GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
INDIRA GANDHI CENTRE FOR ATOMIC RESEARCH
CIVIL ENGINEERING DIVISION

TECHNICAL SPECIFICATION

SECTION V - TECHNICAL SPECIFICATIONS

1 General:

The detailed specifications given hereinafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards. It may also be noted that the specifications are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings. The work also includes all minor details of construction which are obviously and fairly intended and which may not have been referred to in these documents but are essential for the entire occupation in accordance with standard Engineering practice.

Unless specifically otherwise mentioned, all the applicable codes and standards published by the Indian Standard Institution and all other standards which may be published by them before the date of receipt of tenders, shall govern in all respects of design, workmanship, quality and properties of materials and methods of testing, methods of measurements etc. Wherever any reference to any Indian Standard Specifications occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revision thereof, if any, up to the date of receipt of tenders. In case there is no I.S.I. specification for the particular work, such work shall be carried out in accordance with the instructions in all respects, and requirements of the Engineer-in-Charge. The work shall be carried out in a manner complying in all respects with the requirements of relevant bye-laws of the Municipal Committee/Municipal Corporation/Development Authority / Improvement Trust under the jurisdiction of which the work is to be executed or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account.

Samples of various materials, fittings, etc. proposed to be incorporated in eh work shall be submitted by the contractor for approval of the Engineer-in-charge before order for bulk supply in placed.

The contractor shall take instructions from the Engineer-in-charge regarding collection and stacking of materials in any place. No excavated earth or building materials shall be stacked on areas where buildings, roads, services, compound wails etc. are to be constructed.

The contractor shall maintain in perfect condition all works executed till the completion of the entire work allotted to him. Where phased delivery is contemplated, this provision shall apply to each phase.

The contractor shall give a performance test of the entire installation(s) as per standard specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer-in-charge before the work is considered as complete.

The Director, Engineering Services Group (OR) Additional Chief Engineer, Civil Engineering Division shall be the sole deciding authority as to the meaning, interpretations and implications for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.

In case any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities all take precedence. In case of any difference or discrepancy between specifications and drawing, the specifications shall take precedence.

Read 'Department' as 'CED/ESG/IGCAR

2. LIST OF INDIAN STANDARDS:

Following are the various Indian Standards, relevant to the Civil Engineering work: (Latest Revision to be referred.)

No	Indian Standard	Subject
1	***Carriage of materials***	
	4082-1977	Recommendations on stacking & storage of construction materials at site.
2	***Earth Work:***	
	1200 (Pt. I) -1992 4081-1986	Method of measurement of Earth work safety code for Blasting and related drilling Operations.
	6313 (pt. II)-1981	Anti-termite measures in buildings (Part II - Pre-constructional chemical treatment).
3	***Mortar :***	
	196-1966	Atmospheric conditions for testing
	269-1989	Ordinary, rapid hardening and low heat Portland cement
	383-1970	Coarse and fine aggregates from natural sources for Concrete
	455-1989	Portland blast furnace slag cement
	650-1991	Standard sand for testing of cement
	712-1984	Building Lines
	1489-1991	Portland Pozzolana cement
	1514-1990	Methods of sampling & Test for quick lime and Hydrated lime
	1542-1992	Sand for plastering
	1727-1967	Methods of tests for pozzolanic materials
	2250-1981	Code of practice for preparation and use of masonry Mortar
	2386 pt. I-1977	Particle size and shape
	2386 Pt.II_1977	Estimation of deleterious materials and organic impurities
	2386 pt. III-1977	Specific gravity, density, voids, absorption and bulking
	2686-1977	Cinder as fine aggregate for use of lime concrete
	3025-1987	Methods of sampling and test (physical and chemical) water used in industry
	3068-1986	Broken brick (burnt clay) coarse aggregate for use in lime concrete (II-R)
	3182-1986	Broken brick(burnt clay) fine aggregate for use in lime mortar
	3812-1981	Fly ash
	3812pt.I	Fly ash for use as pozzolana
	3812pt.II	Fly ash for use as admixture for concrete
	3812pt III	Fly ash for use as fine aggregate for mortar and concrete
	4031-1988	Methods of physical tests for hydraulic cement
	4032-1985	Method of chemical analysis of hydraulic cement
	4098-1983	Lime pozzolana mixture
	6932(pt.I to X)	Methods of test for building lime
	6932 (pt.I)-1973	Determination of insoluble residue, loss of ignition, insoluble matter, silicon-dioxide, ferric and aluminum oxide, calcium oxide and magnesium oxide.
	6932 (pt.II)-1973	Determination of carbon dioxide content
	6932(pt.III)-1973	Determination of residue on slaking of quick lime
	6932 (pt.IV) - 1973	Determination of fineness of hydrated lime
	6932 (ptV)-1973	Determination of un hydrated oxide
	6932(pt.VI)-1973	Determination of volume yield of quick lime
	6932 (ptVII)-1973	Determination of compressive and transverse strength

	6932(pt.VIII)-1973	Determination of workability
	6932 (pt.IX)-1973	Determination of soundness
	6932(pt.X)-1973	Determination of popping and pitting of hydrated lime
4.	***Concrete work:***	
	383-1970	Coarse and fine aggregates from natural sources for Concrete
	456-2000	Code of practice for plain and reinforced concrete
	515-1959	Specifications for natural and manufactured aggregate for use in mass concrete
	516-1959	Method of test for strength of concrete
	1198-1959	Method of sampling and analysis of concrete
	1200(pt.II)-1974	Methods of measurements of cement concrete work
	1322-1982	Bitumen felts for water proofing and damp proofing
	1661-1987(pt.III)	Code of practice for application of cement lime plaster finishes
	2386-1977	Methods of test for aggregate for concrete
	2386(pt.I)-1977	Test for particle size and shape
	2386(pt.II)-1977	Test for estimation of deleterious materials and organic impurities.
	2386(pt.III)-1977	Test for specific gravity, density. voids, absorption an bulking
	238686(pt.IV)-1977	Mechanical properties
	2645-1975	Specification for integral water proofing compounds
	2686-1977	Specification for cinder aggregate for use in lime concrete
	3812-1981	Fly ash
	3812(pt.I)	Fly ash for use as pozzolana for concrete
	3812(pt.II)	Fly ash for use as admixture for concrete
	3812(pt.III)	Fly ash for use as fine aggregate for mortar and concrete
	7861-1975(pt.I)	Hot weather concreting
	7861-1981(pt.II)	Cold weather concreting
	9103-1979	Admixture for concrete
5.	***RCC Work:***	
	432-1982	Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
	432(pt.I)-1982	Mild steel and medium tensile steel bars
	456-1978	Code of practice for plain and reinforced concrete
	457-1957	Code of practice for general construction of plain an reinforced concrete for dams and other massive structure
	516-1959	Methods of test for strength of concrete
	1139-1966	Hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcement
	1199-1959	Methods of sampling ad analysis of concrete
	1200(pt.II)-1974	Methods of measurement of cement concrete work
	1200(pt.V)-1982	Method of measurement of form work
	1343-1980	Code of practice for priestesses concrete
	1566-1985	Hard drawn steel wire fabric for concrete reinforcements
	1780-1961	Specifications for cold twisted steel bars for concrete reinforcement
	1785-1983	Specifications for plain hard draw steel wire for pre-stressed concrete
	1786-1985	Cold twisted steel bars for concrete reinforcement
	2080-1980	Specifications for high tensile steel bars used in pre-stressed concrete
	2204-1962	Code of practice for construction of reinforced concrete shell roof.V- Page 6 of 197
	2210-1962	Criteria for the design of steel structure and folded plates.

	2502-1963	Code of practice for bending and fixing of bars for concrete reinforcement
	2751-1979	Code of practice for welding of mild steel bars used for reinforced concrete construction
	2911-1979	Code of practice for design and construction of pile Foundations
	2911(pt.I)-1979	Load bearing concrete piles
	2911(pt.III)-1980	Under reamed pile foundations
	3201-1988	Criteria for design and construction of precise concrete trusses
	3370(part I to IV)-1965	Code of practice for concrete structures for storage of liquids
	3385-1986	Code of practice for measurement for Civil Engineering works.
	3414-1968	Code of practice for design and installation of joints in buildings
	3588-1987	Code of practice for use of immersion vibrators for consolidating concrete
	3935-1966	Code of practice for composite construction
	4014-1967(pt.I &II)	Code of practice for steel tubular scaffolding (I: Definition / Material: II: Safety Regulations)
	4990-1981	Specifications for plywood for concrete shuttering work 10262 Code of practice for design mix
6	***Equipments:***	
	460-1985	Specification for test sieves
	1791-1985	Specification for batch type concrete missed
	2430-1986	Specification for roller pan mixer
	2585-1968	Specification for concrete vibrators, immersion type
	2806-1964	Specification for screen board concrete vibrators
	2514-1963	Specification for concrete vibrating tables
	3366-1965	Specification for pan vibrators
	4656-1968	Specification for form vibrators for concrete
	2722-1964	Specification for portable swing weight batchers for concrete (single and double bucket type)
	2750-1964	Specification for steel scaffolding.
7	***Brick work:***	
	1077-1986	Common burnt clay building bricks
	1200(pt.III)-1976	Method of measurements of brick work
	2116-1980	Sand for masonry mortars
	2212-1962	Code of practice for brick work
	2250-1981	Code of practice for preparation & use of masonry Mortar
	3102-1971	Classification of burnt clay solid bricks
	3495(pt.I to IV)-1976	Method of test for clay building work
	5454-1978	Method for sampling for sampling of clay building bricks
8	***Stone Work:***	
	1121-(pt.I)-1974	Methods for determination of compressive, transverse and shear strengths of natural building stones
	1122-1974	Methods for determination of specific gravity and porosity of natural building stones
	1123-1975	Methods of test for water absorption of natural building stones
	1124-1974	Methods of test for absorption of natural building stones
	1125-1974	Methods of test for weathering of natural building stones
	1126-1974	Methods of test for durability of natural building stones.
	1129-1972	Dressing of natural building stones
	1200(pt.IV)-1976	Method of measurement of stone masonry.

	1597-1967	Code of practice for construction of rubble stone masonry
	1597(pt.I)-1992	Code of practice for construction of masonry
	1597(pt.II)-1992	Code of practice for construction of Ashlar masonry
	1805-1973	Glossary of items relating to stone quarrying and Dressing
	4101(pt.I)-1967	Stone facing
9	***Marble work:***	
	1122-1974	Methods for determination of specific gravity and porosity of natural building stones
	1124-1974	Methods of test for water absorption of natural building stones
	1130-1969	Marble (blocks, slabs and tiles)
10	***Wood work:***	
	204-1991/92	Tower bolts (Part 1-1991:ferrous metals : part –II-1992:non ferrous metals)
	205-1992	Non-ferrous metal butt hinges
	206-1992	Tee and strap hinges
	207-1964	Gate and shutter hooks and eyes
	208-1987	Door handles
	281-1991	Mild steel sliding door bolts for use with padlocks
	287-1973	Recommendation for maximum permissible moisture contents of timer used for different purposes.
	303-1989	Plywood for general purpose
	362-1991	Parliament hinges
	363-1993	Hasps and staples
	364-1993	Fanlight catch
	401-1982	Code of practice for preservation of timber
	451-1973	Technical supply condition for wood screws
	452-1973	Door springs, rail-tail type
	453-1993	Double acting spring hinges
	723-1972	Steel counter sunk head wire nails
	729-1979	Drawer locks, cup board locks and box locks
	848-1974	Synthetic resin adhesive for plywood (phenolic and amino plastic)
	851-1978	Synthetic resin adhesive for construction work
	852-1994	Specifications for animal glue for general wood working purposes
	1003	Timer paneled and glazed shutters
	1003(pt.I)-1991	Door shutters
	1003(pt.-II)-1994	Window and ventilator shutters
	1019-1974	Rim latches
	1141-1993	Code of practice for seasoning of timer
	1200	Method of measurement and Building of Civil Engineering Works
	1200(pt.XIV)-1984	Glazing
	1200(pt.XXI)-1973	Wood work and joinery
	1322-1993	Bitumen felts for water proofing and damp proofing
	1328-1982	Veneered decorative plywood
	1341-1992	Steel Butt hinges
	1378-1987	Oxidized copper finished
	1568-1970	Wire cloth for general purposes
	1629-1960	Rules for grading of out size of timer
	1658-1977	Fiber hard board
	1659-1990	Block boards
	1823-1980	Floor door stoppers

	1868-1982	Anodic coating on Aluminum
	1911-1967	Schedule of unit weights of building materials
	2191-1983	Wooden flush door shutter (cellular and hollow core type)
	2191(pt.I)-1983	Plywood face panels
	2191(pt.II)-1983	Particle board face panels for wooden flush door shutters
	2202	Wooden flush door shutters (solid core type)
	2202(pt.I)-1991	Plywood face panels for wooden flush door shutters
	2202(pt.II)-1983	Particle board face panels for wooden flush door shutters
	2209-1976	Mortise locks (vertical type)
	2380-1981	Method of test for wood particle board and boards from lignocelluloses materials
	2681-1993	Non-ferrous metal sliding door bolts for use with pad locks
	2835-1987	Flat transparent sheet glass (3rd revision)
	3087-1985	Wood particle boards (medium density) for general purpose
	3097-1980	Veneered particle boards (1st Revision)
	3400	Method of test for vulcanized rubbers
	3400(pt.II)-1980	Hardness
	3400(pt.IV)-1987	Accelerated aging
	3400(pt.IX)-1978	Relative density and density
	3564-1986	Door closers (hydraulically regulated)
	3618-1966	Phosphate treatment of iron and steel of protection against corrosion
	3813-1987	“C” hooks for use with swivels
	3818-1992	Continuous (piano) hinges
	3847-1992	Mortise night latches
	4020-1967	Methods of tests for wooden flush doors (type tests)
	4021-1983	Timber door, windows and ventilator frames
	4827-1983	Electroplated coating of nickel and chromium on copper and copper alloys.
	4948-1974	Welded steel wire fabric for general use
	4992-1975	Door handles for mortise locks (vertical type)
	5187-1972	Flush bolts
	5523-1983	Method of testing anodic coating on aluminum and its alloys
	5930-1970	Mortise latch (vertical types)
	6318-1971	Plastic window stays and fasteners
	6607-1972	Rebated mortise locks (vertical type)
	6760-1972	Slotted countersunk head wood screws
	7196-1974	Hold fasts
	7197-1974	Double action floor springs (without oil check for heavy doors)
	7534-1985	Mild steel bolts with holders for padlocks
11	***Steel Work:***	
	63-1978	Whiting for paints
	198-1978	Varnish, gold size
	226-1975	Structural steel (standard quality)
	277-1985	Specification for galvanized steel sheets (plain and corrugated)
	278-1978	Galvanized steel barbed wire for fencing
	800-1984	Code of practice for use of structural steel in General building construction.
	806-1968	Code of practice for use of steel tube in general building construction
	813-1986	Scheme of symbols for welding
	814-1991	Covered electrodes for metal are welding of structural steel.
	814(pt.I)-1974	For welding products other than sheets

	814(pt.II)-1974	For welding sheets
	815-1974	Classification and coding of covered electrodes for metal are welding of mild steel and low alloy high tensile steel.
	817-1966	Code of practice for training and testing of metal are welders
	818-1968	Code of practice for safety and healthy requirements in electric and gas welding and cutting operation.
	1038-1983	Steel doors, windows and ventilators
	1081-1960	Code of practice for fixing and glazing of metal (steel and aluminum) door, windows and ventilators)
	1148-1982	Hot rolled steel river bars (up to 40mm diameters) for structural purposes
	1161-1979	Steel tubes for structural purposes
	1182-1983	Recommended practice for radiographic examination of fusion welded joints in steel plates
	1200-1974	Method of measurements of steel work and iron works
	1363-1984	Hexagon bolts, nuts and lock nuts (dia 6 to 39mm) and black hexagon screws (dia 6 to 24 mm)
	1599-1985	Method for bend test for steel products other than sheet, strip, wire and tube
	1608-1972	Method for tensile testing of steel products
	1821-1987	Dimensions for clearance holes for metric bolts
	1852-1985	Rolling and cutting tolerance for hot rolled steel products
	1894-1972	Method for tensile testing of steel tunes
	1977-1975	Structural steel (ordinary quality)
	2062-1984	Structural steel (fusion welding quality)
	4351-1976	Steel door frames
	4736-1986	Hot-dip zinc coatings on steel tubes
	6248-1979	Metal rolling shutters and rolling grills
	7452-1990	Hot rolled steel sections for doors, windows & ventilations
12	***Flooring :***	
	210-1978	Grey iron casting
	653-1992	Sheet linoleum
	777-1988	Glazed earthen-ware tiles
	809-1992	Rubber flooring materials for general purpose
	1122-1974	Methods for determination of specific Gravity and porosity of natural building stones
	1124-1974	Method of test for water absorption of natural building stones
	1130-1969	Marble (blocks, slabs and tiles)
	1197-1970	Code of practice for laying of rubber floors
	1198-1982	Code of practice for laying and maintenance of linoleum floors
	1200(pt.XI)-1977	Method of measurements of paving and floor finished
	1237-1980	Cement concrete flooring tiles
	1443-1972	Code of practice for laying and finishing of Cement concrete flooring tiles
	1661-1972	Code of practice for application of cement and cement lime plaster finishes
	2078-1979	Method of tensile testing of gray cast iron
	2114-1984	Code of practice for laying in situ terrazzo floor finish
	2571-1970	Code of practice for laying in situ cement concrete flooring
	3400	Method of test of vulcanized rubbers
	3400(pt.II)-1980	Hardness
	3400(pt.X)-1977	Compression set at constant strain
	3462-1986	Flexible PVC flooring

	8318-1969	Code of practice for laying of flexible PVC sheet & tiles flooring
	5389-1969	Code of practice for laying hardwood parquet and wood block floors
13	***Roofing :***	
	73-1992	Paving Bitumen
	277-1992	Galvanized Steel sheets (plain and corrugated
	458-1988	Concrete pipes (with an without reinforcement)
	459-1992	Un reinforced corrugated and semi corrugated
	651-1992	Asbestos cement sheets
	702-1988	Salt glazed stone ware pipes and fittings
	1199-1959	Industrial Bitumen
	1200(pt.IX)-1973	Method of sampling & analysis of concrete
	1200(pt.X)-1973	Method of measurements of roof covering (including cladding)
	1202-1978	Method of measurements of ceiling and lining
	1203-1978	Determination of specific gravity for testing Tar and Bitumen
	1205-1978	Determination of penetration for testing Tar and Bitumen
	1208-1978	Determination of Ductility for testing Tar and Bitumen
	1209-1978	Determination of flash point and fire point for Testing tar and bitumen
	1211-1978	Determination of water content for testing Tar and bitumen
	1212-1978	Determination of loss on heating for testing Tar and bitumen
	1216-1978	Determination of solubility in carbon disulphide for testing Tar and bitumen
	1322-1993	Bitumen felts for water proofing and damp proofing
	1346-1976	Code of practice for waterproofing of roof with Bitumen felts
	1609-1991	Code of proactive for laying damp proof treatment using bitumen felts
	1626-1994	Asbestos cement building pipes, gutters and fittings (spigot and socket types)
	1834-1984	Specification for hot applied sealing compounds for joints in concrete
	1838-(pt.I)-1983	Preformed filler for expansion joints in concrete non-extruding and resilient type (bitumen impregnated fiber)
	2115-1980	Code of practice for flat roof finish mud phuska
	2633-1986	Method of testing uniformity of coating on zinc coated articles
	3007-(pt.I-1964	Code of practice for laying of corrugated asbestos cement sheet
	3348-1965	Fiber insulation boards
	3607-1979	Magnetite for chemical industry
	7193-1994	Specifications for glass fiber base coal tar pitch & Bitumen felts
	8183-1993	Bonded mineral wool
14	***Finishing :***	
	75-1973	Linseed oil, raw and refinery
	77-1976	Linseed oil, boiled, for paints
	102-1962	Ready mixed paint, brushing, red, lead for priming and general purposes
	103-1962	Ready mixed paint, brushing, white lead for priming an general purposes
	104-1979	Specification for ready mixed paint, brushing, Zinc chrome priming
	133-1993	Enamel, interior (a) under coating (b) finished colour as required

