be manufactured to safeguard against hydrostatic pressure, water seepage, expansion or contraction of joints and to take care of any deflection or displacement arising due to change in temperature or settlement of foundation to eliminate danger of cracks.

88.3 They shall be effective in tropical climate having high mechanical strength, good ageing, longer life, shall be unaffected by acids, alkalis, metal salts and other chemicals. It shall not be hazardous and shall have fire retardant properties. It shall absorb less water than rubber, shall work as water tight seal but shall allow safe passage of seepage water and shall withstand high hydrostatic pressure. It shall be easily welded and can be installed easily, having high tensile strength and shall be capable of bearing heavy shocks arising due to turbines, earthquakes, floods etc.

88.4 It shall withstand a minimum hydrostatic pressure of 30 m. high column of water.

88.5 The selection criteria of waterstop depends upon the hydrostatic pressure, however the following points should be kept in mind :

1) Where substantial expansion/contraction of joints takes place, Dumb Bell type shall be used.
2) Where a firm grip in concrete is desired, serrated types should be used.
3) The overall width of the waterstop should not be greater than the thickness of concrete.
4) The distance from the face of the concrete to the waterstop must not be less than half the width of the waterstop.
5) The width of the waterstop must be at least 6 times the largest aggregate used for satisfactory compaction.

88.6 The prior approval of selected size and type of waterstop shall be taken from the Architect and Engineer-in-charge, before use.

M-89 Admixtures for Mass Concrete and Mortar

M-89A Joint Sealant :

89A.1 The sealant shall be of approved make, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

89A.2 It shall be a two component polysulphide rubber joint sealant, based on a low molecular weight polymer. It should not contain chlorides or other corrosive substances.

89A.3 It shall be used for sealing joints in water retaining structures, roofs, external walls, cladding, floors, partitions, ceilings etc. It shall have excellent property to adhere most of building materials like Aluminium, Stainless Steel, Glass, Concrete, Marble, Stone, Brick, Masonry block, Plaster, Ceramic and quarry tiles, Timber etc. The modulus of elasticity of the sealant shall be less than 0.16 MPa, $\pm$10% at 100% elongation. The shore "A" hardness of the sealant shall be 22$\pm$3 @ 25^{O}C. The operating temperature range for the sealant shall be -25^{O}C to 800C. The permanent dynamic movement capability of the sealant shall be $\pm$25%. The tensile strength of the sealant shall not be less than 0.4 MPa. The optimum width/depth ratio shall be 2:1. The Sp.gr. of the sealant shall be 1.6 kg/lit. The sealant should be capable to resist attack of water, sunlight, oxidation, corrosive fumes, oils, petrol, diluted acids and alkalis, salt spray, aliphatic and aromatic solvents and shall not contain tar or bituminous ingredients.

89A.4 It shall posses the properties like 550% elongation at break, non-toxicity when fully cured, no staining and shrinkage less than 1%. The trafficable strength shall be achieved within 24 hours and full at 7 days (at 25^{O}C & 250% RH). It shall possess excellent coverage capacity and more strength at low dry temperatures.

M-89B Abrasion Resistant Industrial Flooring Aggregate :

89B.1 The flooring aggregate, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

89B.2 The flooring aggregate shall be a factory processed and specially graded non-oxidising, non-magnetic and chemically inert metallic flooring aggregate, free from oil and grease.

89B.3 It shall be used as a surface hardener to concrete floors. It is recommended for Factory floors, Warehouses, Hangers, Car parks and such other areas, subjected to heavy vehicular traffic. It shall also be used on open and continuously wet surfaces. The flooring aggregate shall build in wear resistance and shall produce high abrasion resistant floor surface. It shall impart extreme surface density and shall offer resistance to oil and water penetration. It shall provide a non-rusting floor surface which is easy to maintain.

89B.4 It shall be used with cement in the ratio, as per the manufacturer's instructions and spread evenly on the surface to be treated, at the rate depending on the type of floor. The flooring aggregate shall be spread when the surface of the concrete floor is still fresh, i.e. as soon as the surface water has evaporated and then trawled, in stages, to bring about an uniform and smooth finish.

M-89C Concrete Hardener and Dustproofer :

89C.1 The Concrete hardener and dustproofer, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

89C.2 It shall have a specific gravity of 1.18 and shall be applied on concrete floors, at the rate of atleast 25 lit.s per 100 $m^{2.}$ per coat. A total of three coats shall be applied for permanently hardened concrete floor, with increased abrasion resistance, increased surface density, increased resistance to chemical attack and to eliminate dust accumulation. Drying time of 4-6 hours for each coat shall be allowed before the floor is put to use or is applied with another coat of the product. Precautions shall be taken while using the product, to avoid contact with eyes and open wounds and to work in good ventilation. After application, the affected parts shall be washed copiously. It shall not be stored for a period of more than 2 months before use.

M-89D Water Repellent Coating :

89D.1 The Water repellent coating, shall be of approved make and as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

89D.2 Water repellent coatings for exterior exposed surfaces shall be acrylic resin based, having a Flash point of approx. 40^0C and specific gravity of 0.95.

89D.3 It shall be suitably used for concrete, brick, stone and plastered surfaces preventing moisture penetration and thus any damage to the interiors. It shall be quick acting, long lasting, invisible i.e. colourless so as to maintain the original colour of the surface treated. It shall impart sealing characteristics so that the treated surface becomes stain and dust free. The coating itself shall not darken or turn yellow with age.

M-89E Accelerating, Water Reducing Admixture and Plasticiser:

89E.1 The Accelerating, Water reducing admixture and plasticiser, shall be of approved make, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

89E.2 It shall be in liquid state with a specific gravity of 1.30 and complying with ASTM C-494 Type E, IS: 9103 & IS: 2645. It shall accelerate the setting and hardening of the concrete mix, thereby achieving higher early age strength. It shall reduce the water content of the concrete without affecting its workability. It is useful for pre-cast/pre-stressed works, structural concrete works, floors, roads, runways, paving etc. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-89F Retarding, Water Reducing Admixture and Plasticiser:

89F.1 The Retarding, water reducing admixture and plasticiser, shall be of best quality and from approved make, as approved by the Engineer-in-charge. It shall conform to the relevant IS Code.

89F.2 It shall be in liquid state with a specific gravity of 1.22 and complying with ASTM C-494 Type B & D, IS : 9103, CRD-C87 Type B & D, BS 5075 Part 1. It shall be added to the concrete mix during the mixing process, at the same time as the water or the aggregates. No extension of normal mixing time is necessary. It shall extend the period of time as to placing the concrete and compacting, i.e., delay the initial and final setting time. It shall help to spread the heat of hydration over a longer period. It shall give a highly workable concrete with a low W/C ratio. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-89G Water & Weather Proof Compound:

89G.1 The water & weather proof integral cement admixture shall be of best quality and from approved make, as approved by the Engineer-in-charge. It shall conform to the relevant IS Code.

89G.2 It shall be used as an excellent cement admixture in all types of concrete/plaster mortars, pointing mortars, masonry works, guniting works and pressure grouting works. It shall improve resistance of concrete surfaces to weathering and chemical attack. It shall be non-toxic so as to use for waterproofing water tanks, reservoirs, bio-gas tank, leaking ceiling, basements, tunnels, lift wells etc.

89G.3 It shall be mixed to concrete or plaster mortar, while mixing. First, water is added and then the admixture, at the rate instructed by the manufacturer. For use of the admixture, precaution shall be taken to use clean materials for preparation of mortar.

M-90 Sand Stone Grills/ Baluster:

90.1 Sample shall be approved by the Architect and Engineer-in-charge.

90.2 It shall be made from best quality either Bansipahadpur or as specified in item having uniform colour (no other colour spot shall be allowed) and texture. The sand stone shall be even, sound, durable and free from any veins, cracks and flaws. The thickness of the stone used shall be as specified in item of work with the permissible tolerance of $\pm$2 mm.

90.3 The sandstone grills shall be produced by fine chiselling. All edges, faces and angles of fine hand chiselled grills, columns, baluster shall be smooth finished.

M-91 Polyurethane Foam Insulation:

91.1 Polyurethane foam shall be of approved make, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Code.

91.2 It shall have high strength to weight ratio alongwith excellent thermal insulation and acoustic absorption. It shall be based on the exothermic, catalytic reaction of polyisocynates with polyol molecules containing hydroxyl groups in the presence of blowing agent. It shall be perfectly homogenous and having uniform characteristics like perfect adhesion to metal surfaces, higher insulation capacity, maximum resistance and lightness. It shall be perfect non-hygroscopic, completely water proof having dimensional stability, optimum thermal insulation, fire retardancy.

91.3 It shall be of low foam density, not more than 40 Kg/m^3. The thermal conductivity shall be 0.02 Kcal/m hr ^{O}C. The compressive strength shall not be less than 2.5 Kg/$cm^{2.}$ and 1.2 Kg/$cm^{2.}$, in direction parallel to rise and perpendicular to rise respectively. The close cell content of the foam shall be 90 to 95% and it shall be workable within the temperature range of -150^{O}C to +80^{O}C. The water vapour permeability shall be 2.0 perms/in.

M-92 Fibreglass Reinforced Plastics (FRP)

92.1 Fibreglass Reinforced Plastic shall be of approved make, as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Code.

92.2 It shall be either unidirectional reinforced or sheet moulded or filament wound epoxy to match the purpose of work and item of tender. It shall have versatile chemical inertness, electrical resistance and mechanical strength, ease of processibility, repeatability and predictability. It shall have desirable characteristics like light weight, high strength, stiffness, toughness, thermal insulation properties, superior weather resistance, complete elasticity, fatigue, creep, resistance to corrosion, rot, swelling, insects, fungus etc.

92.3 There shall be no yield point beyond which buckling or denting of the FRP occurs, to reduce the possibility of irritating damages for minor stresses or impacts. The density, flexural strength and flexural modules shall not be less than 1.5 mg/m^3., 1000 MPa and 40x10^3 MPa, respectively. It shall have minimum tensile strength, tensile modulus and compressive strength of 1000 MPa, 40x10^3 MPa and 250 MPa, respectively. The FRP shall have thermal conductivity about 0.2 w/m^{O}C. Thermal coefficient of expansion shall be less than 10x10^{-6} per ^{O}K.

92.4 The minimum glass content shall be 60%. The weight index for stiffness and tensile strength at yield shall not be less than 0.6 and 0.9 respectively. No damage should be there while testing at impact energy of 8 joules. The level of translucency should be greater than 80% of diffused transmission that of direct light. It shall provide superior aesthetic value with incorporated colour. It shall be good fire retardant, durable and impermeable to water.

M-93 Fly ash

CPWD specifications clause no. 3.1.5 shall be followed.

M-94 Plaster of Paris

94.1 Plaster of Paris is manufactured from heating gypsum at 120ºC - 160º C. When plaster of Paris is mixed in water it rehydrates and form dense matrix of gypsum crystal.

94.2 Chemical formula of POP shall be CaSO4, ½ H2O.

94.3 Plaster of Paris shall be stored at dry place. Once the mix is prepared, it shall be applied within half an hour or the final setting whichever is earlier. Set material and wastage cannot be used.

EARTH WORK & CARRIAGE OF MATERIAL

Note:
1) The method of excavation shall be approved by the Engineer in charge before execution.
2) Excavation shall be carried out very carefully without damaging existing structures and surrounding if any.
3) If required, the contractor shall provide stabilization by any means to protect the foundation of the existing structure and building without any extra cost.
4) Rate shall include dewatering work (pumping out and removing slush) while execution in underwater condition if required.

Item No. 1
Excavation for all kinds of soil
Earthwork in excavation for all kind of soil by any means including getting out the excavated soil, sorting and stacking of useful material, dressing of the sides, ramming of bottom, and disposal of surplus excavated earth for all lead within the site area at non objectionable place and lift up to 1.5 mt depth, including dewatering and working in or under water and /or liquid mud, including pumping out water/slush as required etc complete as directed by engineer-in-charge. In case of excavation for pipe, cable, any services trenches, making base for road work, pavement works walkway, etc, proper slop and camber by any means shall be maintain and dressing of the sides shall be made as per requirement and as directed by engineer-in-charge.

1.0 General

1.1 CPWD specifications clause no. 2.0, 2.1, 2.2, 2.3 shall be followed.

2.0 Site Clearance

2.1 CPWD specifications clause no. 2.4 shall be followed except nothing extra will be paid for removing, diverting existing structures and services and providing fencing for the any archaeological monuments within or adjacent to the area.

3.0 Setting out and making profiles

3.1 CPWD specifications clause no. 2.5 shall be followed.

4.0 Excavation

4.1 CPWD specifications clause no. 2.7, 2.9 shall be followed up to any width (not restricted to 1.5m) and any area (not restricted to 10 sqm) on plan.

4.2 The Contractor shall do the necessary shoring and strutting or shall provide necessary slopes to a safe angle or steps as required or directed at his own cost. No extra payment shall be made for such precautionary measures taken by contractor.

4.3 The Contractor shall at his own expense and without extra charge make provision of supporting all utility services, lighting the trenches, separating and stacking serviceable materials neatly, shoring, timbering, strutting, bailing out water either sub-soil or rainwater, including pumping at any stage of the work. Trenches shall be kept free of water while masonry or concrete works are in progress and till the Architect and Engineer-in-charge considers it necessary, i.e. till the concrete is sufficiently set.

4.4 Maximum of 1 Horizontal: 1 Vertical slope shall be allowed and paid.

5.0 Disposal of the excavated stuff

5.1 The excavated stuff of the selected type shall be used in filling the trenches and plinth or levelling the ground in layers, including ramming and watering etc. complete as directed by the engineer-in-charge.

5.2 The Contractor has to dispose the surplus excavated earth within the site area at non objectionable place.

5.3 The lead is the shortest practical route and not necessarily the route actually taken. The decision of Engineer-In charge shall be final.

6.0 Mode of Measurement and Payment

6.1 CPWD specifications clause no. 2.11, 2.12.1 (a to f) shall be followed.

6.2 Plan area of base PCC as per structural drawing shall be measured for payment (unless otherwise

specified). The contractor shall quote the rate for excavation with additional quantity for surrounding working space (which shall not be paid).

6.3 The rate shall also include necessary shoring & strutting, getting out the excavated soil, sorting and stacking of useful material, dressing of the sides, ramming of bottom, watering, dewatering and working in or under water and/or liquid mud, including pumping out water/slush as required, compacting and disposal of surplus excavated earth for all lead at non objectionable place within the site area as directed by engineer in charge.

PLAIN & REINFORCEMENT CEMENT CONCRETE WORK

Note -
1) All types of shuttering shall be designed by the contractor and submitted to the Engineer in charge along with design calculations (if required) and approved by the Engineer in charge. However, the Stability and compatibility of shuttering shall be the responsibility of the contractor. Shuttering shall be executed as per the approved shop drawing. No extra payment shall be made for the above.
2) Rate shall be inclusive of dewatering work (pumping out and removing slush) while execution in underwater conditions. The contractor shall not claim for dewatering if required.
3) Rate shall be inclusive of providing grooves, drip moulds, pockets, cut-outs, etc., and co-ordination of insert sleeves, insert plate (cost of insert sleeves/ plate shall be paid separately), encasing if any wherever required while casting for all level all height.
4) If required, concrete batching and mixing plant of minimum 60 cum/hr capacity shall be set up by contractor.
5) Mould release agent of approved make shall be used at every repeatation on formwork material.
6) Shuttering shall be compatible with self-compacting concrete (SCC) work, wherever required.
7) Shuttering shall be compatible with heavy/bulky RCC elements, wherever required.

Item No. 2
Concrete (PCC) of grade - M15
Providing and laying in position Controlled cement concrete /Ready mix concrete/ batch mix concrete of cement concrete (PCC) of grade - M15 cement concrete work, using cement content as per approved design mix (Min cementitious level as per latest IS 456 shall be maintained) manufactured in fully automatic batching plant and transported to the site of work in transit mixer for all lead having a continuous agitated mixer, for reinforced cement concrete work including pumping from transit mixer to site of laying; cost of admixtures in recommended proportions as per IS: 9103 to accelerate, retard the setting of concrete, improve workability without impairing strength and durability; finishing, compacting, vibrating, curing, dewatering (if required), etc, including the cost of form work and removal of formwork, dewatering (if required), etc. complete for all level, all height/ depth and for all lead and lift and as directed by the Engineer.

1.0 Material
1.1 Water
1.1.1 Water shall conform to M-1.

1.1.2 Cement
1.2.1 Cement shall conform to M-3.

1.2 Coarse Sand
1.3.1 Sand shall conform to M-6.

1.4 Coarse Aggregate
1.4.1 Coarse Aggregate shall conform to M-12.

2.0 Workmanship

2.1 CPWD specifications clause no. 4.2 to 4.2.14 shall be followed.

2.2 General

2.2.1 Before commencing the concreting, the depth and width of the excavated foundation shall be checked as per the drawing. The bed of foundation trenches shall be cleared off of all loose materials, levelled, watered and rammed, as directed by engineer-in-charge.

3.0 Mode of Measurement and Payment

3.1 CPWD specifications clause no. 4.2.15.1 to 4.2.15.5 and 4.2.15.7 shall be followed.

3.3 The rate includes the cost of material, labour, tools and plant required for mixing, placing in position vibrating and compacting, finishing, curing, form work and removal of formwork, dewatering (if required) as directed by engineer-in-charge of specified strength, for all floors, all shapes at any height and level, and in any position.

The rate shall be for a unit of one **Cum**.

Item No. 3
Providing and laying in position Exposed Finish controlled cement concrete manufactured in fully automatic batch mixed plant of specified/ required capacity (batch mix plant shall be installed by contractor on site) for reinforced cement concrete work as per design mix of specified grade using graded black trap stone aggregates of maximum 20mm nominal (down graded) size including fine aggregates conforming to latest IS 383 with minimum cement content (without fly ash) for durability (followed as per IS-456 and technical specification) shall be followed as per approved design mix for all elements of any shape and size, at all places and heights/ depths including transporting by transit mixer for any lead having continuous agitated mixer, laying of concrete to site by any means like pumping, tower crane or boom placer etc., vibrating, finishing and curing etc. and including admixtures in recommended proportions as per IS 9103 to accelerate, retard setting of concrete, to improve workability without impairing strength and durability as per direction of Engineer-in-charge. Rate shall be inclusive of providing grooves, drip moulds, ghisis, pockets, cutouts etc. and labour for insert sleeves if any wherever required while casting.
Rate shall be inclusive of shuttering and centering/ formwork (shuttering plate made of welded smooth finish plate of min 3mm thick MS plate, thickness of formwork shall be such that no bulging or deformation of concrete element occurs) for exposed finish concrete with pattern, lift charges, scaffolding, staging, propping etc and tie rod assembly of PVC cone and coil on both side of the concrete walls, filling the same with non shrink grout or polymer mortar and excluding cost of steel reinforcement. Full height shuttering with single pour system shall be followed. Contractor to prepare shuttering drawing as per the shuttering pattern given by architect. All concrete work shall be exposed finish (without any honey comb). Contractor shall use mould release agent of approved make before use of shuttering material every time.
A sample of each element shall be prepared with and without shuttering pattern at location as per instruction of Architect and SRFDCL Engineer in charge for review and approval before mass execution.
Contractor may use 18mm laminated ply at some specific place, after taking prior written permission from Architect in charge and SRFDCL before using the ply.
Concrete of M 30 grade

1.0 Materials

1.1 Water

1.1.1 Water shall conform to M-1.

1.2 Cement

1.2.1 Cement shall conform to M-3.

1.3 Coarse Sand

1.3.1 Sand shall conform to M-6.

1.4 Coarse Aggregate

1.4.1 Coarse Aggregate shall conform to M-12.

2.0 Workmanship

2.1 CPWD specifications of item no. 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.4.5, 5.4.6 shall be followed. The relevant CPWD specifications clause no. 4.2.1 to 4.2.14 shall be followed.

2.2 Before quoting the rate, contractor shall confirm the exposure condition for the design of concrete. Mix design shall be carried out for environmental exposure condition as given in IS 456: 2000, page no. 18 table 3.

2.3 All concrete work shall have fair finish concrete surface without any pattern unless otherwise specified.

2.4 For concrete element specified in the drawing fair finish steel shuttering made out of MS sheet not less than 14 gauge/ laminated plywood and supporting frame work shall be of steel. Proper care shall be taken in MS shuttering at the time of concreting during monsoon to achieve rust free concrete surface. The concrete surface shall be rendered if required to give fair finish.

For other concrete shuttering material shall be as follows:

- Columns: Moulds from marine ply with wooden battens or MS steel plates
- Straight walls / Curved wall in plan: Marine plywood with wooden battens of Acro make or equivalent makes plates and soldiers.
- Beam: Bottom - timber / steel plates, Sides - Steel plates / marine ply with battens

2.5 The concrete shall be designed as per relevant IS code- IS 10262 and SP 23, with or without chemical admixture to provide the grade of concrete having required workability and characteristic strength as per IS 456:2000. The proportion of cement, sand and coarse aggregates shall be determined by weight. The weight batch machine shall be used for maintaining proper control over the proportion of aggregates as per mix design. The design mix shall be got approved by Engineer in-charge before starting the concrete work. The minimum cement content shall depend on the exposure condition of the concrete. The minimum cement content given in table (IS 456:2000, table 5) shall be adopted irrespective of whether the contractor achieves the desired strength with less quantity of cement. The strength requirements of different grades of concrete shall be as under:

Grade of Concrete	Compressive strength of 15 cm. cubes in N/mm^2. at 7 and 28 days conducted in accordance with IS : 516 : 1959		
	At 7 days	At 28 days	Max size of agg. In mm
M-10	7	10	20
M-15	10	15	20
M-20	13.5	20	20
M-25	17	25	20
M-30	21	30	20
M-35	24	35	20
M-40	28	40	20

In all cases, the 28 days compressive strength specified in above table be the criteria for acceptance or rejection of the concrete.

2.6 Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for all purposes as concrete belonging to the lower of the two grades between which its strength lies.

2.7 The Contractor shall take necessary care to avoid sand streaks, air holes, honey combining etc., on finished concrete surface.

2.8 Proportioning

2.8.1 The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work and the supply of properly graded aggregate of uniform quality can be maintained till the completion of work. Grading of aggregate shall be controlled by obtaining the coarse aggregate, in different sizes and blending them in the right proportions as required. Aggregate of different sizes shall be stocked in separate stockpiles. The required quantity of material shall be stockpiled several hours, preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading, as approved for samples used in the preliminary tests.

2.8.2 In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag a reasonable number of bags shall be weighed separately, to check the net weight, where cement is weighed from bulk stocks at site and not by bags. It shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in clean and serviceable condition. Their accuracy shall be periodically checked and calibrated in standard laboratory.

2.8.3 It is most important to keep the specified water cement ratio constant and at its correct value. Moisture content in both fine and coarse aggregates shall be determined by the engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates IS: 2386 (Part III) shall be referred. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content.

2.8.4 The minimum cement content for the various mixes shall be as per IS – 456:2000 (Table -5, Page - 20).

2.8.5 All RCC works shall be carried out as per the detailed drawings and direction of Architects and Engineer-in-charge. The concrete shall be placed at all heights, levels and for all shapes.

3.0 Mode of Measurement and Payment

3.1 The relevant specifications of item no. 5.4.11.1, 5.4.11.4, 5.4.11.5, 5.4.12, 5.4.13 shall be followed. The rate shall be included or exclude the cost of centering and shuttering will be as specified in the item description.