	137-1965	Ready mixed paint, brushing, matt or egg-shell flat, finishing, interior, to Indian Standard colour, as required
	158-1981	Ready mixed paint, brushing, bituminous, black lead free acid alkali, water an heat resting for general purposes
	168-1993	Read mixed paint, air drying for general purpose
	217-1988	Cut back bitumen
	218-1983	Creosole and anthracene oil for use as wood preservatives
	290-1961	Coal tar black paint
	337-1975	Varnish, finishing interior
	338-1952	Varnish, under coating exterior, natural resin
	339-1952	Varnish under coating, exterior, synthetic resin
	340-1978	Varnish mixing
	341-1973	Black Japan, type A, B and C.
	345-1952	Wood filler, Transparent, liquid
	347-1975	Varnish shellac for general purpose
	348-1968	French polish
	419-1967	Putty for use of window frames
	427-1965	Distemper, dry, colour as required
	428-1969	Distemper., oil emulation, colour as required
	524-1983	Varnish, finishing exterior, synthetic
	525-1968	Varnish, finishing exterior and general purposes
	533-1973	Gum spirit of turpentine (oil of turpentine)
	712-1984	Specification for building limes
	1200(pt.XII)-1976	Method of measurements of plastering and pointing
	1200(pt.XIII)-1987	Method of measurements of white washing
	1200(pt.XV)-1987	Method of measurements of painting, polishing & varnishing
	2095-1982	Gypsum plaster boards
	2096-1992	Asbestos cement flat sheets
	2339-1963	Aluminum paint for general purposes, in dual container
	2547-1976	Gypsum building plaster
	2932-1994	Enamel synthetic, exterior (a) Under coating (b) Finishing
	2933-1975	Enamel, Exterior (a) Under coating (b) Finishing
	5410-1992	Cement paint, colour as required
	5411(pt.I)-1974	Plastic emulsion paint for interior use
	6278-1971	Code of practice for white washing & colour washing
15	***Demolition and Dismantling:***	
	1200(pt.XVIII)-1974	Method of measurements of demolition and dismantling
16	***Safety Codes:***	
	818-1968	Safety and healthy requirements in Electric and gas welding and cutting operations
	3698-(pt.I)-1987	Safety code for scaffolds
	3696(pt.II)-1966	Safety code for ladders
	3764-1966	Safety code for Excavation works
	4081-1986	Safety code for blasting and related drilling operation
	4130-1976	Safety code for demolition of building
	5916-1970	Safety code for construction involving use of hot bituminous materials
	6922-1973	Structure subject to underground blasts code of practice for safety and design for
	7293-1974	Working with construction machinery safety code

3. Excavations, Filling and Backfilling

Scope of Work

The scope for work covered under this specifications pertain to excavation of foundations, trenches, pits and over areas, in all sorts of soil, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities of any, such as water lines, electric cables etc. dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, refilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth / materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

Site Clearance:

Before the earth work is started the area coming under cutting and filling shall be cleared of all obstruction, loose stones, shrubs, rank vegetation, grass, bushes and rubbish removed up to a distance of 150 metres outside the periphery of the area under clearance. This work is deemed to be included in the earthwork item rate and no separate payment will be admissible.

Roots and Vegetation clearance:

The roots of trees if any shall be removed to a minimum depth of 60 cm below ground level or a minimum of 30 cm below formation level whichever is lower and the hollows filled up with earth leveled and rammed. This work is deemed to be included in the earthwork items and no separate payment will be admissible for the work.

Any material obtained from the site will be the property of the Government of India and the useful materials as decided by the Engineer-in-charge will be conveyed and properly stacked as directed within the lead specified.

Setting out and making profile*s:*

Masonry or concrete pillars will be erected at suitable points in the area to serve as benchmarks for the execution of the work. These benchmarks shall be connected with G.T.S. or any other permanent benchmark approved by the Engineer-in-charge. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labour and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Department will show grid co-ordinate or other reference points. It shall be the responsibility of the contractor to set out center lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the Department will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

Excavation:

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing level for the purpose of measurements. The ground levels shall be taken at 5 to 15 metres intervals in uniformly sloping ground and at closer distance where local mounds, pits, or undulations are met with, as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earthwork is actually started. The labour required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, murrum, soft and hard rock, boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines, levels, grades and levels as directed by the Engineer-in-charge and per items in the schedule of quantities.

The item in the schedule of quantities shall specify the excavation in trenches or over areas. For this purpose, the excavation for any depth in trenches for foundation not exceeding 1.5m in width or 10sqm. on plan shall be described as excavation in foundation trenches.

Excavation exceeding 1.5m in width as well as 10sqm. on plan (excluding trenches for pipes, cables etc.) and exceeding 30cm in depth shall be described as excavation over areas.

Excavation exceeding 1.5m in width as well as 10sqm. on plan but not exceeding 30cm. in depth shall be described as surface Excavation.

Classification of Earth work:

The earthwork shall be classified under the following main categories and measured separately for each category.

All types of soil, murrum, boulders, Soft rock, Hard rock.

All types of Soils, Murrum, Boulders:

This includes earth, murrum, top deposits of agricultural soil, reclaimed soil, clay, sand or any combination thereof ad soft and hard murrum, shingle etc. which is loose enough to be removed with spadies, shovel and pick axes. Boulders not more than 0.03 cum. in volume found during the course of excavation shall also fall under this classification.

Excavation in Soft Rock:

This shall include all materials which are rock or hard conglomerate, all decomposed weathered rock, highly fissured rock, old masonry, boulders bigger than 0.03 cum, in volume but not bigger than 0.5 cum. and other varieties of soft rock which can be removed only with pick axes, crow bars, wedges and hammers with some difficulty. The mere fact that the contractor resorts to blasting and / or wedging and chiseling of reasons of his own, shall not mean the rock is classifiable as hard rock.

Excavation in Hard Rock *:*

This includes all rock other than soft rock mentioned in para above 1.5.1 (b) viz. soft rock, occurring in masses, boulders having approximate volume more than 0.5 cum. plain or reinforced cement concrete, which can best be removed by chiseling and wedging where blasting cannot be permitted owing to any restriction at site.

Excavation In Hard Rock by Chiseling and Wedging:

Where blasting is not permitted and if the Engineer-in-charge so desires, the excavation shall be done by chiseling and wedging or any other agreed method.

Note: All the excavated hard rock obtained shall be stacked properly and neatly within the specified lead by the contractor as directed by the Engineer-in-charge.

Excavation:

The excavation under all classifications in areas in trenches or in pits shall be carried out systematically. Cutting shall be done from top to bottom and not under pining or under cutting will be allowed. The bottom and sides of excavation shall be dressed to proper level, slopes, steps, camber etc. by removing high spots and ramming thoroughly as directed by the Engineer-in-charge.

All the excavation shall be carried out strictly to the dimensions given in the drawing. The width shall generally be of the width of mudmat concrete and depth as shown in drawing or as directed by the Engineer-in-charge, according to availability of the desired bearing capacity of soil below. Any excavation if taken below the specified depths and levels, the contractor shall at his own cost fill up such over cut to the specified level with cement concrete 1:4:8 in case of excavation in all types of soils an with cement concrete 1:2:4 in case of excavation soft and hard rock.

After the excavation is completed, the contractor shall notify the Engineer-in-charge to that effect and no further work shall be taken up until the Engineer-in-charge has approved the depth and dimensions an also the nature of foundation materials, levels and measurements shall also be recorded prior to taking up any further work.

Shoring:

Unless separately provided for in the schedule of quantities, the quoted rate for excavation shall include excavation of slopes to prevent falling in soil by providing and / or fixing, maintaining and removing of shorting, bracing etc. The contractor would be responsible for the design of shoring for proper retaining of sides of trenches, pits etc. with due consideration to the traffic, superimposed loads etc. shoring shall be of sufficient strength to resist the pressure and ensure safety from slips and to prevent damage to work and property and injury to persons. It shall be removed as directed after items for which It is required are completed should the slips occur, the slipped materials shall be removed and slope dressed to a modified stable slope. Removal of the slipped earth will not be measured for payment.

Dewatering:

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water discharged sufficiently away from the foundations t keep it free from nuisance to other works in the neighborhood.

Disposal of Excavated Materials:

Antiquities:

Any finds of archeological interest such as relics of antiquity, coins, fossils or other articles of value shall be delivered to the Engineer-in-charge and shall be the property of the Government.

Useful Materials:

Any material obtained from the excavation which in the opinion of the Engineer-in-charge is useful, shall be stacked separately in regular stacks as directed by the Engineer-in-charge and shall be the property of the Government.

No material excavated from foundation trenches of whatever kind they may be are to be placed even temporarily nearer than about 3m from the outer edge of excavation. Discretion of the Engineer-in-charge in such cases is final. All materials excavated will remain the property of the Department. Rate for excavation includes sorting out of the useful materials and stacking them separately as directed within the specific lead. Material suitable and useful for backfilling or there use shall be stacked in convenient place but not in such a way as to obstruct free movement of materials, workers and vehicles or encroach on the area required for constructional purposes. It shall be used to the extent required to completely backfill the structure to original ground level or other elevation shown on the plan or as directed by the Engineer-in-charge. Materials not useful in anyway shall be disposed off, leveled and compacted as directed by the Engineer-in-charge within a specified lead. The site shall be left clan of all debris and leveled on completion.

Backfilling in sides of Foundations, Plinth, Under Floor etc:

The backfilling shall be done after the concrete or masonry has fully set and shall be done in such a way as not to cause under-thrust on any part of the structure. Where suitable excavated material is to be used for backfilling, it shall be brought from the place where it was temporarily deposited and shall be used in backfilling. The scope of work for backfilling/ filling in foundation, plinth, under floors etc. shall include filling for all the buildings covered under the

contract. Surplus earth available from one building, if required, shall be used for backfilling / filling for other buildings also within the specified lead mentioned in the item.

All timber shoring and form work left in the trenches, pits, floors etc. shall be removed after their necessity ceases and trash of any sort shall be cleared out from the excavation. All the space between foundation masonry or concrete and the sides of excavation shall be backfilled to the original surface with approved materials in layers not exceeding 150mm, in thickness, watered and well consolidated by means of rammers to at least 90% of the consolidation. Areas inaccessible to mechanical equipment such as areas adjacent to walls and columns etc. shall be tamped by hand rammer or by hand held power rammers to the required density. The backfill shall be uniform in character and free from large lumps, stones. shingle or boulder not larger than 75mm. in any direction, salt, clods, organic or other foreign materials which might rot. The backfilling in plinth and under floor shall be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density.

Test to establish proper consolidation as required will be carried out by the Department at rates specified. Two tests per 50 sqm. will be taken to ascertain the proper consolidation. The cost of tests carried out will be recovered from the contractor's bill.

Filling in Plinth and Under Floors:

After the available suitable excavated materials are exhausted as backfilling, the contractor shall notify the Engineer-in-charge of the fact and levels taken jointly with Engineer-in-charge. The earth, murrum, sand, gravel etc. or such materials suitable for filling proposed to be filled under floors and so mentioned in t he item of schedule of quantities shall then be brought to site from approved locations and sources.

Earth Filling:

The earth, soft murrum etc. so brought shall be filled up in layers of 15 cm depth, each layer being well watered and consolidated by approved hand or mechanical tampers or other suitable means to achieve the required density.

Gravel or sand filling:

Gravel if required to be filled under floors, shall be single washed gravel of approved quality and of size varying from 12mm t0 20mm. it shall be uniformly blind with approved type of soil and / or sand to obtain full compaction. Gravel shall be filled in specified thickness and shall be well watered and rammed entirely to the satisfaction of the Engineer-in-charge.

If sand is required to be filled under floors, it shall be clean, medium grained and free from impurities. The filled in sand shall be kept flooded with water for 24hrs. to ensure maximum consolidation shall be done by the contractor at his own cost. The surface shall then be well dressed and got approved from Engineer-in-charge before any other work is taken over the fill.

Lead and Lift:

Lead: The lead for disposal / deposition of excavated materials shall be as specified in the respective item of work. For the purpose of measurements of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided in suitable blocks and for each of the block, the distance between center lines shall be taken as the leads which shall be measured by the shortest straight line route on the plan and not the actual route adopted.

Lift: Lift shall be measured from ground level. Excavation up to 1.5m depth below ground level and depositing excavated material on the ground shall be included in the item of earthwork for various kinds of soil. Extra lift shall be measured in unit of 1.5m or part thereof. Obvious lift shall only be measured that is lifts inherent in the lead due to ground slope shall not be measured, except for lead up to 250m. All excavation shall be measured in successive stages of 1.5m

stating the commencing level. This shall not apply to cases where no lift is involved as in hill side cutting.

Mode of Measurements:

All excavation in areas having depth more than 30cm. pits, trenches etc. shall be measured net. The dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavations for the purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, rafts or other foundations, multiplied by the mean depth from the surface of ground determined by levels. Excavation for side slopes will not be paid for. Excavation in areas having depths less than 30 cms. shall be measured as surface excavation on square meter basis, mentioning the average depth of excavation.

Reasonable working space beyond concrete dimension required for waterproofing and shuttering where considered necessary in the opinion of Engineer-in-charge will be allowed in execution and considered for payment for underground water tank, sump septic tank etc.

Where direct measurements of rock excavation are not possible, volume of rock can be calculated on the basis of length, breadth, and depth of stacks made at site as mentioned in para 1.5.1 (c). The net volume shall be worked out by reducing it by 40% taking the voids into consideration as 40%. Similarly to arrive at net quantity to be paid in the case of soil, reduction at 20% of corresponding stack / truck measurements shall be made.

The rate for excavation shall include carting and disposing and leveling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring, dewatering at various stages, labour, materials etc. to complete all the operations specified.

The backfilling and consolidation in sides of foundation and in plinth with excavated material will not be paid for separately. The rate quoted for excavation shall be deemed to have been included the cost of stacking of excavated materials, conveying within the specified lead, picking of selected stacked materials, conveying it to the place of final backfill, compaction to the required proctor density etc.

Payment for filling and consolidation inside the trenches, sides of foundations, plinth etc. with selected materials brought by the contractor other than the excavated material, shall be paid for separately as per the rates in schedule of quantities which includes cost of such materials/ excavation, royalty, its conveyance within the specified lead, watering, consolidating, dressing etc. Actual quantity of consolidated filling shall be measured and paid in cubic meters up to two places of decimal.

The rate quoted in cum. for items of excavation is deemed to include the necessary additional quantity of excavation involved beyond the plan dimensions of the work which may be necessary to be carried out for carrying out the work in an engineering made, decided upon by the contractor. Therefore no extra payment will be made for any excavation done other than the required quantity as per the plan dimension indicated in the drawings.

Measurements for excavation over areas shall be determined by levels or by "Dead men" or both at the discretion of the Engineer-in-charge. If however the Engineer-in-charge decided on measurement by levels, levels of site shall be jointly taken and recorded by the Engineer-in-charge or his representatives and the contractor, before commencement of the work and after completion of the work and the quantity of work done shall be computed based on these levels. The volume of earth work shall be computed based on "Simpson's formula ' or any other approved method at the discretion of the Engineer-in-charge.

4. ANTITERMITE TREATMENT:

General:

Pre constructional anti-termite treatment is a process in which soil treatment is applied to a building in early stages of its construction. The purpose of anti-termite treatment is to provide the building with a chemical barrier against the sub-terrain termites.

Anti-termite treatment being a specialized job, calls for thorough knowledge of the chemicals, soils, termite to be dealt with and the environmental conditions, in order to give effective treatment and lasting protection to the property undergoing treatment. It is therefore imperative that the works of anti-termite treatment should be got executed through specialized agencies only. The specialized agency should be preferably a member of the Indian pest control Association and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender.

The pre constructional soil treatment is required to be applied during the construction stages of the sub-structure up to plinth level. The contractor has to be watchful of the various stages of sub-structure works and arrange to carry out the soil treatment in time after proper co-ordination with Department and other contractors if any, working at site.

Scope:

The scope of pre constructional anti-termite treatment covers the soil treatment with approved chemicals in water emulsion in foundation trenches for columns, plinth beams, plinth filling, at junction of walls and floor, in expansion joints etc. in stages as detailed in this specifications and drawings. Unless otherwise stipulated, the anti-termite treatment will be carried out as per IS 6313 (part II) 1981 and / or as per direction of the Engineer-in-charge.

Site preparation:

In order to ensure uniform distribution of the chemical emulsion and to assist penetration, the following site preparation shall be carried out:

a) Remove all trees, stumps, logs or roots from the building site.
b) Remove all concrete form work if left anywhere, leveling pegs, timber off-cuts and other building debris from the area to be treated.
c) If the soil to be treated is sandy or porous, preliminary moistening will be required to fill capillary spaces in soil in order to prevent the loss of emulsion through piping or excessive percolations.
d) In the event of water logging of foundation, the water shall be pumped out before application of chemical emulsion and it should be applied only when the soil is absorbent.
e) On clays and other heavy soils where penetration is likely to be slow and on sloping sites, where run-off of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of 75mm at least.
f) All sub-floor leveling and grading should be completed. All cutting trenches and excavations should be completed with backfilling in place, borrowed fill must be free from organic debris and shall be well compacted. If this is not done supplementary treatments should be made to complete the barrier.

Chemical to be used:

The effectiveness of chemical depends upon the choice of the chemical, the dosage adopted and the thoroughness of application. The chemical solutions or emulsions are required to be dispersed uniformly in the soil and to the required strength so as to form an effective chemical barrier which is lethal and repellent to termites.

Soil treatment:

One of the following chemicals in water emulsion, after approval from the Engineer-in-charge shall be used uniformly over the area to be treated.

Chemical	% of concentration of Chemical by weight in the Kerosene emulsion
I. Heptachlor 20 EC emulsifable concentrates (I.S.6439 – 19781-R)	0.5
II. Chlordance 20 EC emulsifable concentrates (I.S.2682-1984 II-R)	1.0
III. THIODAN 35 EC emulsifable concentrates (Endosulphan)	0.5
IV. Chlorpyriphos 20 EC emulsifiable concentrates (I.S. 8944-1974)	1.0

The contractor should produce voucher(s) for the chemical purchased and should get verified the sealed container(s) of the specified chemical from the Engineer-in-charge before preparing the emulsion / use for t he treatment.

Mode and Rate of Application:

The chemical emulsion as stated above will be applied uniformly by sprayers at the prescribed rates as detailed below in all the sages of the treatment.

Treatment in Foundation Trenches:

In case of normal wall load bearing structures, columns pits, wall trenches and basement, the treatment shall be at 5 litres/sqm. or surface area of the bottom and sides to a height of at least 300mm. After the foundation work, the sides shall be treated at 7.5 litres/sqm. of vertical surface of substructure on each side. After the earth filling is done, treatment shall be done by rodding the earth at 150mm centers close to wall surface and spraying the chemical with the above dose i.e. 7.5 litres/sqm. In case of framed structure, the treatment shall start at a depth of 500mm below ground level. From this depth the backfill around the columns, beams and R.C.C. basement walls shall be treated at 7.5 litres / sqm. of the vertical and at 5 litres / sqm. for the horizontal surface at the bottom in the trenches / pits.

Treatment on Top Surfaces on Plinth Filling:

The top surface of the filled earth within plinth walls shall be treated with chemical emulsion at the rate of 5 litres/sqm. of the surface area before sub-base to floor is laid. If filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 to 75mm deep at 150 mm centers both ways shall be made with crow bars on the surface to facilitate saturation of the soil with the emulsion.

Treatment at Junction of Walls and floors:

Special care shall be taken to establish continuity of the vertical chemical barrier on the inner wall surfaces from the finished ground level (or from level where the treatment had stopped) up to the level of the filled earth surface. To achieve this a small channel 30 X 30 mm. shall be made at all the junctions of wall / column with floor (before laying sub-grade) and rod holes made in the channel up to the finished ground level at 150mm apart and the iron rod moved backward and forward to break the earth and chemical emulsion poured along the channel at 7.5 litres (or at recommended quantity per sqm. of the vertical wall / column surfaces so as to soak the soil right up to the bottom. The soil shall be tamped back into place after this operation.

Treatment for Expansion Joints:

The soil beneath the expansion joins shall receive special attention when the treatment under 2.5.1 above is in progress. This treatment shall be supplemented by treating through the

expansion joint after sub-grade has been laid at the rate of 2 litres per metre length of expansion joint.

Precautions during Treatment:

1. Utmost care shall be taken to see that the chemical barrier is complete and continuous. Each part of the area shall receive the prescribed dosage of chemical emulsion.
2. The treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water.
3. Once formed, the treated soil barrier shall not be disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

Precautions for Health Hazards and Safety Measures:

All the chemicals mentioned above are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mist or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully all the safety precautions particularly when handling these chemicals in the from of concentrates.

These chemicals are usually brought to the site in the form of emulsifable concentrates. The containers should be clearly labeled and should be stored carefully out of the reach of children and pets animal. They should be kept securely locked.

Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes they shall be flushed with plenty of water and immediate medical attention should be sought.

The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.

Care should be taken in the application of chemicals / soil toxicants to see that they are not allowed to contaminate wells or springs and other sources of drinking water.

Guarantee :

The contractor has to furnish the guarantee for 10 (ten) years from the date of completion of work, starting that in case of reappearance of termites within the building area due to defective materials or workmanship or due to any other reasons, the contractor will carry out the necessary post constructional treatment to keep the entire area free from termite, once again, without any extra cost to the Department during the guarantee period.

Mode of measurement:

The payment will be made on the basis of plinth area measurements at ground floor only for all the stages of treatment in sqm. correct to two places of decimals. Rate includes the cost of materials, labour and all tools, plants, sprayers required for complete operation.

5. HARD CORE / SOLING UNDER FLOORS / FOUNDATIONS:

Scope of work:

The work covered under this specification includes all type of soling work either by bricks or by rubble stones laid under floors / foundations, hand packed, complete as per specification mentioned below and applicable drawings.

Rubble Stone Soling:

The rubble stone shall be of best variety of black trap / granite / basalt or other approved-variety of stone available locally. The stone shall be hard, durable free from defects and of required size and shall be approved by the Engineer-in-charge.

Preparation of Surface:

The bed on which rubble soling is to be laid shall be cleared of all loose materials, leveled, watered ad compacted and got approved by the Engineer-in-charge before laying rubble soling. Cable or pipe trenches if shown in the drawing and as required by the Engineer-in-charge shall be got done before the soling is started.

Workmanship:

Over the prepared surface, the stone shall be set as closely as possible and well packed and firmly set. The stones shall be of full height and shall be laid so as to have their bases of the largest area resting on the sub-grade. Soling shall be laid in one layer of 230mm or 150mm depth or specified thickness of soling with a tolerance of 25mm.

After packing the stones properly in position, the interstices between them shall be carefully filled with quarry spoils or stone chips of larger size possible to obtain a bard, compact surface. Spreading of loose spoils or stone chips is prohibited.

The entire surface shall be examined for any protrusions and the same shall be knocked off by a hammer and all interstices shall be filled with approved murrum. Excess murrum if any over the surfaces shall be removed. Unless other wise specified, the murrum shall be supplied by the contractor at his own cost from the selected area. The surfaces shall then be watered and consolidated with mechanical or sufficiently heavy wooden tampers and log-rammers as approved by the Engineer. After compaction, the Engineer-in-charge to give the required slope or level and dense sub-base and the surface shall present clean look. Adequate care shall be taken by the contractor while laying and compacting the rubble soling to see that concrete surfaces in contact with soling are not damaged.

Mode of Measurement:

The quoted rate shall be per square metre of the soling of specified thickness. The linear dimension shall be measured up to two places of decimals of a metre and are worked out correct to the two places of decimals of a square metre. Plan areas of soling work actually done limiting to the dimensions as per drawings shall be measured for payment. The rate shall include all the materials labour, transport etc. and no extra payment shall be made for work done at different levels. The rate shall also include the cost of preparation of surface, all materials and labour, watering, consolidation etc. all complete.

6. REINFORCED CONCRETE AND ALLIED WORKS:

Scope:

This specification covers the general requirements for concrete jobs, using on-site production facilities including requirements in regard to the quantity, handling, storage of ingredients, proportioning, batching, mixing and testing of concrete and also requirements in regard to the quality. This also covers the transportation of concrete from the mixer to the place of final deposit and the placing, consolidation, curing, protecting, repairing ad finishing of concrete.

After award of the work, if so desired by the contractor, he / they may be allowed by the Engineer-in-charge till the designed mix is obtained, to carry out the reinforce concrete work In foundation and plinth as per equivalent nominal mix against the specified design mix concrete as per IS Codes. However, all other specification for design mix shall govern for nominal mix also and nothing extra shall
be paid for use of extra cement on this account whether the cement is supplied by the Department or procured by the contractor.

Cement Concrete (Plain and Reinforced):

The quality of materials and method and control of manufacture and transportation of all concrete work in respect of mix, where reinforced or otherwise, shall conform to the applicable portions of these specifications.

The Engineer-in-charge shall have the right to inspect the sources of materials, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipments and the quality control system. Such an inspection shall be arranged by the contractor and the Engineer-in-charge's approval shall be obtained prior to starting the concrete work.

Materials for Standard Concrete:

The ingredients to be used in the manufacture of standard concrete shall consist solely of a standard type Portland cement, clean sand, natural coarse aggregate, clean water, ice and admixtures if specially called for as per drawings or schedule of quantities.

Cement :

Unless otherwise specified or called for by the Engineer-in-charge, cement shall be ordinary Portland cement in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-in-charge. Changing of brands or type of cement within the same structure will not be permitted. Ordinary Portland cement (OPC) 43 grade manufactured as per I.S. specifications of reputed brands like ACC / Ultratech / Zuari / Coramendel or any other brands as approved by the Engineer-in-charge from time to time shall be procured and used on the work. Joint account of cement consumed at site for every day for items of work carried shall be maintained by the Contractor for verification to ensure effective control on quality of cement used in the work.

A certified report attesting to the conformity of the cement to IS specifications by the cement manufactures chemist shall be furnished to the Engineer-in-charge, if demanded. Incase the cement is required to be arranged by the Contractor, the Contractor will have to make his own arrangement for the storage of adequate quantity of cement. Cement in bulk may be stored in bins or silos which will provide complete protection from dampness, contamination and minimize caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangements shall be such that there is no

dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be got approved by the Engineer-in-charge. Consignments in cement shall be stored as received and shall be consumed in the order of their delivery.

Contractor shall establish cement/concrete/soil testing laboratories at site of work with qualified person to handle the laboratory. Every consignment of cement procured shall accompany test certificate from the company indicating lot No etc. Sample shall be taken for each lot and sent to Standard Approved Material Testing Laboratory for physical and chemical analysis. The cost of testing shall be borne by the Contractor.

Cement held in store for a period of 90 (ninety) days or longer shall be retested before use in work. Should at any time the Engineer-in-charge have reasons to consider that any cement is defective, then irrespective of its origin and / or manufacturers test certificate, such cement shall be tested immediately at a National Test Laboratory / Departmental Laboratory or such approved laboratory, and until the results of such tests are found satisfactory, it shall not be used in any work.

Aggregates:

"Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete.

"Fine Aggregate" is aggregate most of which passes through 4.75 mm I.S. sieve.

"Coarse Aggregate" is aggregate most of which is retained on 4.75 mm I.S. sieve.

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

Aggregate shall, except as noted above, consists of natural sand, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, curable against weathering, of limited porosity and free from deleterious materials that may cause corrosion to the reinforcement or may impair the strength and / or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of and shall be based on the "mix design" and preliminary test on concrete specified hereinafter.

Sampling and Testing:

Sampling of the aggregates for mix design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the schedule placing of concrete. Record of tests which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to the Engineer-in-charge in advance of the work or use, in determining suitability of the proposed aggregate.

Storage of aggregates:

All coarse and fine aggregates shall be stacked separately in stock pile in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but also at the time of loading into mixer. Rakers shall be used for lifting the coarse aggregate from bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.00 meters in height to prevent conning or segregation. Each layer shall cover the entire area of the stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected. Rejected materials after remixing may be accepted, if subsequent tests demonstrate conformity with required gradation.

Specific Gravity:

Aggregates having a specific gravity below 2.6 (saturated surface dry basis) shall not be used without special permission of the Engineer-in-charge.

Fine Aggregate:

Fine aggregate except as noted above, and for other than light weight concrete shall consist of natural or crushed sand conforming to IS 383. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, loam, alkali, organic matter mica, salt or other deleterious substances which can be injurious to the setting qualities / strength / durability of concrete.

Screening and Washing:

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

Sand with silt content more than 3 percent will not be permitted to be used unless same is washed and silt content is brought within 3% by weight.

Foreign Material Limitations:

The percentages of deleterious substances in sand, delivered to the mixer shall not exceed the following:

Sl. No.	Substances	Percent by weight	
		Uncrushed	Crushed
I	Material finer than 75 micron IS Sieve	3.00	15.00
II	Shale	1.00	--
III	Coal and Lignite	1.00	1.00
IV	Clay lumps	1.00	1.00
V	Total of all above substances including items (I) to (IV) for uncrushed sand and items (III) and (IV) for crushed sand	5.00	2.00

GRADATION: Unless otherwise directed or approved, the grading of sand shall be within the limit indicated hereunder:-

IS Sieve designation	Percentage passing for			
	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	8-30	20-65
150 micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron (IS) sieve by not more than 5% it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron (IS) sieve or to percentage passing any other sieve size on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to Grading zone IV shall not be used unless mix designs and preliminary tests have shown its suitability for producing concrete of specified strength and workability.

Fineness Modulus:

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2 the fineness modulus is determined by adding the cumulative.

Percentages retained on the following IS sieve sizes (4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron and 150 micron) and dividing the sum by 100.

Coarse Aggregate:

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

The coarse aggregate and fine aggregate shall be tested from time to time as required by the Engineer-in-charge to ascertain its suitability for use in construction and the charges for testing aggregate shall be born by the contractor as specified herein after.

Screening and Washing:

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

Grading:

Coarse aggregates shall be either in single or graded in both the cases. The grading shall be within the following limits:

IS Sieve designation	Percentage passing for single sized aggregates						Percentage passing for graded aggregates of nominal size			
	63mm	40mm	20mm	16mm	12.5mm	10mm	40mm	20mm	16mm	12.5mm
75mm	100	-	-	-	-	-	-	-	-	-
63mm	85-100	100	-	-	-	-	100	-	-	-
37.5mm	0-30	85-100	100	-	-	-	95-100	100	-	-
19mm	0.5	0.20	85-100	100	-	-	30-70	95-100	100	100
16mm	-	-	-	85-100	100	-	-	-	90-100	-
11.2mm	-	-	-	-	85-100	100	-	-	-	90-100
9.5mm	-	0.5	0.20	0.30	0-45	85-100	10-35	25-55	30-70	40-85
4.75mm	-	0.5	0-5	0-10	0-20	0-20	0-5	0-10	0-10	0-10
2.36mm	-	-	-	-	0-5	0-5	-	-	-	-

The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, If present, shall be only in such quantities that will not in the opinion of Engineer-in-charge, affect adversely the strength and / or durability of concrete the maximum size of coarse aggregate shall be the maximum size specified above, but in no case greater that 1/4 of the minimum thickness of the member, provided tat the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of form. Plums above 160mm and up to any reasonable size can be used in plain mass concrete work of large dimensions up to a maximum limit of 20% by volume of concrete when specifically approved by Engineer-in-charge. For heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5mm, less than the minimum clear distance between the reinforcing main bars of 5mm less than minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% or it's over dry weight in air, as determined by IS 2386.

Foreign Material Limitations:

The percentages of deleterious substances in the coarse aggregate delivered to the mixer shall not exceed the following.

Sl. No.	Substances	Percent by weight	
		Uncrushed	Crushed
I	Material finer than 75 micron IS Sieve	3.00	3.00
II	Coal and Lignite	1.00	1.00
III	Clay lumps	1.00	1.00
IV	Soft fragments	3.00	-
V	Total of all the above substances	5.00	5.00

Water:

Water used for both mixing and curing shall be free from injurious amount of deleterious materials; potable waters are generally satisfactory for mixing and curing concrete. In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS 456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The samples shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

Average 28 days compressive strength of at least three 150mm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water.

The initial setting time of test block made with the appropriate test cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than (+) 30 minutes form the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS 4031. Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-in-charge may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values.

Limits of acidity:

To neutralize 200ml sample of water, using phenolphthalein as an indicator, it should not require more than 2ml of 0.1 normal NaOH. The details of test shall be as given in IS 3025.

Limits of alkalinity:

To neutralize 200ml sample of water, using methyl orange as an indicator, it should not require more than 10ml of 0.1 normal HCL. The details of test shall be as given in IS 3025.

Percentage of solids shall not exceed the following:

Organic	2.02% (200 mg/litre)
Inorganic	0.30% (3000mg/litre)
Sulphates (as SO4)	0.05% (500mg/litre)
Alkali chlorides (As cl)	0.20% (2000mg/litre) for plain concrete work & 0.10% (1000mg/litre) for reinforced concrete work
Suspended matter	0.20% (2000mg/litre)

Design Mix Concrete:

All reinforced concrete in the works shall be "Design Mix Concrete" as defined in I.S. 456-2000. All "Design Mix Concrete" work to be carried out under these specifications shall be in grades designated as per table below:

Grades of Concrete:

Grade Designation	Specified Characteristic compressive strength at 28 days(N/mm2)
M 10	10
M 15	15
M 20	20
M 25	25
M 30	30
M 35	35
M 40	40

Note 1 : The characteristic strength is defined as the strength for material below which not more than 5% of the test results are expected to fall.

Note 2: In the designation of a concrete mix, letter M refers to the mix and the number to the specified characteristic compressive strength of 15cm. cubes at 28 days.

The mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than appropriate values given in the table above.

Mix Design:

This is to investigate the grading of aggregates, water cement ratio, workability and the quantity of cement required to give works cubes of the characteristic strength specified. The proportion of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. ***Mix proportioning shall be carried out according to the ACI standard designation ACI-613 or Design of concrete mixes – Road research Note No. 4, Department of Scientific and Industrial Research U.K. or I.S. 10262-1982.***

Selection of Water Cement Ratio:

Since different cements and aggregates of different maximum size, grading, surface texture, shape and other characteristics may produce concretes of different compressive strength for the same free water cement ratio, the relationship between strength and free water cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free water cement ration (by mass) corresponding to the target strength of 28 days may be selected from the relationship shown in Fig. 1 of IS. 10262-page 7.

Alternately, the preliminary free water ratio (by mass) corresponding to the target average strength may be selected from the relationship in Fig2-IS 10262-1982, Page 8 using the curve corresponding to the 28 days cement strength to be used for the purpose.

Other relevant items to be used with design of mix should strictly conform to the relevant clauses and appendices of IS 10262 – 1982.

The calculated mix proportions shall be checked by means of trial batches. The contractor should refer to the item no.4 page 12, and the Appendix D (clause no.4.1) of IS 10262-1982 for neat illustration.

The contractor may refer Appendix C, clause 3.8 page no. 16 of IS 10262-1982 for an example illustrating the mix design of M-20.

The free water cement ratio selected as above, should be checked against the limiting water cement ratio for the requirement of durability and the lower of the two values should be adopted.

Whenever there is a change either in required strength of concrete of water cement ratio or workability or the source of aggregates and / or cement, fresh tests shall be carried out to determine the revised proportion of the mix to suit the altered conditions. While designing mix proportions, over wet mixes shall always be avoided.

While fixing the value for water cement ratio for Design Mix assistance may be derived from the standard graph showing the relationship between the 28 days compressive strength of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269.

It will be contractors sole responsibility to establish the concrete mix designs for different grades of concrete specified in the work consistent with the workability required for nature of work and also taking into consideration the assumed standard deviation which will be expected at site or by establishing the standard deviation based on 30 test results at site for each grade of concrete so as to produce concrete of required strength, durability and surface finish. The materials and proportions used in making the tests to be carried out either at site or under laboratory, conditions shall be similar in all respects to those to be actually employed in the works, as the object of these test is to determine the proportions of cement, aggregates and water necessary to produce the concrete of the required consistency to give such specified strength.

Standard Deviation:

Standard deviation of concrete of each grade shall be determi9ned separately as stated below. When results of sufficient number of tests (at least 30) are not available, than depending on the degree of quality control expected to be exercised at the site, the value of standard deviation given in the following table may be adopted for guidance.

Suggested Values of S.D:

Grade of concrete	S.D. for different degree of control in N/mm^2		
	Very good	Good	Fair
M 10	2.0	2.3	3.3
M 15	2.5	3.5	4.5
M 20	3.6	4.6	5.6
M 25	4.3	5.3	6.3
M 30	5.0	6.0	7.0
M 35	5.3	6.3	7.3
M 40	5.6	6.6	7.6
M 45	6.0	7.0	8.0
M 50	6.4	7.4	8.4
M 55	6.7	7.7	8.7
M 60	6.8	7.8	8.8

Control expected for this work is "Very Good" and the contractor shall deploy weigh batcher if required to attaint the required control Degree of Quality Control Expected under different site conditions:

Degree of Control	Conditions of Productions
Very Good	Fresh cement from single source and regular test, weigh batching of all materials, aggregates supplied in single size, control of water added, frequent supervision, regular workability an strength tests and field laboratory facilities.
Good	Carefully stored cement and periodic tests, weigh batching of all materials, controlled water, graded aggregate supplied, occasional grading and moisture test, periodic check of workability and strength, intermittent supervision an experienced workers.
Fair	Proper storage of cement volume, batching of all aggregate allowing for bulking of sand, weigh batching of cement, water content controlled by inspection of mix and occasional supervision and tests.

Standard Deviation based on Test results:

Number of test results:

The total number of test results required to constitute and acceptable record for calculation of standard deviation shall be not less than 30. Attempts should be made to obtain the 30 test results, as early as possible, when a mix is used for the first time.

Standard deviation to be brought up to date:

The calculation of the standard deviation shall be brought up to date after every change of mix design and at least once a month.

Determination of Standard Deviation:

Concrete of each grade shall be analyzed separately to determine its standard deviation.

The standard deviation of concrete of a given grade shall be calculated using the following formula from the results of individual tests of concrete of that grade obtained as specified for test strength of sample

Estimated standard deviation S = 2/n-1

Where - Deviation of the individual test strength from the average strength of a sample and n - Number of sample test results

When significant changes are made in the production of concrete (for example changes in the materials used, mix design, equipments or technical control), the standard deviation value shall be separately calculated for such batches of concrete.

Proportioning, Consistency, Batching and Mixing of Concrete:

Proportioning:

Aggregate:

The proportions which shall be decided by conducting preliminary tests shall be by weight. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete batching by means of weight batchers conforming to IS 2722, capable of controlling the weights within one percent of the desired value. Except where it can be shown to the satisfaction of the Engineer-in-charge that supply of properly graded aggregate of uniform

quality can be maintained over the period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stacked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible, as determined by the Engineer-in-charge, to ensure maintaining of grading in accordance with samples used in preliminary mix design. The materials shall be stock piled well in advance of use.

Cement:

The cement shall be measured by weight. Every facility should be provided to the Engineer-in-charge for sampling and inspection of stored cement at site of work.