3.2 The rate shall be for a unit of one **cum**.

3.3 The rate shall be inclusive of chemical admixture like plasticizer etc. as directed by the engineer-in-charge. No extra payment shall be paid for.

Specifications of item no. 13 & 14 shall be followed in addition to that following specifications shall also be followed for exposed RCC work.

Formwork for Exposed concrete surface:

All vertical members for formwork shall be of steel like Acro props, H frame etc. Care shall be taken to set all formwork in perfect line, level (or in required camber or slope as specified) and plumb. Formwork propping shall be strong, rigid, and sturdy. The formwork shall be as per pattern & design shown in drawings. Formwork shall be done accurately and precisely to achieve neat, clean, and smooth concrete surface, in line, level and plumb. Clinks, twists, offsets, warps, riveting etc. in plates or forms shall not be allowed. Before placing concrete, forms shall be thoroughly cleaned off all rust, dust and loose materials. Mould release agent as per the Architect / Engineer in charge shall be applied on sheathing before placing the reinforcement steel. Also, the formwork material will be plate of min 3mm thick MS plate and 18mm laminated ply at some specific place, after taking prior written permission from Architect in charge and SRFDCL before using the ply. All exposed concrete surfaces should have uniform colour and texture. After de-shuttering, all concrete surfaces shall be properly rendered with

sandpaper or emery stone. The sample of the exposed concrete shall be got approved by the architect or engineer in charge.

For walls and columns, the sheathing plates shall be bolted with special nuts and bolts- spring coils and PVC cone spacer. No through bolts shall be allowed.

For all kind of exposed concrete work only one brand (to be approved by the Engineer-in-charge) of cement shall be used.

The rate shall be for unit of **Cum**.

Item No. 4
Providing and fixing Thermo-Mechanically Treated bars (Fe 550 D) Reinforcement for R.C.C. work including transporting to the work site, straightening, cutting, bending, cranking, fabricating to required shape, placing/ lowering in position by suitable method, and tying / binding the system (with GI wire) all complete for all leads and lifts, all levels, all floors, all heights/ depth, etc complete and as directed by the Engineer in charge.
Measurement will be made on the length basis and converted into weight by using standard co-efficient (rolling margin's and wastage shall not be paid). No separate payment shall be made for laps, chairs, pins, lifting hooks, spacers, and binding wire.

1. Material
1.1 Reinforcement
1.1 Reinforcement shall conform to M-17.

1.2 Binding Wire
1.2 Binding Wire shall conform to M-18.

2. Workmanship
2.1 CPWD Technical specifications clause no. 5.3.1 and 5.3.2 is to be followed.

2.2 The type of reinforcement shall be as per the item description. The contractor shall submit the test certificate from steel manufacturer as and when required. The test results shall be verified, if required in any reputed laboratory.

2.3 Bar bending schedule shall be made by the contractor before starting the work. The payment shall be done based on quantity worked out in bar bending schedule. The bar bending schedule shall be prepared as per SP 34.

2.4 All the reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position with 18 gauge annealed/GI binding wire as approved by Engineer-in charge. The rebars shall be placed with stay blocks or metal chair spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars shall not be allowed to sag between supports nor displaced during concreting or any other operations of the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports shall not extend to the surface of concrete, except where shown on drawing. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall not allow. Pieces of broken stone or brick and wooden blocks shall not be used. Layers of bars shall be separated by spacer bars at 1m c/c , Precast cover blocks in cement mortar 1:2 (1cement : 2 coarse sand) about 4 X 4 cm square section or 4 cm dia round section or PVC cover blocks shall be used to maintain the cover of the concrete members as directed by Engineer In charge or Architect. Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawing. All the bars projecting from concrete and to which other bars are to be spliced and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout.

2.5 Bars crossing each other where required shall be secured by 18-gauge GI binding wires (annealed) of size not less than 1 mm., in such manner than they do not slip over each other at the time of fixing and concreting.

2.6 As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed. Where directed and practicable overlapping bars shall not touch each other, but be kept apart by 25 mm. or 1.25 times the maximum size of the coarse aggregate, whichever is greater by concrete between them. Where not feasible, overlapping bars shall be bound with annealed wires not less than 1 mm. thick, twisted tight. The overlaps shall be staggered for different bars and located at points along the span where neither shear nor bending movement is maximum in beam and slab.

2.7 Whenever indicated on the drawings or desired by the Architect and Engineer-in-charge, bars shall be joined by couplings which shall have a cross section sufficient to transmit the full stresses of bars. The ends of the bars that are joined by coupling shall be upset for sufficient length so that the effective cross sectional the base of threads is not less than normal cross section of the bar. Threads shall be standard threads. Steel coupling shall conform to IS : 226.

2.8 When permitted or specified on the drawings, joints of reinforcement bars shall be welded with appropriate welding rod as per the instructions given by Structural Engineer. The type of welding, size of fillet etc shall be as approved by Structural Engineer. Welded joints shall preferably be located at points when steel will not be subject to more than 75 % of the maximum permissible stresses and welds so staggered that any one section not more than 20 % of the rods are welded. Only electric arc welding using a process which excludes air from the molten metal and conforms to any or all other special provisions for the work shall be accepted. Suitable means shall be provided for holding bars securely in position during welding. It shall be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M.S electrodes used for welding shall conform to IS: 814. Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed. Welding shall be done by electric arc process as per IS : 816 and IS : 823.

2.9 At the time of concreting, a bar fitter shall remain at site to keep the reinforcement in position.

2.10 Rolling margin shall be checked for each lot of steel received at site. This rolling margin shall be considered for reconciliation of steel at the end of the project or after the end of each month as per the decision of engineer -in charge.

3.0 Mode of Measurement and Payment

3.1 Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Where welding or coupling is resorted to in place of lap joints, such joints shall be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in kg by using standard IS co-efficient. Length shall include hooks at the ends. The wastage of steel and binding wires shall not be measured and paid extra. The rolling margin of steel shall not be paid extra.
Measurement will be made on the length basis and converted into weight by using standard co-efficient (rolling margin's and wastage shall not be paid). No separate payment shall be made for laps, chairs, pins, lifting hooks, spacers, and binding wire.

3.1 The rate for reinforcement shall include the cost of labour and material required for all operations described above like cleaning of reinforcement bars, straightening, cutting, hooking, bending, binding, welding placing in position etc. as per the drawing or directed by the engineer-in-charge Rate shall also include the cost of annealed (with two strands) binding wires, devices like chairs, pins, spacer bars, cover blocks of PVC or cement mortar etc. for keeping reinforcement in position.

3.2 The rate shall be for a unit of **KG**.

Item No. 5
Providing and fixing 110 mm dia PVC pipe having capacity of 6 Kg/cm2 with ISI mark of required length as shown in the structure drawing wherever pipes pass through walls as weep hole before concreting for all level/ all depth/ height. All pipes shall be accurately cut to the required sizes, laid as per drawing, kept in the position while laying reinforcement and shuttering, sleeves shall not get displaced while concreting, and burrs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid clogging while concreting. At one side of pipe, SS 304 mesh shall be placed to protect filled soil. Rate shall be inclusive of pipe and SS 304 mesh. Item shall not be used for diaphragm wall construction. Actual installed length of pipe shall be measured for payment.
PVC Sleeve – Upto 110 mm Diameter

1.0 Materials

1.1 PVC pipe shall be of approved make.

2.0 Workmanship

2.1 Preparation - The joint surfaces must be thoroughly dry, clean, and all the dirt, laitance, oil or grease, rust, scale and protective lacquers from metal surfaces should be cleaned before positioning a bond breaker or back up tape.

2.2 **Supply and Handling -** Joint filler must be checked for tight packing so that no gaps or voids exist at the base of the sealing slot.

2.3 **Installation -** A thin coat of primer should be applied on the concrete surfaces and allowed to dry "tack free" before sealing. The mixed polysulphide sealant must be applied after the evaporation of the solvent but before the primer film has completely reacted. After 3 hours the surface should be re primed before the application of sealant. The sealant should be thoroughly mixed with a paddle stirrer for a full five numbers (at 300 - 500spm). The mix should be applied by a Gun to the joint and should be tooled to a smooth finish. These joints should be flush and unpainted.

2.4 The deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one year after completion of the work and 10% shall be retained for the balance of defects liability period and shall be refunded only after the completion of the defects liability period.

3.0 Measurement for Payment

3.1 The sealant Joint shall be measured in **running meters.**

3.2 The contract unit rate shall include the cost of materials, labour, equipment, and other incidental charges for fixing the sealant in position.

WATERPROOFING WORK

Note:-
1) All waterproofing treatment/work shall be executed through an approved water-proofing agency of an approved manufacturer. The Contractor shall submit technical data sheets for each product that will be used for execution.
2) The Contractor shall submit a methodology statement with all relevant details in illustrative sketch form and get them approved by the Engineer-in-charge.
3) A written guarantee/bond on non-judicial stamp paper (tri-party) shall be submitted by the main Contractor and provided by the principal manufacturer and applicator, who has carried out the work. The guarantee/bond shall be for a period of ten years from the certified date of completion of the overall work. The guarantee shall be for a composite warranty against leakages/seepage/dampness and for the satisfactory performance of the entire waterproofing system.

4) Waterproofing shall be executed under the supervision of the technical team of the manufacturer. Waterproofing shall be tested and approved by the Engineer-in-charge before proceeding with subsequent activities.
5) The Contractor shall repair the concrete elements by injection grouting of suitable non-shrink grout and other suitable methods in case of defective concreting of retaining walls, water tanks, slabs, beams, etc., for which no extra costs shall be payable.
6) Rate shall be inclusive of surface preparation, repairing, injection grouting, saw cutting of construction joints and filling with patch repair mortar, making polymer mortar/Polymer CC fillets at horizontal as well as vertical corners, etc complete. The rate shall be inclusive of testing of elements and the system before and after waterproofing application.
7) Rate shall be inclusive of dewatering work (pumping out and removing slush) while execution in under water conditions.
8) The latest technical system/product shall be adopted at the time of execution.

Item No. 6
Planter waterproofing (screed + Drain board)
Supplying and laying M25 grade vibrated concrete screed (admixed with water proofing compound conforming to IS: 2645 and approved by the Engineer-in-charge) in proper slope and gradient including saw cutting (if required), making angle fillet of 50mm x 50mm at the corners/Junction using M25 grade concrete and filling the grooves/joints/junctions (internal& external) with PU sealant (minimum 20 mm depth over PE backer rod). If Screed concrete shall be laid over on existing concrete surface/existing laid stone surface, a bonding agent shall be applied before laying of concrete. After the laying of the required thickness screed, polypropylene HDPE dimpled drain board (with inbuilt geo textile drainage membrane of 100 gsm at top) shall be laid, with a minimum overlap of 100 mm, based on soil characteristics and height of soil overburden. Cost includes all material, labour, T&P, and wastage involved as mentioned in the item. Actual volume of laid concrete shall be measured for payment without considering wastage.

1.0 Material & Workmanship

Relevant specifications shall be followed as per the item description and as directed by engineer in charge.

2.0 Measurement and Payment

The rate shall be for a unit of one Cum.

Item No. 7
12 to 15 mm thick water proof Plaster
Providing and laying 12 to 15 mm thick water proof single coat smooth / wired finish cement plaster on sides of masonry work / block work / RCC work, in any shape, in CM 1:3 (1 cement : 3 fine sand) and water proofing compound of approved make in proportions recommended by the manufacturer, finishing the surface wired finish/ smooth finish with a floating coat of neat cement slurry for all floors, all height including hacking to RCC surface, scaffolding, curing etc. complete as directed by engineer-in-charge.

1.0 Material & Workmanship

Waterproofing compound shall be of approved make. Relevant specifications shall be followed as per the item description and as directed by the engineer in charge.

2.0 Measurement and Payment

The rate shall be for a unit of one Sqm.