Specific Requirement of Cement for Concrete:

The following minimum cement content, required to ensure durability under specified conditions of exposure as per IS 456-2000, shall be met with, in addition to those already stipulated in the specifications:

Exposure	Example	Plain concrete		Reinforced cement concrete	
		Minimum cement content in Kg/cu.m.	Maximum water cement ratio	Minimum cement content in Kg/cu.m.	Maximum water cement ratio
Mild	Concrete surfaces protected against weather or aggressive conditions, except those situated in coastal area.	220	0.60	300	0.55
Moderate	Concrete surfaces sheltered from severe rain or freezing while wet. Concrete exposed to condensation and rain. Concrete continuously under water. Concrete in contact or buried under non-aggressive soil / ground water. Concrete surface sheltered from saturated salt air in coastal area.	240	0.60	300	0.50
Severe	Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation. Concrete completely immersed in sea water. Concrete exposed to coastal environment.	250	0.50	320	0.45
Very Severe	Concrete surfaces exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet. Concrete in contact with or buried under aggressive sub soil / ground water.	260	0.45	340	0.45
Extreme	Surface of members in tidal zone. Members in direct contact with liquid / solid aggressive chemicals.	280	0.40	360	0.40

Note: The minimum cement content is based on 20mm aggregate. For 40mm aggregate, it should be reduced by 30kg/cum and for 10mm aggregate, it should be increased by 40kg/cu.m.

Water:

Only such quantity of water shall be added to the cement and aggregate in the concrete mix as to ensure dense concrete, specified surface finish, and satisfactory workability, consistent with strength stipulated for each class of concrete. The water added to the mix shall be such as

not to cause segregation of materials or the collection of excessive free water on the surface on the concrete.

Definition of water cement ratio:

The water cement (W/C) ratio is defined as the weight of water in mix (including the surface moisture of the aggregates) divided by the weight of the cement in the mix.

Water cement ratio:

The actual water cement ratio to be adopted shall be determined in each instance by contractor and approved by the Engineer-in-charge.

Proportioning by water-cement ratio:

The W/C ratio specified for use by the Engineer-in-charge shall be maintained. Contractor shall determine the water content of the aggregate as frequently as directed by the Engineer-in-charge as the work progresses and as specified in IS 2386 part III and the amount of mixing water added at the mixer shall be adjusted as directed by the Engineer-in-charge so as to maintain the specified W/C ratio. To allow for the variation in their moisture content, suitable adjustments in the weights of aggregates shall also be made.

Consistency and slump:

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined, the consistency of mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump test, compacting factor tests etc. in accordance with IS 1199, shall be conducted from time to time to ensure the maintenance of such consistency.

The following tabulation gives a range of workability which shall generally be used for various types of construction unless otherwise instructed by the Engineer-in-charge.

Workability of concrete:

Placing Condition	Degree of workability	Value of workability
1	2	3
Concreting of shallow sections with vibration.	Very low	• 20-10 seconds vee-bee time • 0.77-0.80 compacting factor
Concreting of lightly reinforced sections with vibration.	Low	• 10-15 seconds vee-bee time • or 0.80-0.85 compacting factor
Concreting of lightly reinforced sections without vibration, heavily reinforced section with vibration.	Medium	• 5-2 seconds vee-bee time • or 0.85-0.92 compacting factor • or 25-75mm slump for 20mm aggregate.
Concreting of heavily reinforced sections without vibration aggregate.	High	• Above 0.92-compacting factor • or 75-125mm slump for 20mm

Batching and mixing of concrete:

The material and proportions of concrete materials as established by the preliminary tests for the mix design shall be rigidly followed for all concrete on the project and shall not be changed except when specifically permitted by Engineer-in-charge.

Concrete shall be produced only by weigh batching the ingredients. The mixer and weigh batcher shall be maintained in a clean serviceable condition. The accuracy of weigh batches shall be periodically checked. They shall be set up in level on a firm base and the hopper shall be loaded evenly. The needle shall be adjusted to zero when the hopper is empty. Fine and coarse aggregates shall be weighed separately unless otherwise stated. Volume batching will be permitted only at the discretion of the Engineer-in-charge. Concrete shall be of strength stipulated, all concrete shall be mixed in mechanically operated batch mixers complying with IS 1791 and of approved make with suitable provision for correctly controlling the water delivered to the drum. The quantity of water actually entering the drum shall be checked with the reading of the gauge or valve setting, when starting a job. The test should be made while the mixer is running. The volume of the mixed material shall not exceed the manufacturers rated mixer capacity. The batch shall be charged into the mixer so that some water will enter the drum in advance of cement and aggregate. All water shall be in the drum by the end of the firs 15 seconds of the specified mixing time. Each batch shall be mixed until the concrete is uniform in colour, for a minimum period of two minutes after all the materials and water are in the drum. The entire contents of the drum shall be discharged in one operation before the raw materials for the succeeding batches are fed into the drum.

Sampling and Testing Concrete in the field:

Facilities required for sampling materials and concrete in the field, if Engineer-in-charge so desires, shall be provided by contractor at no extra cost. The following equipment with operator shall be made available at Engineers request (all must be in serviceable condition):

1	Cast iron cube moulds 15cm, size	24 nos.(min)
2	Slump cone complete with tamping rod	2 sets
3	Lab. Balance to weigh upto 5kg with sensitivity of 10gm	1 no.
4	Laboratory balance of 2kg. capacity and of sensitivity of 1gm	1 no.
5	I.S. sieves for coarse and fine aggregates	1 set
6	A set of measures from 5ltrs. To 0.4 litr.	Set
7	Electric over with thermostat upto 120^{o}C	1 no.
8	Pycenometer	1 no.
9	Calibrated glass jar 1 litre capacity	2 nos.
10	Glass flasks and metal containers	As required
11	Concrete cube testing machine	1 no

Testing Charges:

Different tests required to be carried out for concrete works including the mix design, cube tested as per the above specifications shall be got done by the con tractor at his own cost in one of the approved laboratories. The choice of laboratory shall rest with Department. All incidental charges / cost shall be borne by the contractor.

Sampling and Strength Test of Concrete:

Samples from fresh concrete shall be taken as per IS 1199-1959 and cubes shall be made, cured and tested at 28 in accordance with IS 516-1959.

In order to get a relatively quicker idea of the quality of concrete, option tests on beams for modulus of rupture at (+) 2 hours or at 7 days or compressive strength tests at 7 days may be carried out in addition to 28 days compressive strength test. For this purpose, the values given in table below may be taken for general guidance in the case of concrete made with ordinary cement. In all cases, the 28 days compressive strength specified shall alone be the criterion for acceptance of rejection of the concrete. If however, from test carried out in particular job over a reasonably long period, it has been established to the satisfaction of the Engineer-in-charge that a suitable ratio between 28 days compressive strength and modulus

rupture t 72 (+) 2 hours or 7 days may accepted the Engineer-in-charge may suitably relax the frequency of 28 days compressive strength, provided the expected strength values at the specified early stage are consistently met.

Optional Tests Requirement of Concrete:

Grade of Concrete	Compressive strength on 15cm cubes min, at 7 days N/mm^2	Modulus of rupture by beam test minimum	
		At 72 (+) 2 hours N/mm^2	At 7 days N/mm^2
M 10	7.0	- 1.2	1.7
M 15	10.0	1.5	2.1
M 20	13.5	1.7	2.4
M 25	17.0	1.9	2.7
M 30	20.0	- 2.1	3.0
M 35	23.5	2.3	3.2
M 40	27.0	2.5	3.4

Frequency of Sampling:

Sampling procedure:

A random sampling procedure shall be adopted to ensure that each concrete batch shall have reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all fixing units.

Frequency:

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

Quantity of concrete In the work (in cum)	Number of samples
1-5	1
6-15	2
16-30	3
31-50	4
51 and above	4 plus one additional for each additional 50 cum. or part thereof

At least one sample shall be taken from each shift.

Test Specimen:

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

Additional cubes may also be required for testing cubes cured by accelerated methods as described in IS 9013-1978. The specimen shall be tested as described in IS 516-1959.

Test Strength of Samples:

The test strength of the samples shall be the average of the strength of three specimens. The individual variation should not be more than (+) 15 percent of the average.

Consistency:

Slump test shall be carried out as demanded by the Engineer-in-charge and invariably from the same batch of concrete from which the test cubes are made. Slump tests shall be done immediately after sampling.

Standard Deviation:

Vide clause 6 of this specification.

Acceptance Criteria:

(16.1) Compressive Strength

The concrete shall be deemed to comply with the strength requirements when both the following condition are met:

a) The mean strength determined from any group of four consecutive test results compiles with the appropriate limits in column 2 of Table 11.
b) Any individual test result complies with the appropriate limits in column 3 of Table 11.

(16.2) Flexural Strength

When both the following conditions are met, the concrete complies with the specified flexural strength.

a) The mean strength determined from any group of four consecutive test results exceeds the specified characteristic strength by atleast 0.3 N/mm^2.
b) The strength determined from any test result is not less than the specified characteristic strength less 0.3 N/mm^2.

(16.3) Quantity of concrete represented by Strength Test Results

The quantity of concrete represented by a group of four consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches.

For the individual test result requirements given in column 2 of Table **(11)** or in item (b) of **(16.2)**, only the particular batch from which the sample was taken shall be at risk.

Where the mean rate of sampling is not specified the maximum quality of concrete that four consecutive test results represent shall be limited to 60m3.

(16.4) If the concrete is deemed not to comply pursuant to **(16.3)**, the structural adequacy of the parts affected shall be investigated (see **17**) and any consequential action as needed shall be taken.

(16.5) Concrete of each grade shall be assessed separately.

(16.6) Concrete is liable to be rejected if it is porous or honey-combed, its placing has been interrupted without providing a proper construction joint, the reinforcement has been displaced beyond the tolerances specified, or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the Engineer-in-charge.

(17) Inspection and Testing of Structures

(17.1) Inspection

To ensure that the construction complies with the design an inspection procedure should be set up covering materials, records, workmanship and construction.

(17.1.1) Tests should be made on reinforcement and the constituent materials of concrete in accordance with the relevant standards. Where applicable, use should be made f suitable quality assurance schemes.

(17.1.2) Care should be taken to see that:

a) design and detail are capable of being executed to a suitable standard, with due allowance for dimensional tolerances;

b) there are clear instructions on inspection standards;

c) there are clear instructions on permissible deviations;

d) elements critical to workmanship, structural performance, durability and appearance are identified; and

e) there is a system to verify that the quality is satisfactory in individual parts of the structure, especially the critical ones.

(17.2) Immediately after stripping the formwork, all concrete shall be carefully inspected and any defective work or small defects either removed or made good before concrete has thoroughly hardened.

(17.3) Testing

In case of doubt regarding the grade of concrete used, either due to poor workmanship or based on results of cube strength tests, compressive strength tests of concrete on the basis of **(17.4)** and / or load test (see **17.6)** may be carried out.

(17.4) Core Test

17.4.1 The points from which cores are to be taken and the number of cores required shall be at the discretion of the Engineer-in-charge and shall be representative of the whole of concrete concerned. In no case, however, shall fewer than three cores be tested.

17.4.2. Cores shall be prepared and tested as described in IS:516.

17.4.3. Concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to atleast 85 percent of the cube strength of the grade of concrete specified for the corresponding age and no individual core has a strength less than 75 percent.

17.5 In case the core test results do not satisfy the requirements of (17.4.3) or where such tests have note been note, load test (17.6) may be resorted to.

17.6 Load Tests for Flexural Member

17.6.1 Load tests should be carried out as soon as possible after expiry of 28 days from the time of placing of concrete.

17.6.2 The structure should be subjected to a load equal to full dead load of the structure plus 1.25 times the imposed load for a period of 24 hours and then the imposed load shall be removed.

Note – Dead load includes self weight of the structural members plus weight of finishes and wall or partitions, if any, as considered in the design.

17.6.3 The deflection due to imposed load only shall be recorded. If within 24h of removal of the imposed load the structure does not recover atleast 75 percent of the deflection under superimposed load, the test may be repeated after a lapse of 72h. If the recover is less than 80 percent, the structure shall be deemed to be unacceptable.

17.6.3.1 If the maximum deflection in mm, shown during 24 h under load is less than 40l2/D, where l is the effective span in m; and D, the overall depth of the section in mm, it is not necessary for the recovery to be measured and the recovery provisions of **17.6.3** shall not apply.

17.7 Members Other Than Flexural Members

Members other than flexural members should be preferably investigated by analysis.

17.8 Non-destructive Test

Non-destructive tests are used to obtain estimation of the properties of concrete in the structure. The methods adopted include ultrasonic pulse velocity [see IS:13311 (Part I)] and rebound hammer [see IS:13311 (Part 2)], probe penetration, pullout and maturity. Non-destructive tests provide alternatives to core tests for estimating the strength of concrete in a structure, or can supplement the data obtained from a limited number of cores. These methods are based on measuring a concrete property that bears some relationship to strength. The accuracy of these methods, in part, is determined by the degree of correlation between strength and the physical quality measured by the non-destructive tests.

Any of these methods may be adopted, in which case the acceptance criteria shall be agreed upon prior to testing.

Specified Grade (1)	Mean of the Group of 4 Non-Overlapping Consecutive Test results in N/mm^2 (2)	Individual Test Results in N/mm^2 (3)
M15	$\geq f_{ck}$ + 0.825 x established standard deviation (rounded off to nearest 0.5 N/mm^2) or f_{ck} + 3 N/mm^2, whichever is greater	$\geq f_{ck}$$^{-3}$ N/mm^2
M20	$\geq f_{ck}$ + 0.825 x established standard deviation (rounded off to nearest 0.5 N/mm^2) or f_{ck} + 4 N/mm^2, whichever is greater	$\geq f_{ck}$$^{-4}$ N/mm^2

Note – In the absence of established value of standard deviation, the values gives in Table 8 may be assumed and attempt should be made to obtain results of 30 samples as early as possible to establish the value of standard deviation.

Admixtures:

General:

Admixture may be used in concrete only with the approval of engineer-in-charge based upon evidence that, with the passage of time neither the compressive strength nor its durability reduced. When admixtures are used, the designed concrete mix shall be corrected accordingly.

Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer-in-charge. rate quoted for concrete should include cost and labour for admixture. No extra payment will be made.

I) Calcium Chloride:

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

II) Air Entraining Agents:

Where specified and approved by Engineer-in-charge, neutralized vinsol resin or any other approved air entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6.260. Air Entraining admixtures for concrete. The recommended total air content of the concrete is 4% (+) 1%. The method of measuring air content shall be as per IS 1199.

III) Retarding Admixtures:

Where specified an approved by Engineer-in-charge, retarding agents shall be added to the concrete mix in quantities specified by Engineer-in-charge.

IV) Water Reducing Admixtures:

Where specified and approved by Engineer-in-charge, water reducing lignosulfonate mixture shall be added in quantities specified by Engineer-in-charge. The admixtures shall be added in the form of a solution.

V) Water Proofing Agents:

Where specified and approved by Engineer-in-charge, chloride and sulphate free water proofing agents shall be added in quantities specified by Engineer-in-charge.

VI) Other Admixtures:

Engineer-in-charge may at his discretion, instruct contractor to use any other admixture in the concrete.

Inspection of Structures:

Immediately after stripping the form work, all concrete shall be carefully inspected and any defective work or small defects, either removed or made good before concrete has thoroughly hardened, as instructed by engineer-in-charge.

In case of doubt regarding the grade of concrete used or results of cube strength are observed to be lower than the designed strength as per specifications at 28 days, compressive strength test of concrete based on core test, ultrasonic test and / or load test shall be carried out by the digital Engineer-in-charge all at the cost of the contractor. In case these tests do not satisfy the requirements, the Department will be at liberty to reject the concrete, and the contractor, at his own cost, has to dismantle and re-do the same or carry out such remedial measures as approved by the Department.

Testing of Structures:

Optional Tests:

Engineer-in-charge, if he so desires, may order for tests to be carried out on cement, sand, coarse aggregate, water etc. in accordance with the relevant Indian Standards.

Tests on Cement will be carried out by Department and shall include (i) Fineness test (ii) test for normal consistency, (iii) test for setting time (iv) test for soundness (v) test for

compressive strength (vi) test for heat of hydration (by experiment and by calculations) in accordance with IS-269.

Tests on sand shall include (i) sieve test (ii) test for organic impurities (iii) decantation test for determining clay and silt content (iv)specific gravity test (v) test for unit weight and bulk age factor (vi) test for sieve analysis and fineness modulus.

Tests on coarse aggregate shall include (i) sieve analysis (ii) specific gravity and unit weight of dry, loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) petrographic examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value.

The test on aggregate would normally be ordered to be carried out only if Engineer-in-charge feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by contractor at an approved test laboratory. Contractor shall have to pay all the charges of optional tests. If the work cubes do not give the stipulated strengths, Engineer-in-charge reserves the right to ask Contractor to dismantle such portions of the work, which in his opinion are unacceptable and re-do the work to the standards stipulated at contractors cost.

The unit rate for concrete shall be all inclusive including making preliminary mix design and test cubes, works cubes, testing them as per specifications, slump tests, optional tests etc. Complete.

However, the Department will test the cubes departmentally. The contractor will have to make arrangements for transportation to the laboratory and testing charges will be borne by the contractor.

The contractor should also conduct conclusive tests such as ultrasonic pulse test, core test etc. to prove the suitability of concrete, in case cube tests give unsatisfactory results. The cost of the conclusive test should be borne by the contractor.

Core test:

The points from which cores are to be taken and the number of cores required, shall be at the discretion of the whole of concrete concerned. In no case, however, shall fewer than three cores be tested. Cores shall be prepared and tested as described in IS 516-1959.

Concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to at least 80% of the cube strength of the grade of concrete specified for the corresponding age and no individual core has strength less than 75%.

In case the core test results do not satisfy the requirements as above or where such tests have not been done, load test (see 4:11:3) may be resorted to.

Load tests on parts of structure:

Load tests should be carried out as soon as possible after expiry of 28 days from the time of placing of concrete.

The structure should be subjected to a load equal to full dead load of the structure plus 1.25 times the imposed load period of 24 hours and then the imposed load shall be removed.

Note: Dead load includes weight of the structural members plus weight of finishes and walls or partitions, if any, as considered in the design.

The deflection due to imposed load only shall be recorded. If within 24 hours of removal of the imposed load, the structure does not recover at least 75% of the deflection under super imposed load, the test may be repeated after a lapse of 72 hours. If the recovery is less than 80% the structure shall be deemed to be unacceptable.

If the maximum deflection in mm shown during 24 hours under load is less than 40L2/D, where L is the effective span and D the overall depth of the section in mm, it is not necessary for recovery to be measured and the recovery provision above will not apply.

Other non-destructive test methods may be adopted, in which case the acceptance criteria shall be agreed upon between the Engineer-in-charge and the Contractor and the test shall be done under expert guidance.

Testing of Underground Water Tank / Septic Tank / Underground structures:

The tank will be tested after the completion according to the procedure laid down here:

The middle compartment shall be filled first to its full height and the leakage if any shall be checked on its outer surfaces if found, the same shall be examined carefully and defects rectified / grouted if necessary. The drop in level exceeds 20mm and shows any leakage in the said walls, necessary steps shall be taken in consultation with the Engineer-in-charge.

After this compartment is tested to the satisfaction of the Engineer-in-charge, all water from middle compartment shall be stepped into side compartment to the full height and checked for water leakages from the outer surfaces of the tank and inner surface of the middle compartment. The drop in level of surface of water shall also be checked as stated and defects rectified.

The external surface of the tank shall be plastered and cured as per the specifications and back filling shall be taken up thereafter. The water from the compartments shall then be pumped out and the inner surface of the tank in all compartments then checked and defects rectified.

After satisfactory completion of checks, internal plaster shall be taken up as specified in the specifications.

The contractor shall be responsible for carrying out the complete test, rectifying the leakages if any. The cost of providing equipments, labour for carrying out tests shall be borne by the contractor. The rates quoted for concreting items for constructing underground water tank shall be inclusive of testing of RCC tank for water tightness as per above specifications. Contractor shall make his own arrangement for filling the tank. The contractor shall make his own arrangement for water required for construction and labour etc. as per contract conditions at his own cost.

Unsatisfactory Tests:

Should the results of any test prove unsatisfactory, or the structure shown signs of weakness, undue deflection or construction, contractor shall remove and rebuild the member or members involved to carry out such other remedial measures as may be required by Engineer-in-charge. Contractor shall bear the cost of so doing, unless the failure of the member or members to fulfill the test conditions is proved to be solely due to faulty design. The cost of load and tests shall be borne by contractor if the tests show unsatisfactory results; otherwise such cost will be borne by the Department.

Concrete in Alkali Soils and Alkaline Water:

Where concrete is liable to attack from alkali salts or alkaline water, special cements containing low amount of tri-calcium shall be used, if so specified on the drawings. Such concrete shall have minimum cement content, for different exposes attached as given in table 19 and 20 in appendix A of IS 456-2000. If specified by Department, additional protection shall be obtained by the use of chemically resistant stone facing or a layer of plaster of Paris covered with suitable fabric, such as jute thoroughly impregnated with tar.

Preparation Prior to Concrete Placement, Final Inspection & Approval:

Before the concrete is actually placed in position, the inside of the form work shall be inspected to see that they have been and oiled. Temporary openings shall be provided to

facilitate inspection, especially at bottom of columns and wall forms, to permit removal of saw dust, wood shavings, binding wire, rubbish, dirt etc. Opening shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/ holes shall be later suitable plugged.

The various traders shall be permitted ample time to install drainage and plumbing lines, floor and trench drain, conduits, hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawing or as necessary for the proper execution of the work. All such embedment shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

Slots, openings, holes pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by the Engineer-in-charge.

Reinforcement and other items to be cast in concrete shall have clear surfaces that will not impair bond.

Prior to concrete placement, all works shall be inspected and approved by Engineer-in-charge, and if found unsatisfactory, concrete shall not be poured until all defects have been corrected at contractors cost.

Approval by Engineer-in-charge of any and all materials and work as required herein shall not relieve contractor form his obligations to produce finished concrete in accordance with the drawings and specifications.

Rain or Wash Water:

No concrete shall be placed in wet weather or on a water covered surface. Any concrete that has been washed by heavy rain shall be entirely removed, if there is any sign of cement and sand having been washed away from the concrete mixture. To guard against damage which may be caused by rain, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted before leaving the work unattended. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid sumps shall be provided.

Bonding Mortar:

Immediately before concrete placement begins, prepared surfaces, except form work, which will come in contact with concrete to be placed, shall be covered with a bonding mortar of same strength of concrete.

Transportation:

All buckets, containers or conveyers used for transporting concrete shall be mortar-tight. All means of conveyance shall be adopted to deliver concrete of the required consistency and plasticity without segregation or loss of slump whatever method of transportation is employed. Chute shall not be used to transport the concrete without the written permission of the Engineer-in-charge and concrete shall
not be re handled before placing.

Re-tempered or Contaminated Concrete:

Concrete must be placed in its final position before it becomes too stiff to work. On no account water shall be added after the initial mixing. Concrete which has become stiff or has been contaminated with foreign materials ad which has not been placed within half an hour of mixing water with cement shall be rejected.

Cleaning of Equipment:

All equipments used for mixing, transporting ad placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipe lines and other equipments shall be thoroughly cleaned after each period of placement.

Procedure for placing of concrete:

1) Engineers approval of Equipment and Methods:

Before any concrete is placed, the entire placing programme, consisting of equipment, layout proposed procedures ad methods shall be submitted to Engineer-in-charge and no concrete shall be of such size ad design to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job ad placement location.

2) Time Interval between Mixing ad Placing :

Concrete shall be placed in final position before the cement reaches its initial set and concrete shall normally be compacted in its final position within thirty minutes o leaving the mixer d once compacted it shall not be disturbed.

3) Avoiding Segregation:

Concrete shall in all the cases be deposited as nearly a practicable directly in its final position ad shall not be re-handled or caused to flow in a manner which will cause segregation, loss of materials displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible, ad in narrow forms, contractor shall provide suitable prop ad Elephant Trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped from height, especially if reinforcement is in the way, particularly in columns and thin walls.

4) Placing by Manual Labour:

Except when otherwise approved by Engineer-in-charge, concrete shall be placed in the shuttering by shovels or other approved implements and shall not be dropped from a height more than 1.0m or handle in a manner which will cause segregation.

5) Placing by Mechanical Equipment:

The following specifications shall apply when placing of concrete by sue of mechanical equipment is specially called for while inviting bids or is warranted, considering the nature of work involved.

The control of placing shall begin at the mixer discharge. Concrete shall be discharged by a vertical drop into the middle of the bucket of hopper and this principle of a vertical discharge of concrete shall be adhered to through out all stages of delivery until the concrete comes to rest in its final position.

Type of buckets:

All concrete shall be conveyed from the mixer to the place of final deposit in suitable buckets, dumpers, containers which shall be leak tight. All means of conveyance shall be adopted for delivering concrete to the required consistency / Workability d plasticity without segregation.

Central bottom dump buckets of a type that provides for positive regulation of the amount and rate deposition of concrete in all dumping position shall be employed.

Operation of Bucket:

In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and then lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1.0m. The bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner which results in separation of ingredients or disturbance of previously placed concrete will not be permitted.

Placement in restricted forms:

Concrete placed in restricted forms by borrows, buggies, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly a practicable in its final position.

Chutting:

Where it is necessary to use transfer chutes, specific approval of Engineer-in-charge must be obtain dot type, length, slopes, baffles, vertical terming of operations. These shall be so arranged that almost continuous flow of concrete is obtained at the discharge ad without segregation. To allow for the loss of mortar against the sides of the chutes, the first mixes shall have less coarse aggregate.

During cleaning of chutes, the waste water shall be kept clear of the forms. The concrete shall not be permitted to fall from the end of the chutes by more than 1.0 m. chutes, when approved for use, shall have slopes not flatter than 1 vertical to 3 horizontal and not steeper than 1 vertical to 2 horizontal, chutes shall be of metal or metal line d of rounded cross section. The slopes of all chute sections shall be approximately same. The discharge end of the chutes shall be maintained above the surfaces of the concrete in the forms.

Placing by Pumping / Pneumatic Placers:

Concrete may be conveyed and placed by mechanically operated equipments e.g. pumps or pneumatic placers, only with the written permission of Engineer-in-charge. The slums shall be held of the minimum, necessary for conveying concrete by this method.

When pumping is adopted, before pumping of concrete is started, the pipelines shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avid blockages ad excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at the end.

Manufacturer's advice shall be followed regarding concrete quality and all other related matters when pumping / pneumatic placing equipments are used.

Concrete in Layers:

Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15cm to 90cm. a directed by Engineer-in-charge. These shall be placed as rapidly as practicable to prevent the formation of cold joints or places of weakness between each succeeding layers within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit, shall spotted progressively along the face of the layer with such overlap a will facilitate spreading the layer to uniform depth and texture with a minimum of shoveling stone into mortar rater than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer-in-charge.

Bedding of layers:

The top surface of each pour ad bedding places shall be approximately horizontal unless other wise instructed.

Compaction:

Concrete shall be compacted during placing, with approved vibrating equipment, until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate ad fits tightly against all form surfaces, reinforcement ad embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of

vibrators shall be consistent with the concrete mix ad caution is to be exercised not to over vibrate the concrete to the point of segregation.

Type of Vibrators:

Vibrator shall conform to IS specifications. Type of vibrators to be used shall depend upon the structure where concrete is to be placed. Shutter vibrators, to be effective, shall be firmly secured to the form work which must be sufficiently rigid to transmit the vibrations strong enough not to be damaged by it. Immersion vibrator shall have No load frequency amplitude and acceleration a as per IS 2505 depending on the size of the vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

Use of Vibrators:

The exact manner application d the most suitable machines for the purpose must be carefully considered ad operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450mm a part ad withdrawn when air bubbles ceases to come to the surface.

Immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of lift, e.g. in a column or wall.

Melding successive batches:

When placing concrete in layers, which are advancing horizontally as the work progress, great care shall be exercised to ensure adequate vibration, blending and melding of the concrete between the successive layers.

Penetration of Vibrations:

The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below the under layer is still plastic to ensure good bond and homogeneity between the two layers ad prevent the formation of cold joints.

Vibrating against reinforcement:

Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set.

They shall also not be allowed to come in contact with forms of finished surfaces.

Use of form attached Vibrators:

Form attached vibrators shall be used only with specific authorization of Engineer-in-charge.

Use of surface vibrators:

The use of surface vibrators will not be permitted under normal conditions. However, for thin slabs, such as highways, runways and similar construction, surface vibrators shall be specifically designed may be permitted, upon approval of Engineer-in-charge.

Stone Pockets and Mortar Pondages:

Formation of stone pockets or mortar pondages in corners and against faces of forms shall not be permitted, should these occur, they shall be dug out, reformed and refilled to a sufficient depth and shape for thorough bounding as directed by Engineer-in-charge.

Placement Interval:

Except when placing with slip forms, each placement of concrete in multiple lift work shall be allowed to set for at least 24 hours after the final set of concrete and before the start of a subsequent placement.

Special provision in placing:

When placing concrete in walls with openings, in floors of integral slab and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls or bottom horizontal surface of the slabs a the case may be. Placing shall be resumed before the concrete in place takes initial set, but not until it has had time to settle as determined by Engineer-in-charge.

Placing Concrete through reinforcing steel:

While placing concrete through reinforcing steel, care shall be taken to prevent segregation of the coarse aggregate. Where the congregation of steel make placing difficult, it may be necessary to temporally move the top steel aside to get proper placement and restore reinforcing steel to design position.

Bleeding:

Bleeding or free water on top of concrete being deposited into the forms shall be caused to stop the concrete pour ad the conditions causing this defect corrected before any further concreting is resumed.

Construction Joints and Keys:

Concrete shall be placed without interruption until completion of the part of the work between predetermined construction joints, as specified therein after. Time lapse between the pouring of adjoining units shall be as specified in the drawing or as directed by Engineer-in-charge.

If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made where the work is stopped. Joints shall be either vertical or horizontal, unless shown otherwise in drawings. In case of an inclined or curved member, the joints shall be at right angles to the axis of the member. Vertical joints in walls shall be kept to a minimum. Vertical joints shall be formed against a stop board, horizontal joints shall be level and wherever possible, arranged, so that the joint lines coincide with the architectural features of the finished work. Battens shall be nailed to the form to ensure a horizontal line ad if directed, shall also be used to form a grooved joint. For tank walls, similar work joints shall be formed as per IS 3370. Concrete that is in the process of setting shall not be disturbed or shaken by traffic either on the concrete itself or upon the shuttering, horizontal and vertical construction joints and shear keys shall be located ad shall conform in detail to the requirements of the plans unless otherwise directed by Engineer-in-charge. Where not described, the joints shall be in accordance with the following:

Column Joints:

In a column, the joint shall be formed 75mm below the lowest soffit of the beams including haunches f any. In flat slab construction the joint shall be 75mm below the soffit of column capital. At least 2 hours shall elapse after depositing concrete in column, piers or walls, before depositing in beams, girders or slabs supported thereon.

Beam and Slab joints:

Concrete in a beam shall be placed through out without a joint but if the provision of a joint is unavoidable, the joint shall be vertical ad at the center or within the middle third of the span unless otherwise shown in drawings. Where a beam intersects a girder, the joints in the girder shall be offset a distance equal to twice the width of the beam and additional reinforcement provided for shear. The joints shall be vertical throughout the full thickness of the

concrete member. A joint in a slab shall be vertical and parallel to the principal reinforcement where it is unavoidable at right angels to the principle reinforcement, the joint shall be vertical and at the middle of span.

Joints in Liquid Retaining Structures:

Vertical construction joints in watertight construction will not be permitted unless indicated on the drawings. Where a horizontal construction joint is required to resist water pressure, special care shall be taken in all phases of its construction to ensure maximum water tightness.

Dowels:

Dowels for concrete work, not likely to be taken up in the near future, shall be wrapped in tar paper and burlap.

Mass Foundations:

Mass foundations shall be poured in lifts not exceeding 1.5m in height unless, otherwise indicated on the drawings and approved by Engineer-in-charge.

Treatment of construction joints on resuming Concreting:

Drier shall be used for the top lift or horizontal pours to avoid a laitance. All laitance d loose stones shall be thoroughly and carefully removed by wire brushing / hacking ad surface washed.

Just before concreting is resumed, the roughened joint surface shall be thoroughly cleaned and loose matter removed and then treated with a thin layer of cement grout of proportion specified by Engineer-in-charge ad worked well into the surface. The new concrete shall be well worked specially against the prepared face before the grout mortar sets. Special care shall be taken to obtain thorough compaction ad to avoid segregation of the concrete along the joint plane.

Curing, Protecting, Repairing ad Finishing:

Curing:

All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water, continuously saturated covering of sacking, canvas, hessain or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold ad hot weather as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

Curing with Water:

Fresh concrete shall be kept continuously wet for a minimum period of 14 days from the date of placing of concrete, following a lapse of 12to 24 hours after lying concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened.

Water shall be applied to unformed concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms.

Continuous Spraying:

Curing shall be assured by use of an ample water supply under pressure in pipes, with all necessary appliances of hose sprinklers a spraying device. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by Engineer-in-charge.

Alternate curing Methods:

Whenever in the judgment of Engineer-in-charge, it may be necessary to omit the continuous spray method, covering of clear sand or other approved means such as wet gunny bags, which will prevent loss of moisture from the concrete, during of after the curing period, will not be permitted.

Conversing shall be kept continuously wet during the curing period.

For curing of curing of concrete in pavements, side-walks, floors, flat roofs or other level surfaces, the ponding method of cutting is preferred. The method of containing the ponded water shall be approved by Engineer-in-charge. Special attention shall be given to edges and corners of the slab to ensure proper protection to these areas. The ponded areas shall be continuously filled with water during the curing period.

Curing Compounds:

Surface coating type curing compound shall be used only on special permission of Engineer-in-charge.

Curing compounds shall be liquid type while pigmented, conforming to U.S. Bureau of Reclamation specification. No curing compound shall be used on surface where future blending with concrete, water or acid proof membrane or painting is specified.

Curing Equipment:

All equipments and materials required for curing shall be on hand ad ready for use before concrete is placed.

Protecting Fresh Concrete:

Fresh concrete shall be protected from the elements, from defacement sad damage due to construction operations by leaving forms in place for ample period as specified later in this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer-in-charge, shall also be taken to protect immature concrete from damage by debris, excessive loading, vibrations, abrasion or contact with other materials etc. that may be warned against and prevented from disturbing green concrete during its setting period, if it is necessary may be warned against and prevented form disturbing green concrete during its setting period, if it is necessary that workmen enter the area of freshly placed concrete, Engineer-in-charge may require that bridges be placed over the area.

Repair and Replacement of unsatisfactory Concrete:

Immediately after the shuttering is removed, the surface of concrete shall be carefully gone over and all defective areas called to the attention of Engineer-in-charge who may permit patching of the defective areas or else reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to the Department. Holes left by form bolts etc. shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing through 2.36mm IS sieve after removing any loose stones adhering to the concrete Mortar filling shall be struck off flush at the face of the concrete. Concrete surface shall be finished as described under the particular item of work.

Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer-in-charge and superficial water ad air holes shall be filled in. The mortar shall be well worked into the surface with wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer-in-charge, the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal for shuttering to remove fine or other irregularities, care being taken to avoid damaging the surfaces. Surface irregularities shall be removed by grinding.

If reinforcement is exposes or the honey combing occurs at vulnerable position e.g. ends of beams or columns, it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer-in-charge shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25mm), the edges being cut perpendicular to the affected surface or with a small under cut if possible, anchors, tees or dowels shall be provided in slots whenever necessary to attach the newly concrete securely in place.

An area extending several centimeters beyond the edges ad the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

Use of Epoxy:

The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer-in-charge. Epoxies shall be applied in strict accordance with the instruction of the manufacturer.

Method of repair:

Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form holts, grout insert holes and slots cut for repair of cracks shall be repaired as follows:

The hole to be patched shall be roughened ad thoroughly soaked with clean water until absorption stops.

A 5mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched followed immediately by the patching concrete which shall be well consolidated with a wooden float and left slightly proud of the surrounding surface. The concrete patch shall be built up in 10mm thick layers. After an hour more, depending upon weather conditions, it shall be worked off flush with a wooden float d a smooth finish obtained by wiping with hessian. Steel trowel shall not be used for this purpose. The mix for patching shall be of the same materials and in the same proportions as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary ad the mix shall be kept as dry as possible.

Mortar filling by air pressure (guniting) shall be used for repair of areas to large ad / or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour ad texture of the surrounding concrete. White cement shall be substituted for ordinary cement, if so directed by Engineer-in-charge, to match the shade of the patch with the original concrete.

Curing of Patched Work:

The patched area shall be covered immediately with an approved non-staining water saturated material such s gunny bags, which shall be kept continuously wet ad protected against sun ad wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by a fine spray of sprinkling water for not less than 10 days.

Approval by Engineer-in-charge:

All materials, producers and operations used in the repair of concrete a also the finished repair work shall be subject tot eh approval of Engineer-in-charge. All fillings shall tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured ad dried.

Finishing:

This specification is intended to cover the treatment of concrete surfaces of all structures.

Finish for Formed surfaces:

The type of finish for formed concrete surfaces shall be as follows, unless otherwise specified by the Engineer-in-charge.

For surface below grade, which will receive waterproofing treatment, the concrete shall be free of surface irregularities which would interfere with proper application of the water proofing materials which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repair of damaged or defective concrete, removal of fins and abrupt irregularities, filling of hole left by form ties and rods ad clean up of loose or adhering debris.

Surfaces which will be exposed to the weather ad which would normally be leveled shall be sloped for drainage. Unless the drawing specify a horizontal surface or shows the slope required, the tops of narrow surfaces such as staircase treads, walls, curbs ad parapets shall be sloped across the width approx. as 1 in 30, Broader surface such as walkways, roads, parking areas ad platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete, sub floors to be covered with concrete topping, terrazzo or quarry tile ad similar surfaces shall be smooth, screened ad leveled to produce even surfaces. Surface irregularities shall not exceed 6mm. Surfaces which will not be covered by backfill, concrete or tile topping such a outside decks, floors of galleried ad sumps, parapets, gutters, side walks, floors and slabs shall be consolidated, screened d floated.

Excess water and laitance shall be removed before final finishing. Floating may be done with hand with hand or power tools ad started a soon as the screeded surface has attained a stiffness to permit finishing operations ad these shall be the minimum required to produce a surface uniform in texture ad free from screed marks or other imperfections. Joints ad edges shall be tooled as called for on the drawings or as faceted by Engineer-in-charge.

Standard Finish for Exposed Concrete:

Exposed concrete shall mea any concrete other than floors or slabs exposed to view upon completion of the job. Unless other wise specified on the drawings, the standard finish for exposed concrete shall be of smooth finish.

A smooth finish shall be obtained with use of lined or plywood form having smoothed and even surfaces and edges. Panels and form linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms, the joint marks shall be smoothed off and all blemished, projections etc. removed, leaving the surfaces reasonably smooth ad unmarred.

Integral Cement concrete Finish:

When specified on the drawings, an integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded, as specified in the drawings ad as per IS 2571. The surface shall be compacted and then floated with a wooden float or power floating machine. The surface shall be tested with a straight edge a any high and low spots eliminated.

Floating or trowelling of the finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

Rubbed Finish:

A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings.