PAINT WORK

Note:-
1) All adhesives, sealants & paint shall be water based, with low VOC with acceptable VOC content as per Green Building Norms requirements and lead free.
2) Paint shall be applied after thoroughly brushing the surfaces, free from mortar dropping and other foreign matter, preparing the surface even and sand papered smooth etc, after applying every coat of putty and primer complete.
3) Contractor shall furnish warranty paper, wherever applicable.
4) If necessary more coats shall be applied till the surface presents a uniform appearance without any extra cost.
5) Paint shall be applied with any means (i.e. brush, roller, spray etc)
6) Contractor shall prepare sample of minimum three shades as suggested by engineer in charge for approval.
7) The rate shall be applicable for all floor, all level, all height by any means of scaffolding.

Item No. 8
Acrylic emulsion paint with primer - Exterior grade
Providing and applying 100% Acrylic Smooth exterior paint with exterior primer of Two or more coats of paint including required number of priming coat of exterior primer as per manufacturer's specification of approved make and shade, having VOC (Volatile Organic Compound) content less than 50 grams/ litre of required shade over any surface etc complete for all floors all heights all levels. Exterior paint and primer shall have minimum 7 years warranty.

1.0 Material
1.1 Acrylic paint
1.1.1 It shall be from approved makes list. It shall conform to the relevant IS Codes.
1.1.2 It shall be used on both interiors and exteriors on all different types of plaster, wooden surfaces, stone, brickwork, asbestos cement sheets, hard and soft boards, etc. as specified in the drawing. It shall render rich smooth finish and shall provide a tough film that forms a suitable protection against all elements.
1.1.3 It shall be water thin able. On interior surface it shall be applied after one coat of cement primer and in case of exterior surface it shall be applied on waterproof cement coating. On a new but highly absorbent surface, a thin coat of the paint shall be applied by adding two parts of water by volume to two parts of Acrylic Emulsion by volume. On previously painted surfaces, one coat of the acrylic paint shall be applied by thinning four parts of the emulsion with one or two parts of water. It shall be applied by brush, roller or spray. It shall have a covering capacity as per manufacture’s specification, depending on the surface and shade used. It can be washed to remove the day-to-day dirt, after the surface has been painted, minimum for a month. It should be non-flammable. For the best performance of paint proper washing and cleaning of all algal and fungal growth at regular intervals at six months is required.

2.0 Workmanship
2.1 General
2.1.1 The materials required for work of painting work shall be obtained directly from approved manufacturers or approved dealer and brought to the site in maker's drums, cage etc. with seal unbroken.

2.1.2 All materials not in actual use shall be kept properly protected, lid of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of water to prevent formation of skin. The materials, which have become stale or flat due to improper and long storage, shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in smaller container. No left over paint shall be

put back into stock tins when not in use. The paint shall be stirred thoroughly in its container before pouring into small containers.

2.1.3 If for any reasons, thinning is necessary, water shall be added as per supplier's instructions.

2.1.4 The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, damp or otherwise unfavorable weather and all the surfaces shall be thoroughly dry before painting work is started.

2.2 Scaffolding

2.2.1 Where scaffolding is required, it shall be erected in such a way that as far as possible, no part of scaffolding shall rest against the surface to be distempered. A properly secured strong and well tied suspended platform (Zoola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary and the floor area shall be covered with plastic so that the flooring is not spoilt.

2.3 Preparation of surface

2.3.1 CPWD specifications clause no. 13.19.2 shall be followed.

2.3.2 The surface spoiled by smoke soot shall be scrapped with steel wire brushes or steel scrapers or shall be rubbed with over burnt surkhi or brick bats. The surface shall be then broomed to remove all dust and dirt and shall be washed with clean water.

2.3.3 Oil or grease spots, algae or other foreign materials shall be removed by suitable chemical and vigorous brush. If the surface is cleaned with water than it should be allowed to dry before application of paint. In no case the finishing shall be allowed on damp course.

2.3.4 All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonry joints properly. Such portions shall be wetted and allowed to dry. Any crevice, at any level shall be cleaned and filled with the plaster mortar and cured as above.

2.3.5 All unnecessary nails shall be removed; the holes, cracks, patches etc. shall be made good with material similar in composition to the surface to be prepared.

2.3.6 New plaster surface shall be allowed to dry for atleast 2 months before applications of paint and primer.

2.3.7 The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with IS: 2395 (Part-1)-1966.

2.3.8 All unnecessary nails, hooks etc. shall be removed. Pitting in plaster shall be made good with plaster again and papered with a fine grade sandpaper and made smooth. A coat of paint shall be applied over the patches. The surface shall be allowed to dry thoroughly before the regular coat of paint is applied. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with IS : 2395 (Part-1)-1966. Before applying paint, any unevenness shall be made good by applying putty made out of plaster of paris mixed with water, on entire surface, including filling up the undulation and then sand papering the same after it has dried.

2.4 Application

2.4.1 Before pouring into small containers for use of applying, the paint shall be stirred thoroughly in its container. Also, the paint shall be continuously stirred in the smaller container, so that its consistency is kept uniform.

2.4.2 The paint shall be laid on evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in

direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

2.4.3 On the newly plastered surface, the first coat shall be applied with 100% dilution or exterior grade primer, second and third coat shall be applied with 40 % dilution or as per the supplier's instructions The second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking of the brush being used.

2.5 Precautions

2.5.1 Old brushes if they are to be used with emulsions paints, shall be completely dried of turpentine or oil paint by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and shall be kept immersed in water during break periods to prevent the paint from hardening on the brush.

2.5.2 In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.

2.5.3 Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

2.5.4 Washing of surfaces treated with emulsion paint shall not be done within 3 to 4 weeks of application.

2.6 Protective measures

2.6.1 The surface of doors, windows, ventilators, floors, furniture etc. and such other parts of the building not to be white/colour washed shall be protected from being splashed upon. Such surfaces shall be cleaned of with white/colour wash splashed, if any, immediately after completing the painting, at no extra cost

3.0 Mode of measurement and payment

3.1 Length and breadth shall be measured correct to a cm and area shall be calculated in sqm correct to two places of a decimal.

3.2 Priming coat of exterior primer, scraping of surface spoiled by smoke soot, removal of oil and grease spots, treatment for infection of efflorescence, mould, moss, fungi, algae and lichen and patch repairs to plaster shall be included in this item for which nothing extra shall be paid for.

3.3 All the work shall be measured net in this item as in place subject to the following limits unless otherwise stated herein after

(a) Dimensions shall be measured to the nearest 0.01 m.
(b) Area in individual items shall be worked out to the nearest 0.01 m^2.
All work shall be measured in m^2. No deductions shall be made for ends of joints, beams, posts etc. and openings, not exceeding 0.5 m^2. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish around ends of joints, beams posts etc.

3.4 Deductions of opening exceeding 0.5 m^2 but not exceeding 3.0 $m^{2,}$ each shall be made as follows and net addition shall be made for reveals, jambs, soffits etc. of these opening

(a) When both the faces of walls are provided with same finish, deductions shall be made for one face only.
(b) When each face of is provided with different finish, deduction shall be made for that side of frame for doors, windows etc. on which width of reveal is less than that of the other side but no deduction shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of finish.
(c) When only one face of wall is treated and the other face is not treated, full deductions shall be made if the width of the reveal on treated side is less than that on untreated side but if the width of the reveal is equal or more than that on untreated side neither deductions nor additions to be made for reveals, jambs, soffits, sills etc

3.5 In case of opening of area exceeding 3.0 $m^{2,}$ each, deduction shall be made for actual size of the openings and jambs, sills and soffits shall be measured and paid separately.

3.6 No deductions shall be made for attachments such as casings, conduits, pipes, electric wiring and the like.

3.7 Corrugated surfaces shall be measured flat as fixed and not girth. The quantities measured shall be increased by the following percentage and the resultant shall be included with the general areas:

(a) Corrugated steel sheets	14%
(b) Corrugated A.C. Sheets	20%
(c) Semi corrugated A.C. Sheets	10%
(d) Nainital pattern roof (Plain sheeting with rolls)	10%
(e) Nainital pattern roof (with corrugated sheets)	25%
(f) Sand faced Plaster / textured plaster / Smooth or mala plaster ----------	0%

3.8 Cornices and other wall features, when they are picked out in a different finish/colour shall be girthed and included in the general area.

3.8.1 Item includes removing nails, making good holes, cracks, patches with materials similar in composition of distemper.

3.9 **Rate**

3.9.1 The rate includes cost of all materials, labors, scaffolding, protective measures etc. involved in all the operations described above, carried out at all floor heights in any position at all levels. This shall also include conveyance, delivery, handling, unloading, storing work etc. as directed by engineer in charge.

3.9.2 The rate shall be for a unit of one sqm.

Item No. 9

Stain-repellent transparent coating - For exposed concrete work

Providing and applying (solvent/ water based), low VOC, breathable and biodegradable, water, oil, and stain-repellent transparent fluorocarbon-based coating with anti-graffiti properties (suitable product according to natural stone, exposed concrete work) of approved make having fluoro carbon-based nanotechnology at all heights & leads and wherever instructed by Engineer-In-Charge. The treatment shall be in two coats wet-on-wet or as recommended by the approved manufacturer including preparation of surfaces by cleaning, curing, protecting, scaffolding, etc complete. The rate includes the cost of all materials, their application by specialized applicators by spray coating with an airless sprayer, cleaning the substrate of all laitance, construction dust, contaminants, scaffolding, labour, etc., all complete and at all levels, leads and heights as per particular specification & directions of Engineer-in-Charge. Guarantee Bond in the prescribed proforma shall be executed by the contractor for the satisfactory performance of the application for 5 years. The look and feel of the natural stone surface, and exposed concrete shall not be affected by coating.

1.0 Materials

1.1 Silicone Paint

Silicone Paint shall be of approved make.

2.0 Workmanship

2.1 The silicone paint shall be diluted with water or solvent (benzene or toluene) based in proportion as per manufacturer's specifications.

2.2 Before applying the surfaces should be thoroughly cleaned of dust, dirt, concrete slurry or any other foreign material etc. as directed by Engineer-in-charge.

2.3 The treatment shall be in two coats wet-on-wet or as recommended by approved manufacturer. Its application by specialized applicators by spray coating with airless sprayer. The sample shall be approved by Architect before execution.

2.4 Unless otherwise specified silicone paint shall be executed through approved specialized agency. Contractor shall furnish a guarantee of 5 years on stamp paper to the employer directly and the tender rate shall be inclusive of the same which is also to be signed by the specialized agency. However, soul responsibility shall be of main contractor for any leakages.

2.5 Copy of work order mentioning the rate issued to the specialized agency shall be attached with guarantee bond.
A guarantee bond on appropriate stamp paper, shall be given by the Contractor to the Client in the manner form prescribed below
FORM OF GUARANTEE BOND
"I/We .....(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by water or any other humid conditions, for a period of 5 years after completion of the work of Silicone painting as per the terms and conditions of the contract and Contractor hereby indemnifies and agrees to save the Client from any loss and or damage that might be caused on account of exposure to water and hereby Guarantees to make good any loss or damages suffered by the Client and further guarantee to redo the affected work without claiming any extra cost."
This guarantee shall remain in force for a period of 5 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 5 years.

3.0 Mode of Measurements and Payment.

3.1 The rate shall be for a unit of one Sqm.

METAL WORK

Note -
1. Contractor shall prepare shop drawing base on concept design/ drawing for any type of fabrication work and get approved. Contractor shall prepare mock-up/ prototype (as suggested) as per approved shop drawing for approval. Work shall be carried out as per approved shop drawing, approved mock-up/ prototype and as suggested by Engineer in charge.
2. Rate shall be for all floor, all level all height.
3. The rate shall include cost of all types of fasteners (ETA approved) to be used for fixing.
4. Structural stability shall be responsibility of contractor for all kind of metal work.
5. All elements shall be factory fabricated and finished, only final finishing to be made on site with all precautions.
6. Contractor shall coordinate all services work (cut-outs and provisions) in metal work. All cut-out and services provisions shall be finished at factory/ work shop.
7. contractor shall provide PVC/ nylon separator, where two different metals connect to avoid galvanic reactions.