Upon removal of forms, all fins a do there projections on the surfaces shall be carefully removed, off sets leveled and voids ad/ or damaged sections immediately saturated with water ad repaired by filling with water and repaired by filling with concrete or mortar of the same composition as was used in the surfaces. The surfaces shall then be thoroughly wetted and rubbed with carborandum or other abrasive. Cement mortar may be used in the rubbing, but the finished surfaces shall not be brush coated with either cement or grout after rubbing. The finished surfaces shall present a uniform a smooth appearance.

Protection:

All concrete shall be protected against damage until final acceptance by Engineer-in-charge.

Foundation Bedding, Bonding and Jointing:

All surfaces upon or against which concrete will be placed shall be suitably prepared by thoroughly cleaning, washing and dewatering a may be indicated in the plans or as Engineer-in-charge may direct to meet the various situations encountered in the work.

Soft or spongy areas shall be cleaned out and back filled with either a soil cement mixture, lean concrete or clan sand fill compacted to minimum density of 90%. Modified proctor, unless otherwise mentioned in schedule of quantities. Prior to construction of form work for any item where soil will not act as bottom form, approval shall be obtained from Engineer-in-charge as to the suitability of the soil.

Preparation Rock Strata of Foundations:

To provide tight bond with rock foundations, the rock surface shall be prepared ad the following general requirements shall be observed.

Concrete shall not be deposited on large sloping rock surface shall be prepared and the following general requirements shall be observed.

Concrete shall not be deposited on large sloping rock surface. Where required by Engineer-in-charge or as indicated on the plans, the rock shall be cut to form rough steps or benches to provide roughness or a more suitable bearing surface.

Rock foundation stratum shall be prepared by picking, barring, wedging and similar methods which will leave the rock in an entirely sound ad unshattered condition.

Shortly before concrete is placed, the rock surface shall be cleaned with high pressure water ad air jet even though it may have been previously cleaned in that manner.

Prior to placing concrete, the rock surface shall be kept wet for a period for 2 to 4 hours unless otherwise directed by the Engineer-in-charge.

Before placing concrete on rock surfaces, all water shall be removed from expressions to permit through inspection and proper bonding of the concrete to the rock.

Preparation of Earth Strata of Foundations:

All earth surfaces, upon which additional concrete is to be placed later, shall preferably be done by scarifying ad cleaning while the concrete is between its initial ad final set. This method shall be used wherever practicable and shall consist of cutting the surface with picks ad stiff brooms and by use of an approved combination of air and water jet as directed by Engineer-in-charge. Great care shall be taken in performing this work to avoid removal of too much mortar ad the weakening of the surface by loosening of aggregate. When it is not practicable to follow the above method, it will be necessary to employ air tools to remove laitance ad roughen the surface.

The final required result shall be pitted surface from which all dirt, unsound concrete, laitance ad glazed mortar have been removed.

Bonding Treatment Mortar:

After rock or concrete surfaces upon which new concrete is to be placed have been scarified, cleaned ad wetted specified herein, it shall receive a bonding treatment, immediately before placement of the concrete.

The bonding medium shall be a coat of cement sand mortar. The mortar shall have the same cement-sand proportion the concrete which shall be placed on it. The water cement ratio shall be determined by placing conditions ad approved by Engineer-in-charge.

Bonding mortar shall be placed in sufficient quantity to completely cover the surface about 10mm thick for rock surface and about 5mm thick for concrete surfaces. It shall be brushed or broomed over the surface and worked thoroughly into all cracks, crevices and depressions. Accumulations or puddles of mortar shall not be allowed to settle in depressions ad shall be brushed out a satisfactory degree as determined by Engineer-in-charge.

Mortar shall be placed at such a rate that it can be brushed over the surface just in advance of placement of concrete. Only as much area shall be covered with mortar as can be covered with concrete before initial set in the mortar takes place. The amount of mortar that will be permitted to be placed at any one time, or the area which is to cover, shall be in accordance with Engineer-in-charge.

Cleaning and Bonding of formed Construction Joints:

Vertical construction joints shall be cleaned as specified above or by other methods approved by Engineer-in-charge in placing concrete against formed construction joints, the surfaces of the joints, where accessible, shall be coated thoroughly in the specified bed-joint bonding mortar immediately before they are covered with concrete or by scrubbing with wire brooms, dipped in to the fresh converter. Where it is impracticable to apply such a mortar coating, special precautions will be taken to ensure that the new concrete is brought into intimate contact with the surface of the joint by carefully paddling ad spading with aid of vibrators and suitable tools.

Expansion ad Contraction:

Provision shall be made for expansion a contraction in concrete by use of special type joints located as shown in the drawings. Construction joint surfaces shall be treated as specified in the specification, shown in te drawings a directed by Engineer-in-charge.

Hot Weather Requirements:

All concrete work performed in hot weather shall be in accordance with IS 56, except as herein modified. Admixtures may be used only when approved by Engineer-in-charge. Adequate provision shall be made to lower concrete temperatures by cool ingredients, eliminating excessive mixing, preventing exposure of mixers and conveyors to direct sunlight ad the sue for reflective paint, on mixers etc. The temperature of the freshly placed concrete shall not be permitted to exceed $300^{o}C$.

Consideration shall be given to shading aggregate stock piles from direct rays of the sun and spraying stock piles in water, use of cold water available and burying, insulation, shading d / or painting white the pipe line sand water storage tanks ad conveyances.

In order to reduce loss of mixing water, the aggregates, wooden forms, sub grade, adjacent concrete ad other moisture absorbing surfaces, shall be well wetted prior to concreting, placement ad finishing shall be done as quickly as possible.

Extra precautions shall be taken for the protection and curing of concrete. Consideration shall be given to continuous water curing and protection against high temperature and drying hot wind for a period of at least 7 days immediately after concrete has set and after which normal curing procedures may be resumed.

Placing concrete under Water:

Under al ordinary conditions all foundations shall be completely dewatered ad concrete placed in the dry. However, when concrete placement under water is necessary, all work shall conform to IS 456 and procedure shall be as follows:

Method of placement:

Concrete shall be deposited under water by means of tremise or drop bottom buckets of approved type.

Direction, Inspection and Approval:

All work requiring placement of concrete underwater shall be designed, directed ad inspected with regard to the local circumstances ad purposes. All under water concrete shall be placed according to the plans or specifications ad as directed and approved by Engineer-in-charge.

4.31 Pre cast Concrete and Pre cast Reinforced concrete:

Pre cast concrete & pre cast reinforced concrete shall comply with IS 456 and with the following requirements:

General requirements:

Pre cast reinforced concrete units such as columns, fencing posts, door window frames, lintels, chajjas, copings, stills, shelves, slabs, louvers etc. shall be of grade of mix as specified and cast in forms or moulds. The forms/moulds shall be of fiber glass or of steel sections for better finish. Provision shall be made in the forms and mould store accommodate fixing devices such as nibs, clips, hooks, bolts and forming of notches and holes, Pre cast concrete shall be cast on suitable bed or platform with firm foundation ad free from wind. The contractor may pre cast the units on a cement or steel platform which shall be adequately oiled provided the surface finish is of the same standard as obtained in the forms. Each unit shall be cat in one operation.

Contractor shall be responsible for the accuracy of the level or shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.

Concrete used for pre casting the units should be well proportioned, mixed, placed ad thoroughly compacted by vibrations or tamping to give a dense concrete free from voids ad hone combing.

Pre cast articles shall have a dense surface finish showing no coarse aggregate and shall have no cracks or crevices likely to assist in disintegration of concrete or rusting of steel or other defects that would interfere with the proper placing of the units. All angles of the pre cast units with the exception of the angles resulting from the splayed or chamfered faces shall be true right angles. The areas shall be clean and sharp except those specified or shown to be rounded. The wearing surface shall be true tot eh lines. On being fractured, the interior of the units should present a clean homogenous appearance.

The longitudinal reinforcement shall have a minimum cover of 12mm or twice the diameter of the main bar whichever is more, unless otherwise directed in respect of all items except fencing posts or electric posts where the minimum cover shall be 25mm.

Curing:

After having been cast in the mould or form the concrete shall be adequately protected during setting in the first stages of hardening from shocks ad from harmful effects of frost, sub shine, drying windows d cold. The concrete shall be cured at least for 7 days from the date of casting.

The pre cast articles shall be matured for 28 days before erection or being built in so that the concrete shall have sufficient strength to prevent damage built when first handled. Side shutters shall not be struck in less than 24 hours after depositing concrete ad no pre cast unit shall be lifted until the concrete reaches strength of at least twice the stress to which the concrete may be subjected at the time of lifting.

Marking:

Pre cast units shall be clearly marked to indicate the top of member and its location and orientation in the structure.

Pre cast units shall be stored, transported and placed in position in such a manner that they will not be overstressed or damaged. The lifting and removal of pre cast units shall be undertaken without causing shocks, vibration or under bending stress or in the units. Before lifting and removal takes place, contractor shall satisfy Engineer-in-charge or his representative that the methods he proposes to adopt for these operations will not overstress or otherwise affect seriously the strength of the pre cast unit. The reinforced side of the units shall be distinctly marked.

Pre cast Cement Concrete Jali:

The jail shall be of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 5mm nominal size) reinforced with suitable mild steel wire/rod unless otherwise specified.

Fixing:

The Jali shall be set in position true to plumb and level before the joints, sills and soffits of the openings are plastered. It shall then be properly grouted with cement mortar 1:3 (1cement : 3 coarse sand) and rechecked for levels. Finally the jambs, sills and soffits shall be plastered embedding the jail uniformly on all sides by connector pins no all sides.

Measurements:

The Jali shall be measured for its gross superficial area. The length and breadth shall be measured correct to a cm. The thickness shall not be less than that specified.

Rate:

The rate shall be inclusive of materials ad labour involved in all the operations described above except plastering of jambs, still ad sofits, which will be paid for under relevant item of plastering.

Curing:

All pre cast work shall be protected from the direct rays of the sun for at least 7 days after casting ad during that period each units shall be kept constantly watered or preferably by completely immersed in water if the size of unit so permits. Otherwise curing practice as given in clauses stated earlier shall be followed.

Slots, Opening etc.

Slots, opening or holes pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by the Engineer-in-charge. Any deviation from the approved drawings shall be made good by contractor at his own expenses without damaging any other work. Sleeves, bolts, inserts etc. shall also be provided in concrete work where so specified.

Grouting:

Standard Grout:

Grout shall be provided as specified in the drawings:

The proportions of grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage. The grout proportions shall be limited as follows:

Use	Grout Thickness	Mix. Proportions	W/C Ratio (Max.)
a. Fluid Mix	Under 25mm	One part Portland cement of one part sand	0.44
b. General	25mm and over but less than 50mm	One part Portland cement of two part sand	0.53
c. Stiff mix	50mm and over	One part Portland cement of three part sand	0.53

Sand shall be such as to produce a flowable grout without any tendency to segregate. Sand, for general grouting purposes, shall be graded within the following limits:

Passing I.S. sieve 2.36mm	-	95 to 100%
Passing I.S. sieve 1.18mm	-	65 to 95%
Passing I.S. sieve 300 micron above	-	10 to 30%
Passing I.S. Sieve 150 micron above	-	3 to 10%

Sand for fluid grouts shall have the fine material passing the 300 and 150 micron sieves at the upper limits specified above.

Sand for stiff grouts, shall meet the usual grading specifications and concrete surface to be grouted shall be thoroughly roughened and cleaned of all foreign matter and laitance.

Anchor bolts, anchor bolt hole and bottom of equipment and column base plates shall be cleaned of all oil, grease, dirt d loose material. The use of hot, strong, caustic solution for this purpose will be permitted.

Prior to grouting, the hardened concrete surfaces to be grouted shall be saturated with water.

Water in anchor bolts holes shall be removed before grouting is started.

Forms around base plates shall be reasonably tightened to prevent leakage of the grout.

Adequate clearance shall be provided between forms and base plate to permit grout to be worked properly into place.

Grouting once started shall be done quickly and continuously to prevent segregation, bleeding and breakdown of initial set. Grout shall be worked from one side of one end to the other to prevent entrapment of air. To distribute the grout ad to ensure more release from entrapped air, link chains can be used to work the grout into place.

Grouting through holes in base plate shall be by pressure grouting.

Variations in grout mixes ad procedures shall be permitted if approved by the Engineer-in-charge.

Special Grout:

Special grout where specified on the drawing shall be provided in strict accordance with the manufacturers instructions / specifications on the drawings.

Inspection:

All materials, workmanship and finished construction shall be subject to the continuous inspection ad approval of Engineer-in-charge.

All rejected materials supplied by contractor and all rejected work or construction performed by contractor, as is not in conformance with the specifications ad drawings, shall immediately be replaced at no additional expense to the Department.

Approval of any preliminary material or phase of work shall in no way relieve the contractor from the responsibility of supplying concrete and/ or producing finished concrete in accordance with the specifications and drawings.

All concrete shall be protected against damage until final acceptance by the Department or its representatives.

Clean up:

Upon the completion of concrete work, all forms, equipments, construction tools, protective coverings ad may debris resulting from the work shall be removed from the premises.

All debris, i.e. empty containers, scrap wood etc. shall be removed dump daily or as directed by the Engineer-in-charge.

The finished concrete surfaces shall be left in a clean condition tot eh satisfaction for the Engineer-in-charge.

Plain Cement Concrete for General Work:

For plain cement concrete work, the specification for materials viz., cement, sand, fine and coarse aggregates and water shall be the same as that specified in reinforced concrete work specification. But the proportion of mix will be nominal ad the ratio of fine and coarse aggregate may be slightly adjusted within limits, keeping the total value of aggregates to a given volumes of cement constant to suit the sieve analysis of both the aggregates. Cement shall on no account be measured by volume, but it shall always be used directly from the bags (i.e. 50kg/ bag). The proportion of cement, sand, aggregate and water for concrete of proportion 1:5:10,1:4:8, 1:3:6 & 1:2:4 by volume shall generally consist of quantities as given below :

Proportion of Ingredients	Quantity of material used per bag of cement				
	Cement	Fine aggregate (Sand)	Coarse aggregate	Total of fine and coarse aggregates	Water
1:5:10	1	170 litres	340 litres	800 kgs	60 litres
1:4:8	1	130 litres	272 litres	625kgs	54 litres
1:3:6	1	102 litres	204 litres	480 kgs	31 litres
1:2:4	1	68 litres	136 litres	350 kgs	32 litres

The quantity of water used shall be such as to produce concrete of consistency required by the particular class of work and shall be decided by the use of a slump cone. Sufficient care should be taken to see that no excess quantity of water is used. The final proportion of the aggregate and quantity of water shall be decided by the Engineer-in-charge on the basis of test in each case.

The slump shall be specified for each class of work and shall be general be as follows:

Type of Concrete	Max. slump (in mm)
Mass concrete	50
Concrete below water proofing treatment	50
Coping	25
Floor paving	50

All plain concrete should be preferably mixed in a drum type powder driven machine with a loading hopper which will permit the accurate measure of various ingredients. If hand mixing is authorized, it should be done on a water right platform.

The mixing of each batch in the concrete mixer shall continue for not less than 1.5 minutes after the materials and water are in the mixer. The volume is mixed materials per batch shall not exceed the manufacturers rated capacity of the mixer. The mixer shall rotate at a peripheral speed of about 60 metres per minute.

Concrete shall be poured and consolidated in its final position within half an hour of mixing. The re-tempering of concrete which has partially hardened, that is remixing with or without additional cement aggregate or water shall not be permitted. Concrete of mix 1:3:6 and 1:2:4 will be required to be vibrated if specified ad directed by the Engineer. In case of the thickness of concrete is more than 150mm, it may be vibrated as directed by the Engineer.

The concrete shall be cured for 10 days in ordinary weather ad 15 days in hot weather.

Measurements for the work done shall be exact length, breadth ad depth shown in figures on the drawings or as directed by the Engineer ad after the concrete is consolidated. NO extra shall be paid for excess quantity resulting from faulty workmanship.

Specific Requirements for concrete ad allied works:

The following specific requirements shall be met within addition to those provided in the clause of specification for concrete ad allied works:

General:

If so specified in Schedule 'A' for the work, the Department shall supply with specification for "Concrete and Allied works" and the contractor shall be solely responsible for supplying mixed concrete in accordance with the specification for concrete and allied works ad also this specification. The rates for the reinforced concrete work shall be based on the issue rates of cement ad steel as given in the schedule "A".

Water:

Clean water in pipes under pressure shall be provided by the contractor with all necessary equipment for giving a nozzle pressure of not less than 2.0 kg/ sq.cm for the convenient ad effective jetting of rock foundations ad concrete surfaces, for cooling aggregate required for concrete, for curing concrete ad other requirements.

Fire protection System:

The contractor shall provide ad maintain at all times in adequate fire protection system to protect his equipment, material ad construction. In case of an emergency, the contractor shall permit the Engineer-in-charge to use the system for protecting equipment, works etc. on the project.

Concrete:

The rates for all concrete work should be based as per specifications ad taking into consideration the guidelines indicated in special instruction under relevant clause.

The placement Intervals:

Each placement of concrete shall be allowed to set for a period of 48 hours and longer when required before the start of subsequent placement. A time gap between the two adjoining pours in the horizontal plane and the two adjacent pours in the vertical plan shall be 7 days ad 3 days respectively.

Finishing of Concrete:

General:

Unless otherwise specified, concrete finishes shall confirm to the following specification:

Finish F1, F2 and F3 shall describe formed surface.

Finish U1, U2 and U3 shall describe un-formed surface.

Off sets or fins caused by disposed or misplaced form sheathing lining or form sections or by defective form lumber shall be referred to as abrupt irregularities. All other irregularities shall be referred to as gradual irregularities. Gradual irregularities shall be measured as

deviation from a place surface with a template 1.5 m long for formed surface and 3 m long for unformed surfaces.

Formed surfaces:

Finish F1:

Shall apply to all formed surfaces for which finish F2,F3 or any other special finish is not specified and shall include filling up all form tie holes.

Finish F2:

Shall apply to all formed surfaces so shown on the drawings or specified by the Engineer-in-charge. This shall include filling all form tie-holes, repair of gradual irregularities exceeding 6mm, removal of ridges ad abrupt irregularities by grinding.

Finish F3:

Shall apply to all formed surfaces exposed to view or where shown in the drawing or specified by the Engineer-in-charge. Finish F3- shall include all measures specified for finish F2 ad in addition, filling air holes with mortar ad treatment of the entire surface with sack rubbed finish. It shall also include clean up of loose d adhering debris. Where a sack rubbed finish is specified, the surfaces shall be prepared within two days after removal of the forms.

The surface shall be wetted ad allowed to dry slightly before mortar is applied by sack rubbing. The mortar used shall consist of one part cement to one ad half parts by volume of fine (minus n0.16 mesh) sand. Only sufficient mixing water to given the mortar's workable consistency shall be used. The mortar shall then be rubbed over the surface with a fine burlap or linen cloth so as to fill all the surface voids. The mortar rubbed in the voids shall be allowed to stiffen and solidify after which the whole surface shall be wiped clean so that the surface presents a uniform appearance without air hole, irregularities etc.

Curing of the surface shall be continued for a period of 10 (ten) days.

Unformed Surfaces:

Finish U 1:

Shall apply to all unformed surfaces for which the finish U2, U3 or any other special finish is not specified and shall include screeding the surface for the concrete to the required slope and grade. Unless the drawing specified a horizontal surface or shown the slope required, the tops of narrow surfaces such as stair, treads, walls, curbs, and parapets shall be sloped approximately 10mm per 300mm width. Surfaces to be covered by backfill or concert sub-floors to be covered with concrete topping, terrazzo ad similar surfaces shall be smooth screened and leveled to produce even surface, irregularities not exceeding.

Finish U2:

Shall apply to all unformed surfaces as shown in the drawing or specified by the Engineer-in-charge and shall include screeding ad applying a wood float finish to the surface of the concrete to the required slopes and grade.

Repair of abrupt irregularities unless a roughened texture is specified. Repair of fradual irregularities exceeding 6mm.