Item No. 10
Structural steel work - Fabrication works - with paint
Providing, fabricating, assembling, hoisting, erecting and fixing in position structural steel work at all heights/ all levels/ all shapes & sizes with all leads & lifts using any type of MS section like rolled steel sections, hollow sections, plates, chequered plates, bar, sheet, rod, threaded bolt, railing etc. all confirming to latest relevant IS codes for the metal elements i.e. window grill, transom bar, bright bar in wooden door - window frame, railings, gates, grills, bracings, foundation plate & bolt, support at truss system, truss, purlin, rafter ,cleat, platforms, brackets, fencing pole, platform, trench cover, flag fixing sleeve pole, garbage box, signage pole, service elements, Jali, clamp, logo, metal dustbin as per design intent etc. including straightening, cutting, bending, profile cutting, embosing, bolting and welding, eatching (if required) the members all as per structural drawings and as per detailed specifications (for materials & workmanship) including profile cutting, smooth grinding, machining of edges/ faces, necessary welding (electric arc welding) for required weld lengths and sizes, machine drilling of holes for joining/ anchoring/bolting, necessary arrangements of templates to keep the foundation bolts in position dry sanding, degreasing (wet cleaning) & preparation of rust-free surface manually or mechanically, metal putty to make the surface even and smooth, necessary scaffolding/ staging, anchor fasteners,extra for bending elements for fixing etc complete. Incase of Metal dustbin, openable MS Shutter shall be with invisible self-closing hinge of required capacity and locking arrangement inside the shutter as per design intent. Contractor shall prepare mock-up of any element wherever required as directed by the Engineer-in-charge.
Contractor shop/ fabrication prepare shop drawing and get approved. The fabrication work shall start only after approval of the fabrication drawings. Fabrication shall be in a perfect Architectural workmanship manner and as provided in Section V & VI of IS 800 & IS 7215. Contractor shall responsible against stability, safety etc all complete
The rate shall include for applying (on all surfaces of MS member) two or more coats PU paint (DFT min 40 micron per coat) of approved make and shade over two coat (DFT min 50 micron per coat) of anti corrosive epoxy base primer for PU paint, as per manufacturer's specification, anchor fastener etc all complete.

1.0 Material
1.1 Structural steel
1.1.1 Structural Steel shall conform to M-60.

2.0 Workmanship

2.1 Laying out and Preparation of Surface
2.1.1 CPWD specifications clause no. 10.3.1 shall be followed.

2.1.2 Surfaces which are to be welded together shall be free from loose mill scale, rust paint, grease or foreign matters. A coating of linseed oil shall be permitted.

2.2 Fabrication

2.2.1 CPWD specifications clause no. 10.3.2, 10.4.2.1, 10.4.2.2, 10.4.2.3 10.4.2.4, 10.4.2.5, 10.4.2.6 shall be followed.

2.3 Erection

2.3.1 CPWD specifications clause no. 10.3.3, 10.4.2.7 shall be followed. Grouting shall be done with cement mortar 1:3 (1 cement: 3 coarse sand) or non shrink free flow cement grout of approved make as per manufacture's specification as directed by engineer-in-charge.

2.4 Precautions

2.4.1 CPWD specifications clause no. 10.4.2.3 shall be followed.

2.4.2 The following points shall be borne in mind during the process of welding

(a) Welds shall be made in flat position wherever practicable.
(b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
(c) The segments of welding shall be such that where possible, the members which offer the greatest resistance to compression are welded first.
(d) Proper care shall be taken while welding, for shrinkage and distortions, as the drawing dimensions are the finished dimensions of the structure.
(e) Cutting of plates shall be profile cut.
(f) Welding rod shall be of Ishab Corporation or equivalent.
(g) The drilling is to be done with drill or magnetic drill.

2.4.3 The defective welds which shall be considered harmful to the strength shall cut out and rewelded.

2.4.4 Finished welds and adjacent part shall be protected with clean boiled linseed oil and after all stag has been removed welds and adjacent parts shall be painted after the same are approved.

2.4.5 All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming coat of zinc chromate red oxide before fixing them in position. All fabricated members shall be suitably packed to be protected from any damage while transportation, if any.

2.4.6 Grinding to the finished level is to be done, if directed by Engineer in charge. All exposed weld shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed of with water before painting unless alkali resistant paint is used.

2.4.7 The following checking and inspection shall be carried out before, during and after erection :
- Damages during transportation
- Accuracy of alignment of structures
- Erection according to drawings and relevant specifications
- Progress and workmanship

2.5 Painting

2.5.1 CPWD specification clause no. 10.2.2 shall be followed except paint shall be as per Item description.
2.5.2 First priming coat of zinc chromate yellow oxide is to be applied on the fresh steel arrived at site.
2.5.3 Once the cutting, fabrication, grinding work gets completed second coat of primer and first coat of enamel paint is to be applied on the priming coat.
2.5.4 After paint has been already dried erection is done as specified in the item or as directed by engineer-in-charge.
2.5.5 After the erection final coat or second coat of paint is to be applied on the structural steel.

2.6 1 coat of epoxy primer of 50-to-60-micron DFT (dry film thickness), 2 top coats of Metal PU Paint of having DFT 40 to 50 micron of approved shade of ICI or equivalent paint is to be applied.

2.7 Unless otherwise specified proprietary treatment shall be executed through approved specialized water proofing agency. Contractor shall furnish a guarantee of 5 years on stamp paper to the employer directly and the tender rate shall be inclusive of the same which is also to be signed by the specialized agency. However, soul responsibility shall be of main contractor for any damages to paint.

2.8 Copy of work order mentioning the rate issued to the specialized agency shall be attached with guaranteed bond.

2.9 A guarantee bond on appropriately stamp paper shall be given by the contractor to the client in the manner form prescribed below:

FORM OF GUARANTEE BOND

"I/We .....(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by water or any other form of weather condition, for a period of 5 years after completion of the work of painting as per the terms and conditions of the contract and the Contractor hereby indemnifies and agrees to save the Client from any loss and or damage that might be caused on account of water and or other similar form of weather conditions and hereby guarantees to make good any loss or damage suffered by the Client and further guarantees to redo the affected work without claiming any extra cost."

2.10 This guarantee shall remain in force for a period of 5 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 5 years.

3.0 Mode of Measurement and Payment

3.1 For Riveted and bolted sections CPWD specification clause no. 10.3.5, 10.3.6, 10.4.3 shall be followed except in case of skew cut if the balance material is used at other place, same shall be deducted from quantity of skew cut i.e. **Used wastage from skew cuts shall be deducted from it's quantity and shall not be paid in skew cut.**

3.2 The weight of steel plates, sections and strips shall be taken from relevant IS Codes, based on 7.85 kg/m² for every mm. sheet thickness, if steel is supplied by the Contractor, otherwise, the weight shall be calculated on the actual weight basis on which steel is supplied to the Contractor by the Client. If the steel is supplied by the client, testing & checking as per relevant IS code, recording and intimation of quality of steel (to client and consultant) shall be sole responsibility of the contractor.

3.3 For forged steel and steel castings, weight shall be calculated on the basis of 7850 kg/m3.

3.4 Rolling Margin and wastage shall not be considered when weight is determined by standard weight on the basis of IS codes.

3.5 The rate includes cost of all material, labor involved in all operations as described above like erection, hoisting, scaffolding, painting as specified in item description, safety measures and sundry required for proper completion of the item of work, at all heights, all shapes and all places. This shall also include conveyance and delivery, handling, loading, unloading and storing etc. required for completion the item described above including necessary wastage involved.

3.7 The rate shall be for an unit of one Kg.

Item No. 11

Extra charges for providing hot dip galvanizing work conforming to IS 4759/2629/2633 with a zinc coating of 610 GSM thickness on any type of MS sections for various elements, for all locations, heights, and levels as per the drawings and as instructed by the Engineer-in-Charge. The rate includes surface preparation by shot blasting or acid washing prior to hot dip galvanizing, as well as all necessary labour, tools, and machinery (sample to be approved). The weight of the steel sections before galvanization shall be measured for payment without considering any wastage. A sample and mock-up shall be prepared for approval by the Engineer-in-Charge before mass execution.

1.0 Scope

This specification covers the general requirements of hot dip galvanizing for fabricated M.S. sections-plates, foundation bolts including cleaning of any paint, grease, rust, scale, acid or alkali or such other foreign matters.

2.0 Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable.

(i) IS: 4759-20.79: Specification for Hot Dip Zinc Coatings on Structural Steel and other allied Products.
(ii) IS: 209-20.79: Specification for zinc.
(iii) IS: 2629-20.66: Recommended Practice for Hot Dip Galvanizing of Iron and Steel.
(iv) IS: 6158-20.71: Recommended Practice for Safe-guarding against Embrittlement of Hot Dip Galvanized Iron & Steel Product.
(v) IS: 2633-20.72: Method of Testing Uniformity of Coating on Zinc Coated Articles.
(vi) IS: 6745-20.72: Method for Determination of weight of Zinc Coating on Zinc coated iron and steel articles (with amendment No. 1).
(vii) ASTM A-123: Spec. for Zinc (Hot Galvanized) Coatings on (20.78) Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips.

3.0 General Requirements

QUALITY OF ZINC: Zinc conforming to at least grade Zn 99.95 specified in IS: 209-20.79 shall be used for the purpose of galvanizing.

BASE METAL: The steels and castings shall be in accordance with clause 2 of IS: 6158-20.71. Where steel is supplied by the fabricator, it is the responsibility of the fabricator to select suitable steel which shall withstand normal galvanizing operation without embrittlement.

The edges of tightly contacting surfaces shall be completely sealed by welding. The residue of coated electrodes shall be removed, prior to pickling, by brushing, chipping or sand blasting.

SURFACE PREPARATION: Surface shall be cleaned and prepared as per clause 4 of IS: 2629-20.66. Malleable iron castings shall be shot and grit blasted before galvanizing.

GALVANISING: The members shall be galvanized in accordance with the practice contained in the IS: 2629-20.66 unless otherwise specified in the succeeding paragraphs.

4.0 Coating Requirements

MASS OF ZINC COATING: Minimum average mass of zinc coating on different kinds of articles shall be as under:

a)	Fabricated steel Thickness less than 2 mm but not less than 1.2 mm	340 gm/sqm
	Thickness 2 mm and above	750 gm/sqm
b)	Fasteners Up to nominal size M10	270 gm/sqm
	Over M10	300 gm/sqm

Note: Articles galvanized with 1000 g/m² zinc coatings shall be identified by a band of green paint by the galvanizer.

FREEDOM FROM DEFECTS: The zinc coatings shall be uniform, adherent, reasonably smooth, and free from imperfections such as flux ash and dross inclusions, bare patches, black spots, pimples,

lumpiness and runs, rust stains, bulky white deposits and blisters, etc. These terms have been defined in IS: 2629-20.66 (duly amended wherever necessary).

STEEL EMBRITTLEMENT: The design of the product and the selection of steel, wherever steel is to be supplied by fabricator, for its suitability to withstand normal galvanizing operations without embrittlement or the method of fabrication shall be the responsibility of the fabricator. Recommended precautions to properly design, fabricate and prepare the material for galvanizing to prevent embrittlement shall be as per IS: 6158-20.71.

5.0 Tests

TYPE TESTS

(a) Visual Inspection
(b) Adhesion of coating
(c) Uniformity of coating
d) Mass of zinc coating

Each test shall be conducted on three samples.

ACCEPTANCE TESTS

(a) Visual Inspection
(b) Adhesion of coating
(c) Uniformity of coating
(d) Mass of zinc coating

ROUTINE TESTS

(a) Visual Inspection

Scale of Sampling and criteria for conformity

LOT: All the material of the same type in a coating bath whose characteristics are intended to be uniform shall be grouped together to constitute a lot.
A lot shall not consist of more than one shift's production or 100 nos. whichever is lower.

Sample shall be taken from each bath and tested for conformity of coating. Where the galvanizing is done without the presence of Purchaser, the manufacturer may prepare lots consisting of the articles of the same type and material and galvanized in the same bath. If there is more than one bath, separate lots shall be prepared for each bath.

6.0 SCALE OF SAMPLING:

Samples in accordance with TABLE 1 shall be taken, at random, from each lot for tests.

TABLE 1: Scale of Sampling

Lot size	Sample size	Permissible no. of defective units
Up to 25	3	0
26-50	5	0
51-100	8	0
101 and above	13	1

For materials of inconvenient lengths and from which it is not possible to cut a specimen for coating characteristic tests, two test pieces of same cross section and not less than 90 cm length shall be galvanized in the same bath.

The samples selected in accordance with Table 1 above shall be subjected to the visual inspection.

If any sample fails to conform to the requirement, the lot shall be rejected. The galvaniser, however, may segregate the good pieces of the lot and submit them once again for inspection.

If the lot inspected for visual inspection, passes the test, 3 samples for coating characteristics shall be taken from the samples, which were subjected to the visual tests.

Each of the 3 samples shall be subjected to test for adhesion, uniformity, and mass of zinc coating. Shall any sample fail in any test, six more samples shall be taken from the lot and all the 3 tests repeated. Shall any sample fail in the retest, the lot shall be rejected. If it is not possible to take six samples for the test, the lot shall be rejected.

The material in a lot which has been rejected may be stripped and re-galvanized and submitted for inspection and tests.

7.0 TEST METHODS

VISUAL INSPECTION: The material shall be inspected visually to observe that it is smooth, reasonably bright, continuous and free from such imperfections as flux/ash/dross inclusions, bare patches, black spots, pimples, lumpiness runs, rust stains, bulky white deposits and blisters. The stains of flux, usually white in color, shall not be regarded as flux intrusions.

8.0 ADHESION OF GALVANISED COATING:

Coating shall withstand the knife tests as prescribed in IS: 2629-20.66. When cut or pried into, such as with a stout knife applied with considerable pressure, in a manner tending to remove a portion of the coating, it shall only be possible to remove small particles of the coating; and it shall not be possible to peel any portion of the coating so as to expose iron or steel underneath.

On articles fabricated from angles, channels, beams and rolled sections of 8 mm or more thickness, the adhesion may, alternatively, be tested by pivoted hammer tests as per IS : 2629-20.66. This test is not suitable for curved and round surfaces.

9.0 UNIFORMITY OF GALVANISED COATING:

On small articles, which can be conveniently handled the uniformity of the coating shall be determined by Preece Test in accordance with IS: 2633-20.66 by dipping the whole article in the copper sulphate solution. For sheets, strips and other fabricated articles a 10 cm x 10 cm specimen may be cut for tests. For tubes, 100 mm long piece shall be cut from each end of the product, after discarding 300 mm length from the end. The article shall withstand 5 dips of one minute each.

For long articles, measurement of coating thickness at a number of places by magnetic method shall be taken as a uniformity test.

Note: The Preece Test is primarily meant for articles where surface is mechanically scrapped or wiped after dip in the galvanizing baths etc

10.0 MASS OF GALVANISED COATING:

The average mass of galvanized coating shall be determined by any one of the following methods as agreed between the purchaser and the galvaniser before the tests.

Mass before and after galvanizing: The mass of coating may be determined by weighing the article before and after galvanizing, subtracting the first mass from the second and dividing the result by the coated surface area. The first mass shall be determined after pickling, rinsing and drying; and the second after cooling to the ambient temperature.

Stripping method: In case of materials galvanized without purchasers' inspection, average mass of coating shall be determined by stripping the entire article in accordance with IS: 6745-20.72. If the surface area of the entire article cannot be measured easily or if the article is inconveniently large, a specimen of 100 sqcm area may be cut from each of the three samples and stripped.

Magnetic thickness gauge method:
For large products such as poles, towers, structural shape and castings the average weight of the coating shall be determined by a magnetic thickness gauge.

Before making the measurement the gauge shall be calibrated by measuring the thickness of zinc coating on a test panel and comparing the measured value with the value obtained by stripping method on the same piece.

For castings etc. at least 5 readings may be taken at convenient locations nearly in the centre. Thickness, in micro-meters, when multiplied by 7.047 would give the average mass of zinc coating (g/m^2). Three articles in each lot of up to 100 shall be tested in this manner.

11.0 RECTIFICATION OF DAMAGE

Normally all fabrication work in the case of galvanized articles shall be completed prior to galvanizing. If, for any reason, fabrication such as cutting, drilling or welding has to be undertaken after galvanizing, protection of metal exposed as a result of fabrication and rectification of damaged galvanized areas shall be done in accordance with either the following methods or any other method approved by the Purchaser.

USE OF ZINC BASED SOLDERS: The surface to be protected, or the surface where galvanizing has been damaged, shall be cleaned and any oxides removed with a weak acid solution and a wire brush. The surface shall be thoroughly washed with water to make it free from any traces of acid. The cleaned area shall be heated with a welding torch and rubbed with white salammoniac. A piece of zinc stick or rod 5-10 mm diameter of high purity shall be melted on this area and spread out with a heated piece of salammoniac. The areas shall then be washed down by water and lightly wire brushed. The workmanship shall be such that the finished surface is smooth and non-porous.

USE OF ZINC RICH PAINTS: The damaged surface after cleaning shall be painted with two or more coats of zinc rich primer followed by a finishing coat of a zinc rich paint as per the painting schedule recommended by the manufacturers. It is to be ensured that the dry film thickness of zinc rich primer shall not be less than the average thickness of the galvanized coating. The complete painting system i.e. zinc rich primer with the finishing zinc rich paint for this purpose shall be produced from a source of repute and approved by the Purchaser.

12.0 DEFECTS, THEIR CAUSES AND REMEDIAL MEASURES

Defects	Causes	Recommended actions	Ground for rejection
	Paint grease or oil residues	Check cleaning practices	
Bare spots	Scale or rust residues	Check pickling practices	Yes, if bare spots are bigger than 8 mm dia. or 8 mm diagonal.
	Residual welding slag	Blast-clean wells; avoid coated rods	
	Breakdown of preflux coating	Check preflux and drying conditions	
	Aluminium content of bath too high	Regulate aluminium additions	
	Rolling defects in basic	Check steel supply	

Defects	Causes	Recommended actions	Ground for rejection
	steel		
	Article in contact during galvanizing.	Keep articles separated.	
General	Analysis or original surface condition of steel	Check steel supply.	
roughness	Over-pickling	Reduce pickling use inhibitor	No
	High galvanizing temperature or long immersion time or both	Adjust galvanizing conditions.	
Pimples	Entrapped dross particles	Avoid agitation of dross layer; check carryover of pickle salt.	No, unless dross contamination is heavy
Lumpiness and runs (uneven	Withdrawal speed too high	Remove work slowly	No.
	Cold galvanizing bath.	Increase temperature.	
	Delayed run-off from seams, joints, bolt holes, etc.	Remove work slowly.	
drainage)	Article in contact during withdrawal.		
	Stale flux burnt on during dipping.	Refresh or renew flux blanket.	Yes.
Flux inclusions	Surface residues on steel.	Check steel preparation.	
	Flux picked up from top of bath.	Skim before withdrawal.	
	Ash burnt on during dipping.	Skim bath before dipping.	Yes, if in gross lumps.
Ash inclusion	Ash picked up from top of bath.	Skim before withdrawal.	
Black spots	Includes flux particles from flux ‘dusting’.	Confine fluxing to top of bath.	Yes.
	Dirt smuts, splash marks.	Check storage conditions.	No.
Dull grey coating (all alloy, no free	Steel composition (high silicon, phosphorous or carbon) severe cold work.	Check steel supply for composition order to adjust for galvanizing.	No.
Zinc).	Slow cooling after galvanising.	Avoid hot stacking quench.	
	Release of absorbed hydro-gen during solidification of coating.	Avoid over pickling; use inhibitor.	
	Weeping of acid etc. from seams and folds.	Check product design and fabrication.	
Rust stains	Storage near rusty material.	Check storage condition.	No.
Bulky white deposit (wet storage stain,	Confinement of close packed articles under damp conditions.	Storage dry well-ventilated conditions, separate articles with spacer.	No.

Defects	Causes	Recommended actions	Ground for rejection
White rust).	Packing of articles while damp.	Dry before packing; include desic cant.	
	Expansion of entrapped hydrogen and moisture in flaws.	Check steel quality	Yes, if general.
Blisters	Driving off of hydrogen absorbed during pickling.	Use shot blast instead of pickle; check steel supply.	
	Improper malleabilising (for malleable iron castings only)	Check malleabilising practice.	
Tiny blisters	Effect sometimes observed on quenched work notably malleable castings. May be caused by gas evolved from the work resulting from absorbed hydrogen or break-down of combined carbon near surface.	Use shot blast instead of pickle. Check malleabilising treatment. Shall have no combined carbon near surface of casting.	Yes, if blistering is generally wide spread.

13.0 STRIPPING METHOD (Extracted from IS: 6745-20.72)

Cleaning of test piece: The test pieces shall be washed with solvent naphtha, trichloro ethylene or any other suitable organic solvent, then with alcohol and finally dried thoroughly.

Stripping Solutions:

Dissolve 20 g of antimony trioxide (Sb_2O_3) or 32 g of antimony trichloride ($SbCl_3$) in 1000 ml of concentrated hydrochloric acid (specific gravity 1.1).

Immediately before tests, prepare the stripping solution by adding 5 ml of the solution, 1 to 100 ml of concentrated hydrochloric acid (specific gravity 1.16). Mix well.

Procedure – Weigh the cleaned test specimen whose mass is less than 200 g nearest to 0.01 g; for test piece whose mass is between 300 to 1000 g to the nearest 0.1 g; and for test specimen of over 1000 g to the nearest 0.5 g. After weighing immerse each test piece singly in test solution and allow to remain there until the violent evolution of hydrogen and only a few bubbles are being evolved. This requires about 15 to 30 seconds.

The mass of zinc coating (in g/m²) of surface may be calculated as per the following formula:

$$M = \frac{M1 - M2}{A} \times 10^6$$

Where,
M = mass of zinc coating, in g/m², of surface, M1 = original mass, in g, of test piece, M2 = mass in g, of stripped test piece, and A = coated area of the test piece, in mm².

14.0 Mode of Measurement:

Sample MS elements with hot dip galvanized finish must be approved before mass execution. Mock-ups for each element should be prepared by the contractor and approved by the architects before mass execution works begin.
Architect reserves right to reject part or all work of sub standard or not in confirmation to sample approved as per mock up.

The rate includes cost of all materials and labour required to carry the works for all floor all height as per the above specifications. Any deviations from approved samples/mock-ups must be rectified promptly at the contractor's expense.

The rate shall include preparing the surface by shot blasting/ acid washing prior to hot dip galvanizing, labour, tools, machinery etc complete.

The rate shall be for a unit of kg.