Finish U3:

Shall apply to unformed surfaces for which a high degree of surface smoothness is required, where shown on the drawing or specified by the Engineer-in-charge. This shall

include screeding, floating and applying a steel trowel finish to the surface of the concrete tot eh required slopes ad grade.

Repair of abrupt irregularities.

Repair of gradual irregularities exceeding 6mm, finishing joints and edges of concrete with edging tools.

Mode of Measurement for concrete work:

General:

Concrete as actually done shall be measured for payment, subject to the following tolerances, unless otherwise stated hereinafter. Any work done extra over the specified dimensions shall not be measured for payment.

a. Linear dimensions shall be measured in full centimeters except for the thickness of slab which shall be measured tot eh nearest half centimeter.
b. Areas shall be worked out to the nearest 0.01 sqm.
c. Cubic contents shall be worked out the nearest 0.001 cum.
d. The concrete shall be measured for its length, breadth and height/depth limiting dimensions to those specified on drawings or as directed by the Engineer-in-charge.

Note: The sizes of RCC members as assumed in to estimate are based on preliminary drawings and are likely to be changed. The contractor is not entitled to any extra claim due to such changes.

Deductions:

No deduction shall be made for the following:

a. Ends of dissimilar materials e.g. joists, beams, posts, girders, rafters, purlins, trusses, corbels, steps etc. up to 500 sq.cm in cross section.
b. Opening up to 0.1 sqm. (1000 sq.cm).
c. Volume occupied by reinforcement.
d. Volume occupied by pipes, conduits, sheathing etc. not exceeding 25sq.cm. each in cross sectional area. Nothing extra shall be paid for leaving ad finishing such cavities and holes.

Column Footing:

R.C.C. in foundation and footings shall be measured for its length, breadth and depths limiting dimensions to those specified in drawing or as ordered in writing by the Engineer-in-charge. In case of tapering portions of column footings, the quantities shall be calculated by Prismoidal Formula.

Column:

Column shall be measured from top footings to the plinth level and from plinth level to the structural slab level ad to the subsequent structural slab levels. Measurements for

higher grade concrete in column at its junction with lower grade concrete beams shall be restricted tot eh column section supporting the beam in question.

Wall:

All walls shall be measured from top of the wall footing to the plinth level ad from plinth level to the top of structural first floor and to subsequent floors.

Beam and Lintel:

Beam shall be measured from face to face of the columns, walls, cross beams including haunches if any. The depth of the beams shall be measured from the top of the slab tot eh bottom of the beam except in the case of inverted beam where it shall be measured from top of slab to top beams. The beams and lintels with narrow width even though acting as facia in elevation in some cases will be measured as beams and lintels only.

I) Slab:

The length and breadth of slab laid to correct thickness as shown in the detailed drawing for as ordered by the Engineer-in-charge shall be measured between beams, walls ad columns.

II) Chajjas, Facias, Fins ad Mullions:

a. Chajjas shall be measured net from supporting faces upto the edges of chajjas without any facia.
b. Facia shall be measured full excluding chajja thickness.
c. End fins shall be measured full.
d. Intermediate fins, mullions shall be measured between chajjs or other supporting structural members.
e. Parapets shall be measured from top of slab / chajja.

III Staircase:

The concrete in all members of staircase like waist slabs, steps, cantilever steps, stringer beams etc. shall be measured for their length, breadth ad depth, limiting dimensions to those specified on drawings. No deductions shall be made for embedded plugs, pockets.

Rates:

The rate for PCC / RCC shall include the cost of all materials, labour, transport, tools ad plants and all the operations mentioned hitherto, including or excluding the cost of form work and / or reinforcement as mention din the schedule for quantities. The rates also shall include the cost of testing material, mix design; cube test ad allied incidental expenses.

The reinforcement steel used in the works shall be measured and paid for separately under relevant item.

7. FORM WORK

General:

The form work shall consist of shores, bracings, sides of beams and columns, bottom of slabs etc, including ties, anchors, hangers, inserts etc. complete which shall be properly designed and planned for the work. The false work shall be so constructed that up and down vertical adjustment can be made smoothly. Wedges may be used at the top or bottom of timber shores, but not at both ends, to facilitate vertical adjustment and dismantling of form work.

Design of Form Work

The design and engineering of form work as well as its construction shall be the responsibility of Contractor. The drawings and calculations for the design of the form work shall be submitted well in advance to the Engineer-in-charge for approval before proceeding with work, at no extra cost to the Department. Engineer-in-charge's approval shall not however, relieve Contractor of the full responsibility for the design and construction for the form work. The design shall take into account all the loads vertical as well as lateral that the forms will be carrying including live and vibration loadings.

Tolerances:

Tolerances are specified permissible variation from lines, grade or dimensions given in drawings. No tolerances specified for horizontal or vertical buildings lines or footings. Unless otherwise specified, the following tolerances will be permitted.

Tolerances for R.C. Buildings:

I) Variation from the plumb:

a) In the line ad surfaces of columns, piers, walls and in buttresses: 5 mm per 2.5m, but not more than 25 mm.

b) For exposed corner columns ad other conspicuous lines
In any bay or 5 m, maximum : (+) 5 mm
In 10 m or more: (+) 10mm

ii) Variation from the level or from the grades indicated on the drawings.
   a) In slab soffits, ceilings, beam soffits and in arises.
   b) In 2.5m (+) 5mm
      In any bay or 5m maximum (+) 8 mm
      In 10 or more (+) 15mm
   c) For exposed lintels, sills, parapets, horizontal grooves and conspicuous lines

iii) Variation of the linear building lines from established position in plan and related position of columns, walls and partitions.
   In any bay or 5m maximum (+) 10 mm
   In 10 or more (+) 20mm

iv) Variation in the sizes ad locations of sleeves, openings in walls and floors except in the case of and for anchor bolts : (+) 5mm

v) Variation in cross sectional dimensions of columns and beams and in the thickness of slabs and walls: (+) 10 mm/(-)5mm

vi) Footing :
   a) Variation in dimensions in plan (+) 50mm/(-) 5mm.V- Page 55 of 197
   b) Misplacement or eccentricity: 2% of footing within the direction of misplacement but not more than 50mm.

c) Reduction in thickness (-) 5% of specified thickness subject to maximum of 50mm.

vii) Variation in steps:

a) In a flight of stairs

Rise	(+) 3.0 mm
Tread	(+) 5.0 mm

b) Consecutive steps

Rise	(+) 1.5 mm
Tread	(+)3.0 mm

Tolerances in other concrete structure

a) Structures :

Variation of the constructed liner outline from established position in plan

In 5 m ...	...	...	(+) 10mm
In 10 m or more		...	(+) 15 mm

1) Vacation of dimensions to individual structure features from established position in plan

In 20m or more	...	(+) 25 mm
In buried constructions	...	(+) 150 mm

2) Variation from plumb, from specified batter or from curved surfaces of all structures.

In 2.5m ...	...	...	(+) 10 mm
In 5.0m ...	...	...	(+) 15 mm
In 10.0mor more		...	(+) 25 mm
In buried constructions			(+) Twice the above limits

3) Variation from level or grade indicated on drawings in slabs, beams, soffits, horizontal grooves.

In 2.5m ...	...	...	(+) 5 mm
In 7.5m ...	...	...	(+) 10 mm
In buried constructions			(+) Twice the above limits

4) Variation in cross-sectional dimensions of columns, beams, buttresses, piers of similar members (+) 10mm / (-) 5mm

5) Variation in the thickness of slabs, walls, arch sections of similar members (+) 10mm / (-) 5mm

B) Footings for columns, piers, walls, buttresses and similar members :

I) Variation of dimensions in plant (+) 50mm/(-) 10 mm

II) Misplacement of eccentricity: 2% of footing within the direction of misplacement but not more than 50 mm

III) Reduction in thickness : 5% of specified thickness subject to maximum of 50mm.

Tolerances in other type of structures shall generally conform to those given in clause 2.4 of Recommended Practice for concrete form work (ACI 347)

Type of Form work :

Form work may be of timber, plywood, Acrow spans, Acrow pipe (or) Doka type formwork. For special finishes, the form work may be lined with plywood, steel, sheets, oil tempered hard board etc. Sliding forms and slip forms may be used with the approval of Engineer-in-charge.

Form work requirements :

Forms shall conform to the shapes, lines grades and dimensions including camber of the concrete as called for in the drawings. Ample studs, water braces, straps, shores etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete has set sufficiently to permit removal for forms. Forms shall be strong enough to permit the use of immersion vibrators. In special cases, form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete. Faces coming in contact with concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water ad fine material from concrete.

Plywood shall be used for exposed concrete surfaces, where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces which are to be rubbed finished shall be planed to remove irregularities or unevenness in the face. Form work with lining will be permitted.

All new and used form lumber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness ad cleanliness of surfaces. Form lumber unsatisfactory in any respect shall not be used ad if rejected by Engineer-in-charge shall be removed form the site.

Shores supporting successive stores shall be placed directly over those below or be so designed and placed that the load will be transmitted directly by them. Trussed supports shall be provided for stores that cannot be secured on adequate foundation.

Formwork, during any stage of construction showing signs of distortion or distorted to such a degree that the intended concrete work will not conform to the exact contour indicated on the drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be entirely removed and formwork corrected prior to placing new concrete.

Excessive construction camber to compensate for shrinkage settlement etc. that may impair the structural strength of members will not be permitted.

Forms shall be so designed and constructed that they can be striped in the order required and their removal do not damage the concrete. Face formwork shall provide true vertical and horizontal joints shall be as directed by Engineer-in-charge.

Where exposed smooth or rubbed concrete finishes are required, the forms shall be constructed with special care so that the desired concrete surfaces could be obtained which require minimum finish.

Bracings, Struts and Props:

Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bracings. The shuttering for beams and slabs shall be so erected that the shuttering on the sides of beams and under the soffit of slab can be removed without disturbing the beam bottoms.

Re-propping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering.

If the shuttering for a column is erected for the full height of the column, one side shall be left open and built upon sections as placing of concrete proceeds, or windows may be left for

pouring concrete from the sides to limit the drop of concrete to 1.0 m or as directed by Engineer-in-charge.

Inspection of Formwork :

Following points shall be borne in mind while checking during erection of form work and formwork got approved by the Engineer-in-charge before placing of reinforcement bars:

a) Any member which is to remain in position after the general dismantling is done, should be clearly marked.

b) Material used should be checked to ensure that, wrong items/ rejects are not used.

c) If there are any excavations nearby which may influence the safety of form works, corrective and strengthening action must be taken.

d) (i) The bearing soil must be sound and well prepared and the sole plates shall bear well on the ground.

(ii) Sole plates shall be properly seated on their bearing pads or sleepers.

(iii) The bearing plates of steel props shall not be distorted.

(iv) The steel parts on the bearing members shall have adequate bearing areas.

e) Safety measures to prevent impact of traffic, scour due to water etc should be taken. Adequate precautionary measures shall be taken to prevent accidental impacts etc.

f) Bracing, struts and ties shall be installed along with the progress of form work to ensure strength ad stability of form work at intermediate stage. Steel sections (especially deep sections) shall at adequately restrained against tilting, over turning and form work should be restrained against horizontal loads. All the securing devices and bracing shall be tightened.

g) The stacked materials shall be placed as catered for, in the design.

h) When adjustable steel props are used, they should :

(i) Be undamaged ad not visibly bent

(ii) Have the steel pins provided by the manufacturers for use

(iii) Be restrained laterally near each end.

(iv) Have means for centralizing beams placed in the fork heads.

i) Screw adjustment of adjustable props shall not be over extended.

j) Double wedges shall be provided for adjustment of the form to the required position wherever any settlement / elastic shortening of props occurs. Wedges should be used only at the bottom end of single prop. Wedges should not be too steep and one of the pair should be tightened / clamped down after adjustment to prevent other shifting.

k) No member shall be eccentric upon vertical member

l) The number of nuts and bolts shall be adequate

m) All provisional of the design ad / or drawings shall be complied with

n) Cantilever supports shall be adequate

o) Props shall be directly under one another in multistage constructions as far as possible.

p) Guy ropes or stays shall be tensioned properly.

q) There shall be adequate provision for the movement and operation of vibrators an other construction plant and equipment.

r) Required camber shall be provided over long spans.

s) Supports shall be adequate and in plumb within the specified tolerances.

Form Oil :

Use of form oil shall not be permitted on the surface which require painting. If the contractor desire to use form oil on the inside of formwork of the other concrete structures, a non staining mineral oil or other approved oil CEMOL-35 of Ms. Hindustan Petroleum Co. Ltd may be used, provided it is applied before placing reinforcing steel and embedded parts. All excess oil on the form surfaces and any oil on metal or other parts to be bedded in the concrete shall be carefully removed. Before treatment with oil, forms shall be thoroughly cleared of dried splatter of concrete from placement of previous lift, wooden shavings and other unwanted materials.

Chamfers and Fillers :

All corners and angles exposed in the finished structure shall be formed with moldings to form chamfers or fillers on the finished concrete. The standard dimensions of chamfers ad fillers, unless otherwise specified, shall be 20 X 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the mounding shall be planed or surfaced to the same texture as the form s to which it is attached.

Vertical Construction Joint Chamfers :

Vertical construction joints on faces which will be exposed at the completion of the completion of the work shall be chamfered as above accept where not permitted by Engineer-in-charge.

Wall Ties :

Wire ties passing through the walls, shall not be allowed. Also through bolts shall not be permitted.

For fixing of formwork, alternate arrangements such as coil nuts shall be adopted at the contractors cost.

Reuse of forms :

Before reuse, all forms shall be thoroughly scrapped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary repaired and the inside retreated to prevent adhesion, to the satisfaction of Engineer-in-charge. Warped lumber shall be resized.

Contractor shall equip himself with enough shuttering to complete the job in the stipulated time.

Removal of forms :

Contractors shall record on the drawings or a special register, the date upon which the concrete is placed in each part of the work and ht date on which the shuttering is removed therefrom.

In no circumstances shall forms be struck until the concrete reaches a strength of the at least twice the stress due to self weight and any construction erection loading to which the concrete may be subjected at the time of striking form work.

In normal circumstances (generally where temperature are above 20^{o}C) forms may be struck after expiry of the following periods :

Sl. No.	Type of formwork	Minimum Period Before striking Formwork (For OPC Cement)
a)	Vertical formwork to columns, walls, beams	16 – 24h
b)	Soffit formwork to slabs (Props to be refixed immediately after removal of formwork)	3 days
c)	Soffit formwork to beams (Props to be refixed immediately after removal of formwork)	7 days
d)	Props to slabs: I) Spanning upto 4.5 m II) Spanning over 4.5 m	 7 days 14 days
e)	Props to beams and arches: I) Spanning upto 6 m II) Spanning over 6 m	 14 days 21 days

Striking shall be done slowly with utmost care to avoid damage to arise ad projection a without shock or vibration, by gently easing the wedges. If after removing the formwork, it is found that timber has been embedded in the concrete, it shall be removed ad made good as specified earlier.

Reinforced temporary opening shall be provided, as directed by Engineer-in-charge, to facilitate removal of formwork which otherwise may be inaccessible.

Tie rods, clamps, form bolts etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than 24 hours nor later than 40 hours after concrete has been deposited.

Ties, except those required to hold forms in place, may be removed at the same time. Ties withdrawn from walls and grade beams shall be pulled to wards the inside face. Cutting ties back from the faces of walls and grade beams will not be permitted. Work damaged due to premature or careless removal of forms shall be reconstructed at contractors cost.

Mode of measurement :

The form work measured shall be the area of concrete in contact with concrete only.

In case the item of concreting are inclusive of cost of form work, it shall not be measured separately.

All temporary form work such as bulk heads, stop boards provided at construction joints which are not shown in the drawings shall not be measured.

No deduction shall be made for opening / obstructions upto an area 0.1 sqm. and nothing extra shall be paid for forming such openings.

The rate shall include the cost of erecting, centering, shuttering materials, transport, de shuttering and removal of materials from site an labour required for all such operations etc.

8. STEEL REINFORCEMENT

Steel reinforcement bars, if supplied or arranged by contractor, shall be either plain round mild steel bars grade as per IS 432 (part-I) or medium tensile steel bars as per IS 452 (part-I) or hot rolled mild steel ad medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars and hot weld strength deformed bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from Engineer-in-charge.

Storage :

The reinforcement steel shall not be kept in direct contact with ground but stacked on top of an arrangement of timber sleepers or the like. Reinforcement steel shall be with cement wash before stacking to prevent scale and rust. Fabricated reinforcement shall be carefully stock to prevent damage, distortion, corrosion ad deteriorations.

Quality :

All steel shall be grade I quality unless specifically permitted by the Engineer-in-charge. No rolled material will e accepted. If demanded by the Engineer-in-charge. Contractor shall submit the manufacturers test certificate for steel. Random tests on steel supplied by contractor may be performed by Department as per relevant Indian Standards. All costs incidental to such tests shall be at contractors expense. Steel not conforming to specifications shall be rejected. All reinforcement shall be clean, free from grease, oil, paint, dirt loose mill, scale dust, bituminous materials or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used. All bars shall be rigidly held in position before concreting. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer-in-charge. If welding is approved, the work shall be carried as per 2751, according to best modern practices ad as directed by the Engineer-in-charge in all cases of important connections, tests shall be made to prove that the joints are of the full strength of bars welded. Special specifications, as specified by the Engineer-in-charge, shall be adhered to in the welding of cold worked reinforcing bars and bars other than mild steel.

Laps :

Laps ad splices for reinforcement shall be shown in the drawings. Splices, in adjacent bars shall be staggered ad the locations of all splices, except those pecified on the drawing shall be approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available length of bars at site.

Bending :

All bars shall be accurately bent according to the sizes ad shapes shown on the detailed working drawings/ bar being schedules. They shall be bent gradually by machine or other approved means.

Reinforcing bars shall not be straightened and rebent in a manner that will injure the materials. Bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 25mm in diameter which may be bent hot if specifically approved by the Engineer-in-charge. Bars bent hot shall not be heated beyond cherry red colour (not exceeding $645^{o}C$) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only of ht means used for straightening and rebinding be such as shall not, in the opinion of the Engineer-in-charge injure the material. NO reinforcement bar shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having links or bends other than those required by design shall not be used.

Bending at Construction Joints :

Where reinforcement bars are bent aide at construction joints and afterwards bent back into their original position, care should be taken to ensure that no time the radius of the bend is less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

Fixing / Placing ad Tolerance on Placing :

Reinforcement shall be accurately fixed by ay approved means maintain din the correct position as shown in the drawings by the use of blocks, spacer and chairs as per IS 2502 to prevent displacement during placing ad compaction of concrete. Bar intended to be in contact at crossing point shall be securely bound together at all such points with number 16 gauge annealed soft iron wire. The vertical distances required between successive layers of bars in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

Tolerance on placing of reinforcement :

Unless otherwise specified by the Engineer-in-charge, reinforcement shall be placed within the following tolerances:

Tolerance in spacing

a) For effective depth, 200 mm or less $\pm$ 10 mm

b) For effective depth, more than 200 mm $\pm$ 15 mm

Cover to Reinforcement :

The cover shall in no case be reduced by more than one third of specified cover or 5mm whichever is less. Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish shall be as follows) :

a) At each end of reinforcing bar not less than 25 mm, nor less than twice the diameter of such bar.

b) For a longitudinal reinforcing bar not less than 25 mm, nor more than 40 mm, nor less than the diameter of such bar. In the case of column of maximum dimensions of 200mm or under, whose reinforcing bars do not exceed 12mm, a cover of 25mm may be used.

c) For longitudinal reinforcing bar in a bar, not less than 25 mm nor less than the diameter of such bar and.

d) For tensile, compressive, shear, or other reinforcement in a slab, not less than 25mm, nor less than the diameter of such bar and.

e) For any other reinforcement not less than 15mm, nor less than the diameter of such bar.

f) Increased cover thickness may be provided when surfaces of concrete members are exposed to the action of harmful chemicals (as in the case of concrete in contact with earth faces contaminated with such chemicals), acid, vapour, saline, railways) etc. and such increase of cover may be between 15mm and 50 mm beyond the figures given in (a to e) above as may be specified by the Engineer-in-charge.

g) For reinforced concrete members, totally immersed in sea water the cover shall be 40mm, more than specified (a to e) above.

h) For reinforced concrete members, periodically immersed in sea water or subject to sea spray, the cover of concrete shall be 50 mm more than that specified (a to e) above.

i) For concrete of grade M25 and above, the additional thickness of cover specified in (f), (g) and (h) above a my be reduced to half. In all such cases the cover should not exceed 75mm.

j) Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coating as specified on the drawings. In such case, the extra cover, mentioned in (h) and (i) above, may be reduced by the Engineer-in-charge, to those shown on the drawing.

k) The correct cover shall be maintained by cement mortar briquettes or other approved means. Reinforcement for footings, grade beams ad slabs on sub grade shall be supported on precise concrete blocks as approved by the Engineer-in-charge. The use of pebbles or stones shall be permitted.

l) The minimum clear distance between reinforcing bars shall be in accordance with IS 456 or as shown in drawings.