EXTERNAL DEVELOPMENT WORK

Note -
1) Stones shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for all kind of stone work.
2) Stones shall be selected and sorted for uniform colour, figure and thickness and approved by Engineer in charge prior to procurement.
3) Stone shall be from same lot and/ or source (stone quarry) for same kind of work and as approved by Engineer in charge.
4) Contractor shall apply Stone Impregnation primer/ sealer coat on back side and all edges (after cutting and finishing of the stone as per size) of stones of approved make. Stone Impregnation primer/ sealer coat shall be of water based with pH value 7 to 10 in minimum two coat as per manufacturer's specification and as directed by Engineer in charge. No extra shall be paid for the same.
5) Contractor shall prepare and submit shop drawing for all kind of stone work with sub base/ framing work/ fixing arrangement/ joinery with all required fasteners and get approval from Engineer in charge.
6) Mock up/ sample shall be prepared as per approved shop drawing and get approved by Engineer in charge before execution of work.
7) All adhesives and sealants shall be with low VOC and lead free with acceptable VOC content as per Green Building requirements.
8) Stone work shall be carried out for all floor, all level, all height, all places including loading, unloading, stacking, transporting, hoisting, erecting by any means (mechanical or manual).
9) All type of stones shall be cut to size with help of with water jet cutting/ laser cut/ CNC machine according to the design and shape for best workmanship as per shop drawing.
10) Granite shall be mirror polished/ flame finished/ sand blasted/ river wash finish or other as per specified.
11) All type of stone/ stone elements shall be factory cut and factory finished. Finish on any stone shall be as per satisfaction of Engineer in charge. If required, final finish/ touch-up shall be executed at site as per direction of Engineer in charge.
12) Structural stability of solid stone work shall be responsibility of contractor.
13) Contractor shall make necessary provision for any services cut-out/ other required provision, co-ordinate with all services work and making good etc complete.
14) All visible surfaces of stone shall be same finished.

Item No. 12
Kota Stone - For treads/copping/seating - fixing with Cement Mortar
Providing and laying machine-cut Kota stone 40 mm thick any type of Polished/ Textured (i.e. river wash finish, leather finish, linen finish, canvas finish etc) finish Kota stone in a single piece of any shade (uniform), any size, and any shape in treads of steps, coping and seating, etc as per the drawings. Kota stone slab having pencil corner and same polished at the exposed edge in even and uniform thickness and laid over upto 20 mm thick base of cement mortar 1: 6 (1 cement: 6 coarse sand)/ suitable adhesive as per manufacturer specification, and jointed (paper joint) with grey/ white cement slurry mixed with pigment to match the shade of the slabs, including finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing.
The rate shall be inclusive of Kota stone (as per the approved sample), fixed with cement mortar bedding/ adhesive, cement slurry, matching pigment, all labour, etc complete. The contractor shall arrange loose Samples for approval from the Engineer-in-Charge before mass execution.
The actual laid area of the Kota stone shall be measured for payment without considering any wastage.

1.0 Material
1.1 Kota Stone
1.1.1 Kota Stone shall conform to M-44. machine-cut Kota stone 40 mm thick any type of Polished/ Textured

(i.e. river wash finish, leather finish, linen finish, canvas finish etc) finish Kota stone in a single piece of any shade (uniform), any size, and any shape in treads of steps, coping and seating, etc as per the drawings. Kota stone slab having pencil corner and same polished at the exposed edge in even and uniform thickness.

1.2 Cement Mortar

1.2.1 Cement mortar shall conform to M-11.

2.0 Workmanship

2.1 For dressing CPWD specifications clause no. 11.21.2 shall be followed.

2.1 For laying and preparation of surface CPWD specifications clause no. 11.21.3 shall be followed except upto thickness of CM shall be 20 mm, cement mortar shall be 1:6 (1 cement : 6 sand) / suitable adhesive as per manufacturer specification used.

2.2 While laying any chiseling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm. between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required, shall be provided as per the drawing and design.

2.3 In places where full tiles cannot be fixed, the tiles shall be cut to the size and smoothened at edge to give straight and true joints.

2.4 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect and Engineer-in-charge.

2.5 The floor shall be kept wet for a minimum period of 7 days, so that bedding and joints set properly.

2.6 **Polishing** shall be normally commenced after 14 days of laying the slab. For special polish polishing to be done with 2 coats of 60, 120 grades of emery, balckchapadi and gutka. For semi mirror polish polishing to be done with 220, 320, 400, 600 grades of emery. Water shall be properly used during polishing. The flooring shall then be washed clean with oxalic acid. Daily moping for 15 days shall be done after polishing or up to the satisfaction of client and engineer-in-charge. All works shall be carried out as directed by the Architect and as specified in the item, no waxing will be permitted.

2.7 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

2.8 The holes required for Nahni traps, pipes any other fittings shall be made without any extra cost.

3.0 Mode of Measurement and Payment

3.1 Kota slab flooring shall be measured in $m^{2.}$ for visible area of work done. Length and breadth shall be measured correct to a cm before laying skirting, dado or plaster.

3.2 No deductions shall be made or extra paid for any opening in the floor area upto 0.1 m^2. Nothing extra shall be paid for use of cut tiles or for laying the floors at different levels in the same room or courtyard. Kota slabs laid in floor boarders and bands etc. shall be measured in the same item and nothing extra shall be payable on account of these or similar bands formed of half or multiples of half size standard tiles/or other uncut tiles.

3.3 The treads of stairs and steps paved with tiles without nosing shall also be measured under this item.

3.4 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be approved by the Architect/ Engineer-in-charge before placing orders.

3.5 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds &

cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

3.6 The rate shall include for fixing the flooring in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

3.7 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

3.8 The rate shall be inclusive of Kota stone (as per the approved sample), fixed with cement mortar / adhesive bedding, cement slurry, matching pigment, all labour, etc complete. The contractor shall arrange loose Samples for approval from the Engineer-in-Charge before mass execution.

The rate shall be inclusive of finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing.

The actual laid area of the Kota stone shall be measured for payment without considering any wastage..

The rate shall be for a unit of one **Sqm.**

Item No. 13
Kota Stone - For risers of steps, dado etc. or similar - fixing with cement mortar
Providing and laying machine-cut Kota stone 25 mm thick any type of Polished/ Textured (i.e. river wash finish, leather finish, linen finish, canvas finish etc) finish Kota stone in a single piece of any shade (uniform), any size, and any shape in the risers of steps, dado or similar etc. as per the drawings. Kota stone slab having pencil corner and same polished at the exposed edge in even and uniform thickness and laid in any pattern fixed on any type of leveled surface with approximate 12 mm thick (average) cement mortar 1:3 (1 cement : 3 coarse sand)/suitable adhesive as per manufacturer specification, and jointed (paper joint) with grey/ white cement slurry mixed with pigment to match the shade of the slabs, including finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing. The rate shall be inclusive of Kota stone (as per the approved sample), cement mortar for fixing/ adhesive, cement slurry, matching pigment, all labour, etc complete. The contractor shall arrange loose Samples for approval from the Engineer-in-Charge before mass execution.
The actual laid area of the Kota stone shall be measured for payment without considering any wastage.

Relevant specification shall be followed as per item no -13 (as above) machine-cut Kota stone 25 mm thick any type of Polished/ Textured (i.e. river wash finish, leather finish, linen finish, canvas finish etc) finish Kota stone in a single piece of any shade (uniform), any size, and any shape in the risers of steps, dado or similar etc. as per the drawings. Kota stone slab having pencil corner and same polished at the exposed edge in even and uniform thickness and laid in any pattern fixed on any type of leveled surface with approximate 12 mm thick (average) cement mortar 1:3 (1 cement : 3 coarse sand)/ /suitable adhesive as per manufacturer specification, and jointed (paper joint) with grey/ white cement slurry mixed with pigment to match the shade of the slabs, including finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing . Finishing and texture shall be as per approved by architect before mass execution.

The rate shall be inclusive of Kota stone (as per the approved sample), fixed with cement mortar / adhesive, cement slurry, matching pigment, all labour, etc complete. The contractor shall arrange loose Samples for approval from the Engineer-in-Charge before mass execution.

The rate shall be inclusive of finishing, rubbing, curing, polishing, cleaning, protection, scaffolding,

wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing.

The actual laid area of the Kota stone shall be measured for payment without considering any wastage.

The rate shall be for a unit of one **Sqm.**

Item No. 14
Kota Stone - For risers of steps, dado etc. or similar - fixing with cement mortar
Providing and laying machine-cut Kota stone 55 to 65 mm thick any type of Polished/ Textured (i.e. river wash finish, leather finish, linen finish, canvas finish etc) finish Kota stone in a single piece of any shade (uniform), any size, and any shape in the risers of steps, dado, planter sides, or similar etc. as per the drawings. Kota stone slab having pencil corner and same polished at the exposed edge in even and uniform thickness and laid in any pattern fixed on any type of leveled surface with approximate 12 mm thick (average) cement mortar 1:3 (1 cement : 3 coarse sand)/suitable adhesive as per manufacturer specification, and jointed (paper joint) with grey/ white cement slurry mixed with pigment to match the shade of the slabs, including finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing. The rate shall be inclusive of Kota stone (as per the approved sample), cement mortar for fixing/adhesive, cement slurry, matching pigment, all labour, etc complete. The contractor shall arrange loose Samples for approval from the Engineer-in-Charge before mass execution. The actual laid area of the Kota stone shall be measured for payment without considering any wastage.

Relevant specification shall be followed as per item no -14 (as above) machine-cut Kota stone 55 to 65 mm thick any type of Polished/ Textured (i.e. river wash finish, leather finish, linen finish, canvas finish etc) finish Kota stone in a single piece of any shade (uniform), any size, and any shape in the risers of steps, dado or similar etc. as per the drawings. Kota stone slab having pencil corner and same polished at the exposed edge in even and uniform thickness and laid in any pattern fixed on any type of leveled surface with approximate 12 mm thick (average) cement mortar 1:3 (1 cement : 3 coarse sand)/ /suitable adhesive as per manufacturer specification, and jointed (paper joint) with grey/ white cement slurry mixed with pigment to match the shade of the slabs, including finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing . Finishing and texture shall be as per approved by architect before mass execution.

The rate shall be inclusive of Kota stone (as per the approved sample), fixed with cement mortar / adhesive, cement slurry, matching pigment, all labour, etc complete. The contractor shall arrange loose Samples for approval from the Engineer-in-Charge before mass execution.

The rate shall be inclusive of finishing, rubbing, curing, polishing, cleaning, protection, scaffolding, wastage, etc. all complete for all levels, all floor, all height, and as directed by the Engineer-in-Charge. The joint between the tread and riser shall be finished as per the drawing.

The actual laid area of the Kota stone shall be measured for payment without considering any wastage.

The rate shall be for a unit of one **Sqm.**

Item No. 15
18 mm thick WPC Plank/board - coping/seating on bench etc.
Providing & laying 18 mm thick machine-cut External category WPC Pank/board of any finish, any texture, any color, any shade, any size and any shape, wpc board /plank having density 550 kg/cum for coping, seating on bench in required design and patterns as per the drawings, fixed with suitable adhesive of minimum 6 mm thicknes fixing adhesive as per IS-15477 of an

approved make, including making groove as per drawing, exposed edge treatment and champharing/ making pencil corner if required, rounded corner treatment in even thickness and finished same as plank/board finish as per drawing and as approved and directed by Engineer in charge, WPC board/plank shall be used in single possible length/as per drawing for coping / seating on bench. Necessary anchoring shall be done if required as per design intent.
The actual laid area of the WPC Board/Plank shall be measured for payment without considering any wastage.

1.0 Material & Workmanship

WPC board/ plank shall be as per the approved make. Relevant specifications shall be followed as per the item description and as directed by the engineer in charge.

2.0 Measurement and Payment

The rate shall be for a unit of one sqm.

Item No. 16
Precast RCC Bench - modular type linear/ curvature in Plan and elevation, Tube type
Providing, hoisting, stacking and arranging in position, precast exposed fair finished modular type linear/ curvature in Plan and elevation, bench as per design intent, made of minimum M-30 grade RCC, with/ without a back rest of approximate size and shape as per the design intent, as directed by the Engineer-in-charge. The Contractor shall submit a methodology for the erection of the precast bench and get approval from the Engineer-in-Charge. Installed precast bench shall not be damaged in any way. The sample shall be approved by the Engineer-in-charge before mass production. The rate shall include for erecting and fixing the precast bench in position as per the drawing, finishing, necessary TMT reinforcement bars etc., complete, as directed by the Engineer-in-Charge. The location and type of each lifting hook for erecting the bench shall be as per the design intent and as approved by the Engineer-in-Charge. The Architect and the Engineer-in-Charge reserve the right to reject part or all work found to be sub standard or not as per the approved sample and the mock-up. The sample and the mockup shall not be payble if rejected or cast in another location (not in scope of work area). if required bench shall be in coloured/ pigmented concrete however additional cost of for pigment shall be paid relevant tender item.The actual laid volume shall be measured for payment without any wastage.

1.0 Material & Workmanship

Relevant specifications as per reinforced concrete work shall be followed except the item will be executed for precast element.

The method of transporting and placing the precast members shall be as approved by the Engineer-in-charge. Members shall be so transported that no breakage or undue stresses are induced in them.

All members shall have a key provided on both the faces i.e. top and bottom surfaces, of adequate size so as to fill the same with concrete while laying. The function of this key is to avoid the leakage through the joint between the precast member and the member on which it is laid.

While fixing the precast member, the key provided in the member shall be filled with ordinary cement concrete made of same proportion as that of the member except that grit shall be used instead of stone aggregate. Except for the key, cement mortar of proportion 1:1 (1 cement: 1 sand) shall be spread over the surface on which the member is to be laid. The mortar shall be of dry consistency as is possible to use. The member and the surface shall be thoroughly cleaned before placement, and both shall be kept moist for a sufficient period after placement.

Rendering exposed surface for the exposed RCC precast elements shall be carried out and the rate for the same shall be included in this item.

Sample shall be approved by Architect and Engineer in charge before mass production. Architect reserves right to reject part or all work of sub standard or not in confirmation to approved sample as per mock up. Sample and mock shall not be payable if rejected or casted in other location (not in scope of work area).

2.0 Mode of Measurement

Rate shall be inclusive of RCC, shuttering, reinforcement, rendering for exposed surface and all labour required for complete execution as per item description.

The rate shall be for a unit of one cum .

Item No. 17
ACP sheet signage on Existing Pole/ New Pole for Vehicular Direction Signages:
Providing, making and fixing 4 mm thick ACP sign of any shape and size and of approved make to be cut on CNC router cutting and smoothen all corners and edges. Matter shall be cut in 3M High intensity prismatic Reflective vinyl ASTM Type 4 and paste on it as per design and detail and as per manufacturer's specifications. UV stabilized lamination (exterior grade) shall be done on it. The ACP sheet shall be fixed with clamp and angle on new or any type of Pole as per drawing. Content of sign shall be letters (in any language), number, graphics/ maps, signs, arrows, etc. in any colour as per design, drawing and approved by Architect and Engineer. All side of box shall be covered with ACP sheet, but only one side elevation area shall be measured and paid in sqm. Cost of MS Pole, MS framing and civil works shall be paid as per relevant tender items. The rate shall also include cost of scaffolding, drilling, fabrication, finishing, adhesive material, back and sides plain cap sheet, fixing charges, etc at all height and all lead. The contractor shall submit the drawings with as per concept design and do the sampling and get it approved before execution.

1.0 Materials:
Material shall be as per item description and material specifications of approved make. Contractor shall get ACP sheet and reflective vinyl approved before procurement. The sign board and matter of sign board should be as per drawing.

ACP sheet – 4mm thick, approved shade, bubble free, cutting with CNC cutter in any shape and size as per drawing.
Reflective vinyl – of 3M for matter, letter, graphic pasting as per design.
The sign board and matter of sign board should be as per drawing.

2.0 Workmanship:
Module of signage shall be fixed on new or existing pole or column as per drawing. Workmanship shall be of best quality as described and approved by Engineer and Architect. Relevant manufacturer's specifications shall be followed.

3.0 Mode of Measurements and Payment:
The item shall be measured and paid for a unit of Sqm. of only one side elevation area of the sheet. Rate shall be inclusive of all labour, material, and scaffolding, fixing, drilling, fabrication, screws, studs, fasteners/ adhesive materials and finishing for all height but exclusive of the cost of structural steel work.

The rate shall be for unit of Sqm.

Item No. 18
Vinyl Stickers:
Providing, Cutting & pasting of vinyl stickers of approved make and shade with digitally printed graphic/ letter as per design and as directed by engineer in charge. Pasting of vinyl must be accurate as per the design on the approved size ACP without any kind of bubbles. The rate shall also include cost of scaffolding, drilling, fabrication, finishing, adhesive material etc at all height and all lead. Only out to out area elevation of vinyl stickers shall be measured and paid in sqmt. The contractor should submit the drawings based on concept design and do the sampling and get it approval before execution.

1.0 Materials :
Material shall be as per item description and material specifications of approved make. Contractor shall approve reflective vinyl before procurement.
The sign board and matter of sign board should be as per drawing.
Reflective vinyl – of 3M for matter, letter, graphic pasting as per design of approved shade, bubble free, of any shape and size as per drawing.
The sign board and matter of sign board should be as per drawing.

2.0 Workmanship:
Reflective vinyl shall be paste on any existing surface as per drawing. It shall be bubble free.
Workmanship shall be of best quality as described and directed by EIC.

3.0 Mode of Measurements and Payment:
The item shall be measured and paid for a unit of Sqm.
Only out to out area elevation of vinyl stickers shall be measured and paid in sqmt..
Rate shall be inclusive of all labour, material, and scaffolding, fixing and finishing for all height all level.

Item No. 19
SS Plate Signs:
Providing Making and fixing SS plate signs on 2mm thick ISI Brushed S.S. Grade 304 plate with acid etching and duco painting. All plates will be made in CNC Water Jet Cutting, with all edges smoothen and all corner to be cute round. Acid etching should be done 0.3mm deep and Use ICI duco paint for colour infill of approved colour. The letters of made of Vinyl stickers. The font colour shall be of as per drawing and specified by Architect. The plate will be fixed on wall with the stud/ fastener/ adhesive tape of 3M, jointing sealant as per design as per specification and approved by Architect or Engineer in charge. The rate shall be inclusive of scaffolding, drilling, fasteners/ adhesive material etc. at all heights as directed by engineer in charge. Only elevation area shall be measured and paid. The rate shall also include cost of scaffolding, drilling, fabrication, finishing, adhesive material etc at all height and all lead. The contractor should submit the drawings based on concept design and do the sampling and get it approval before execution.

1.0 Materials:
Material shall be as per item description and material specifications of approved make. Contractor shall get SS sheet and duco paint/ acid etching approved before procurement. The sign board and matter of sign board should be as per drawing.

SS Plate shall be of SS 304 grade – 2mm thick, approved shade, cutting with CNC cutter in any shape and size as per drawing.
Acid etching should be done 0.3mm deep and ICI duco paint shall be used for colour infill of approved colour.
The sign board and matter of sign board should be as per drawing.

2.0 Workmanship:

Module of signage shall be fixed on walls, doors, etc. as per drawing. Workmanship shall be of best quality as described and approved by Engineer and Architect.

The contractor should submit the drawings based on concept design and do the sampling and get it approval before execution

3.0 Mode of Measurements and Payment:

The rate shall be inclusive of scaffolding, drilling, fasteners/ adhesive material etc. at all heights as directed by engineer in charge.

Only elevation area shall be measured and paid. The rate shall also include cost of scaffolding, drilling, fabrication, finishing, adhesive material etc at all height and all lead.

DISMANTLING WORKS

Note: -
1) The method of demolition work shall be approved by the Engineer-in-charge before execution of work.
2) Demolition work shall be carried out by any means and as per approved method without damaging adjoining elements/ building and any building/ campus property.
3) The rate includes all necessary machinery, labour, tools, and tackles for the dismantling of specified elements in any condition, by any means, etc. complete as directed by the Engineer-in-charge including disposing of serviceable material within the campus and unserviceable material outside the campus for all lead and lift at the non-objectional place as directed by Engineer-in-charge.

1.0. Workmanship

1.1. The demolition shall consist of demolition of one or more parts of the building as specified or shown in the drawings. Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown in the drawings.

1.2. Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.

1.3. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roof, masonry etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.

1.4. All materials obtained from demolition shall be the property of Client unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge.

1.5. Any serviceable materials, obtained during dismantling or demolition shall be separated out and stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed by the Engineer-in-charge.

1.6. On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.

1.7 Cutting depth and width shall be as per actual site requirement and as instructed by the Engineer-in-Charge.

1.8 Cutting shall be done perfectly in line, level, and alignment to avoid damage to adjoining surfaces.

2.0. Mode of measurements and payment

2.1. Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed. Specification for deduction for voids, openings etc. shall be on same basis as that employed for construction of work.

2.2. All work shall be measured in decimal system as fixed in its place subject to the following limits; unless otherwise stated hereinafter: (a) Dimensions shall be measured to the nearest 0.01 mt. (b) Area shall be worked out to the nearest 0.01 sqm. (c) Cubical contents shall be worked out to the nearest 0.01 cum.

2.3. The rate shall include cost of all labour involved and tools used in demolishing and dismantling including scaffolding.

2.4. The rate shall also include the charges for disposing the unserviceable materials with all lead and lift.

2.5. The rate also includes for temporary shoring for the safety of the portion not required to be pulled down or of adjoining property arid providing temporary enclosures or portions where considered necessary.

2.6 Unit for measurement shall be as per respective items description.

MISCELLANEOUS WORK

Item No. 22
Chemical Anchor:
Supplying, Drilling/ Cleaning hole and injecting grouting chemical with the help of dispenser, into a hole of dia & depth as per manufacturer/ structural consultant's specification and fixing rebar of the required diameter subsequently. Fixing methodology shall be followed as per manufacturer's guidelines. Steel will be paid under relevant item. Manufacturer to submit Rebar Depth Calculation based on design loads & other parameters as provided by consultant and in accordance with EOTA-TR-023/029 "guidelines for post installed rebar connections" for approval. Rate shall be inclusive of all material, labour, necessary scaffolding etc complete for all height as directed by engineer in charge.
23.1 10mm x 150mm
23.2 12mm x 180mm
23.3 16mm x 240mm
23.4 20mm x 300mm
23.5 25mm x 375mm

1.0 Materials and Workmanship

Chemical anchor shall be of approved make. The item shall be executed as per manufacturer's specification. Item shall be executed as directed by engineer in charge, not executed for installation tender item i.e. stair railing, doors windows, etc.

2.0 Mode of Measurement and Payment

Rate shall be for unit of one No.

Item No. 23
Rebaring:
Providing material and labour for Drilling/ Cleaning hole and injecting grouting chemical with the help of dispenser, into a hole as per manufacturer/ structural consultant's specification and fixing rebar of the required diameter subsequently. Fixing methodology shall be followed as per manufacturer's guidelines. Steel will be paid under relevant item. Manufacture to submit Rebar Depth Calculation based on design loads & other parameters as provided by consultant and in accordance with EOTA-TR-023/029 "guidelines for post installed rebar connections" for approval. Rate shall be inclusive of all material, labour, necessary scaffolding etc complete for all floors, all height as directed by engineer in charge.
24.1 Dia 8mm and depth 120mm
24.2 Dia 10mm and depth 150mm
24.3 Dia 12mm and depth 180mm
24.4 Dia 16mm and depth 240mm

1.0 Material:
Medium duty injection adhesive for rebar fixing shall be of approved make of required dia as suggested by engineer in charge.

2.0 Workmanship:
The item shall be executed as per manufacturer's specification. Item shall be executed as directed by engineer in charge, not executed for installation tender item i.e. stair railing, doors windows, etc.

3.0 Mode of measurement:
Rate shall be inclusive of all material, labour, necessary scaffolding etc. Rate shall be for unit of one No.