The Bars shall be kept in correction position by the following methods:

a) In case of beam ad slab construction precast cover blocks in cement mortar 1:2 (1 cement : 2 coarse sand) about 4X4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcement.

b) In case of cantilevered ad doubly reinforced beams or slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 metre or at shorter spacing to avoid sagging.

c) In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in theme or with block of cement mortar 1:2 (1 cement : 2 coarse sand) of required size suitably tied to they reinforcement to ensure that they are in correct position during concreting,

d) In case of other RCC structure such as arches, domes, shells, storage tanks etc. a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in-charge.

Inspection :

Erected and secured reinforcement shall be inspected and approved by Engineer-in-charge prior to placement of concrete.

Mode of Measurement for reinforcement for R.C.C Works :

Reinforcement a detailed in schedule of quantities shall be measured for payment lineally as per ht cutting length nearest to a centimeter shown in bar bending schedule submitted by the contractor and approved by the Engineer-in-charge and weight calculated based on the standard weights as per I.S.S. per meter length. No allowance shall be measured. The cost of steel used by the contractor in the reinforcement only upto the extent shown in the drawings. As far as possible, laps in bars shall be avoided. Any laps and hooks provided by the contractor other than authorized as per approved bar bending schedule will be considered to have been provided by the contractor for his own convenience ad shall not be measured for payment. Pins, chairs, spacers shall be provided by the contractor wherever required as per drawing and bar bending schedule and as directed by the Engineer-in-charge and shall be measured for payment. Fan hooks as required shall be provided by the contractor as per direction of Engineer-in-charge and shall be measured for payment.

The rate shall include the cost of all materials and labour required for all above operation including transport, wastage, straightening, cutting, bending, binding and the binding wire as required.

9. STRUCTURAL STEEL

Scope of Work :

The work covered by this specification consists of furnishing ad erecting of structural steel complete in strict accordance with this specifications ad the applicable drawings.

Materials :

All structural steel shall be of standard sections as marked on the drawings ad shall be free of scale, blisters, laminations, cracked edges ad defects of any sort. If the structural steel is not supplied by the Department and the Contractor is required to bring such steel, the Contractor shall furnish duplicate copies of all mill orders and / or also the test report received from the mills, to satisfy the Engineer-in-charge.

All structural steel and electrodes shall comply in all respects with relevant I.S.S. for structural steel.

Workmanship :

All workmanship shall be of first class quality in every respect to get greatest accuracy to ensure that all parts will fit together properly on erection.

All ends shall be cut true to planes. They must fit the abutting surfaces closely.

All stiffeners shall fit tightly at both ends.

All holes in plates and section between 12mm and 20 mm thick shall be punched to such diameter that 3mm of metal is left all around the hole to be cleaned out to correct size by reamer.

The base connection shall be provided as shown on drawings and the greatest accuracy of workmanship shall be ensured to provide the best connections.

Figured dimensions on the drawings shall be taken.

Erection and Marking :

Erection ad fabrication shall be according to IS 800-1984 section –11. During erection, the work shall be securely braced and fastened temporarily to provide safety for all erection stresses etc. No permanent welding shall be done until proper alignment has been obtained.

Any part which do not fit accurately or which are not in accordance with the drawings and specifications shall be liable to rejection and if rejected, shall be at once be made good.

Engineer-in-charge shall have full liberty at all reasonable times to enter the contractors premises for the purpose of inspecting the work and no work shall be taken down, painted r dispatched until it has been inspected and passed. The contractor shall supply free of charge all labour ad tools required for testing of work.

Delivery at Site :

The contractor shall deliver the component parts of the steel work in an undamaged state at the site of the works and the Engineer-in-charge shall be entitled to refuse acceptance of any portion which has been bent or otherwise damaged before actual delivery on work.

Shop Drawing :

The shop drawings of structural steel based on contract drawings hall be submitted to the Engineer-in-charge.

The necessary information for fabrication, erection, painting of structure etc. must be furnished immediately after acceptance of the leader.

Painting :

Painting should be strictly according to IS. 1477-1971 (Part-I-Pretreatment) and IS 1477-1971 (part-II painting).

Painting should be carried out on dry surfaces free from dust, scale etc. The paint shall be approved by the Engineer-in-charge. Once coat of shop paint (red lead) shall be applied on steel, except where it is to be encased in concrete or where surfaces are to be field welded.

Welding :

Welding shall be in accordance with IS. 816-1969,IS819-1957, IS 1024-1979, IS1261-1959, IS 1323-1982 and IS 9595-1980 as appropriate. For welding of any particular type of joint, welders shall give evidence of having satisfactory completed appropriate test as described in ay of IS 817-1966, IS 1393-1961, IS 7307 (part-I) –1974, IS 7310 (part-I) 1974 and IS 7318 (part-I) 1974 as relevant.

Welding Consumables :

Covered electrodes shall conform to IS 814 (part-I) – 1974 and IS814 (part-II)- 1974 or IS 1395-1982 as appropriate.

Filler rods and wires for gas welding shall conform to IS 1278-1972.

The bar wire electrodes for submerged are welding shall conform t IS 7280-1974. The combination of are and flash shall satisfy the requirements of IS 3613-1974.

The filler rods ad bare electrodes for gas shielded metal, are welding shall conform to IS 6419-1971 and IS 6560-1972 as appropriate .

Type of Welding :

Are welding (direct or alternating current) or Oxyacetylene welding may used. Field welding may be used. Field welding shall be by D.C.

Size of Electrode Runs :

The maximum gauge of the electrodes for welding any work and the size of run shall be based on the following tables :

Average thickness of plate or section	*Maximum gauge or diameter of electrodes to be used*
Less than 3/16"	10 S.W.G
3/16" and above but less than 5/16"	8 S.W.G
5/16" and above but less than 3/8"	6 S.W.G.
3/8" ad above but less than 5/8"	4 S.W.G
5/8" and above but less than 1"	5/16" dia
1" and above thick section	3/8" dia

Note : On any straight weld the first run shall not ordinarily be deposited with a larger gauge electrode than No.8 S.W.G. For subsequent runs the electrode shall not be increased by more than two electrode size between consecutive runs.

Welding contractors:

The contractor shall ensure that each welding operator employed on fabrication or erection is an efficient and dependable welder, who has passed qualifying tests on the type of welds which will be called upon to make, sample test shall have to be given by the contractor to the entire satisfaction of the Engineer-in-charge.

Welding Procedure :

Welding should be done with the structural steel in flat position in a down hand manner wherever possible. Adequate steps shall be taken to maintain the correct are length, rate of travel, current and polarity for the type of electrode and nature of work. Welding plant capacity means of measuring the current shall be available either as a part of the welding plant or by the provision of a portable ammeter. In checking the welding current, a tolerance of 10% or 30 amperes from the specified value whichever is less shall be permitted.

The welding procedure shall be such as to ensure that the weld metal ca be fully and satisfactory deposited through the length ad thickness of all joints so that distortion and shrinkage stresses are reduced to the minimum and thickness of welds meet the requirements of quality specified.

Workmanship :

Preparation of Fusion Faces :

Fusion faces shall be cut by staring machine or gas cutting and later dressed by filling or grinding so that they shall be free from irregularities such as would interfere with the deposition of the specified size of weld to cause the defects. Fusion faces ad the surrounding surfaces shall be free from heavy slag, oil paint or any substance which might affect the quality of the weld or impede the progress of welding. The welding face shall be free of rust an shall have metal shine surfaces.

The parts to be welded shall be brought into as close contact as possible ad the gap due to faulty workmanship or incorrect fit up shall not exceed 1/16". If separation of 1/16" or more occurs locally, the size of the fillet weld shall be increased at such position by an amount of equal to the width of the gap.

The parts to be welded shall be maintained to their correct poison during welding. They shall be securely held in position by means of tack welds, service bolts, clamps or rings before commencing welding so as to prevent and relative movement due to distortion, wind or any other cause.

Step Back Method should be used to avoid Distortion :

The minimum leg length of a fillet weld as deposited should not be less than the specified size and the throat thickness as deposited should be not less than that tabulated below :

Throat Thickness of Fillet :

Angle between fusion faces	60^o – 90^o	91^o – 100^o	101^o – 106^o	107^o – 113^o	114^o – 120^o
Throat thickness in cms.	0.70	0.65	0.60	0.55	0.50

In no case should a concave weld be deposited without the specific approval of the Engineer-in-charge unless the leg length is increased above the specified length so the resultant throat thickness is as great as would have been obtained by the deposition of a flat.

All welds shall be deposited in a pre-arranged order ad sequence taking due account of the effects of distortion ad shrinkage stresses.

After making each run of welding, all slag shall be removed ad final run shall be protected by clean boiled linseed oil till approved.

The weld metal, as deposited, shall be free from crack, slag, excessive porosity, cavities and other faults.

The weld metal shall be properly fused with the parent metal without overlapping or serious undercutting at the toes of the weld.

The surfaces of the weld shall have a uniform and consistent contour ad regular appearance.

In welds containing crack, porosity or cavities in which the weld metal tends to overlap on the parent metal without proper fusion, the defective portions of the welds shall be out cut and re-welded.

Where serious under cutting occurs, additional weld metal shall be deposited to make good reduction.

Mode of Measurement :

All structural steel shall be measured on weight basis in metric tones or quintals or kgs. as mentioned in the schedule of quantities. The length or areas of various members including gusset plates shall be measured correct to two places of decimals as the net weight worked out from the standard steel tables approved by Indian Standard Institution. No separate measurements shall be taken for welding, riveting, bolting, field connections etc. The rate shall include cost at of all labour, materials, scaffolding, transport and also cost of welding, riveting ad bolting, field connections if any all to complete the job as per specifications.

10. DAMP PROOF COURSE

Scope of work :

The work covered under this specifications consists supplying and laying plain cement concrete or cement plaster 1:3 as damp proof course with or without waterproofing admixture with this specification and applicable drawings.

Workmanship :

Surface to receive damp proof course shall be cleaned and carefully wiped to remove all dust, laitance etc. and shall be approved by the Engineer-in-charge Damp proof course shown shall be cement concrete as per proportion indicated in the schedule or cement plaster in the ratio CM 1:3. Approved water proofing compound @ 2% by weight of cement or as directed by the manufacturer shall be mixed in cement mortar for this concrete or plaster. The damp proof course shall be laid to the full width of the walls and the edges shall be straight, even and truly vertical. Wooden forms shall be used to obtain good edges. No masonry work shall be commenced on freshly laid damp proof course unless it is cured for 48hours of its laying by curing of damp proof course shall be continued along with the masonry work. Specification for cement, sand, aggregate and water shall be as described herein before for concrete works / cement plaster.

Mode of measurement :

The work shall be measured in sqm. area actually laid limited to sites as shown in drawing. The rate shall include cost of all the materials, labour etc. and scaffolding (if any).

11. BRICK WORK

Scope of work :

The work covered under this specification pertains to procurement of best quality locally available bricks and workmanship of building walls of various thickness. In strict compliance with the specifications and applicable drawings.

Materials :

Brick shall be best quality locally available bricks and shall be got approved by the Engineer-in-charge before incorporation in the work.

The nominal size of bricks (F.P.S) shall be 22.9 X 11.4 X7cm (9" X 4 1/2 X 2 3/4"). Permissible tolerance on dimensions shall be + 3mm. in length and + 1.5 mm in width / thickness. The contractor shall get approved the sample and source of bricks from Engineer-in-charge before procurement on large scale and shall maintain the same for the entire work.

In case the size of bricks used in the work found lesser than the specified one for the whole lot :

Extra cement consumed due to more number of joints and due to additional thickness of plaster than the specified in the tender to match with adjoining columns and beams, shall be to contractor's account.

If the plastering to be done is more than the specified thickness to bring the plaster surface to perfect line, level ad plumb with adjoining columns, beams walls etc., the contractor shall be responsible to provide and fix chicken wire mesh to receive more thickness of plaster at his own cost and nothing extra will be paid on this account.

In case the size of bricks used in the work, found more than the permissible, the contractor shall chip out the exposed edges of bricks upto the required level of wall to receive specified thickness of plaster at no extra cost.

Bricks shall generally conform to IS 1077-1970. In any case minimum crushing strength shall not be less than 35 kg/sq.cm and water absorption shall not be more than 25% by weight. The Engineer-in-charge shall have the right to reject bricks obtained from any field where the soil have an appreciable quantity of sulphates and chlorides. The specifications for cement, sand and water shall be same as described herein before under cement concrete. Bricks shall be thoroughly soaked in water before using till the bubles ceases. No half or quarter brick shall be used except as closer. The closers shall be cut to required size and used near the end of the walls. The walls shall be raised truly to plumb. The type of bond to be adopted shall be decided by the Engineer-in-charge, but vertical joints shall be laid staggered.

Workmanship :

Four courses of brick work with four joints should not exceed by more than 40mm the same bricks piled one over the other without mortar.

Brick work shall not be raised more than 10 courses a day unless otherwise approved by the Engineer-in-charge. The brick work shall be kept wet for at least 7 days. Brick work

shall be uniformly raised around and no part shall be raised more than 1.0 metre above another at any time.

All joints shall be thoroughly flushed with mortar of mix as specified in the schedule of quantities, at every courses. Care shall be taken to see that the bricks are bedded effectively and all joints completely filled to the full depth.

The joints of brick work to be plastered shall be raked out to a depth not less than 10mm as the work proceeds. The surface of brick work shall be cleaned down and wiped properly before the mortar sets.

The adhesion between the brick masonry surface d the concrete surface of columns, beams, chajjas, lintels etc. should be proper by ensuring that the concrete surface coming in contact with brick masonry is backed / chipped / keyed, cleaned and cement slurry is applied so that a proper bond is achieved between the two dissimilar materials. It is responsibility of the contractors to ensure that there will not be any cracks / fissure anywhere in the brick masonry.

In case the cracks appear subsequently in those areas, they should be made good by cement grouting or epoxy putty grouting/ poly sulphide compound grouting or as per standard modern specifications/methods with the prior approval of the Engineer-in-charge, at the cost of the contractor.

All the courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Specified mortar of good and approved quality shall be used. Lime shall not be used where reinforcement is provided in brick work. The mortar should completely cover the bed and sides of the bricks. Proper care should be taken to obtain uniform mortar joint thought out the construction. The walls should be raised uniformly in proper, approved bond. In construction of the wall, first of all two end corners are carefully laid to line and level ad then it between portion is built, with a cord stretching along the headers or stretchers held in position at the ends. This helps in keeping the alignment of the courses and marinating them in level. Similarly all other courses are built. Care shall be taken to keep the perpends properly aligned within following maximum permissible tolerances :

Deviation from vertical within a storey shall not exceed 6mm per 3 m height Deviation in verticality in total height of any wall for building more than one storey in height shall not exceed 12.5 mm.

Deviation from position shown on plan of any brick work shall not exceed 12.5 mm.

Relative displacement between load bearing wall in adjacent storeys in the ended to be vertical alignment shall not exceed 6mm.

A set of tools comprising of wooden straight edge, masonry spirit level, square, 1 meter rule line and plumb shall be kept on the site of work for every 3 masons for proper check during the progress of work.

No brick work shall be carried on during frosty weather except with the written permission of the Engineer-in-charge who will give special directions as to the manner in which the work is to be performed. All brick work laid during the day shall, in seasons liable to frost, be properly covered up at night as directed by the Engineer-in-charge. Should any brick work be damaged by frost, the brick work shall, at the discretion of the Engineer-in-charge, be pulled down ad made good at the cost of the contractor.

Concrete surfaces of columns, beams, lintels, chajjas etc. coming in contact with masonry work shall be properly chipped, washed ad given a thick coat of cement slurry before start of work. The rate quoted shall include wire brushing and cleaning brick work covered with fungus or deleterious materials.

Brick work shall be well watered / cured throughout the day for atleast a week from the date of building and the work shall be protected from sub and rain.

Materials ad workmanship for a half brick or brick on edge partition wall shall be a specified above.

The wall shall be stiffened by providing with 2 nos. 6mm diameter M.S. or as specified in the schedule as bottom reinforcement (only the M.S. reinforcement will be paid separately under relevant item).

The rates for brick work shall include the cost of the following :

Providing and fixing necessary single or double scaffolding and removing the same after the work is completed.

Watering, curing, lifting of material to any height.

Raking out of joints to receive plaster.

Forming slab sittings, cutting or leaving holes for lugs of windows, doors, sills, switch and plug boxes etc.

Making good all holes, chases etc. to any depth due to conduit pipes, holdfasts, bolts, switch and plug boxes etc.

Bedding and pointing precast lintels, sills etc. in or on walls.
For the purpose of measurements, the thickness of one brick wall ad over shall be taken in terms of multiples of half brick.

Mode of measurement :

For Brick work measured in Cubic Metres :

The contract rate shall be for a unit of one cubic metre of brick masonry as actually done.

For measurement purpose, thickness of single brick wall shall be taken as 215 mm. irrespective of thickness used. Brick walls of more than one brick thickness shall be measured as per actual thickness constructed.

All opening in brick work for doors, windows and ventilators shall be deducted to get the net quantity of actual brick work done.

Opening or chases required for P.H. or electrical inserts less than 0.1 sqm. and bearing of precast concrete members shall not be deducted.

No extra payment shall be made for any extra work involved in making the above openings or placements.

For Brick work measured in square metre :

Half brick thick masonry walls shall be measured in sqm. All openings in brick work for doors and windows and windows ad ventilators shall be deducted to get the net quantity of actual work done.

Openings of chases required for P.H. or Electric inserts less than 0.1 sqm. and bearing of precast concrete members shall not be deducted. No extra payment shall be made for extra work involved in making the above openings or placements.

PRECAST CEMENT CONCRETE SOLID BLOCK MASONRY :

Scope of work :

The work covered under this specifications pertains to procurement of best quality locally available or locally manufactured precast cement concrete solid block and workmanship in building walls of various thickness sin strict compliance with the specifications and applicable drawings.

Material :

Precast cement concrete solid blocks shall be of best quality locally available manufactured at site and should be approved by the Engineer-in-charge before incorporation in the work. The ingredient and the cement concrete used shall confirm to relevant IS as stipulated in specification for cement concrete works herein before.

Minimum crushing strength of the solid blocks shall be 40 to 60kg/sq.cm at 28th day after curing. The type of the bond to be adopted will be decided by the Engineer-in-charge but vertical joints shall be staggered. The size of the blocks shall be 390 X 190 X 140 mm and 390X190 X 100mm or as approved by Engineer-in-charge and the proportion used in making the blocks shall be 1:11 (I cement : 11 fine and coarse aggregates).

The blocks shall be cured well atleast for 14 days before incorporation into the work. The cement mortar for concrete blocks masonry shall be 1:4 and joints shall not be more than 10mm thick.

Workmanship and Mode of measurement :

The workmanship and mode of measurement shall be as stipulated in the specification for thick work as applicable stated earlier ad concrete block masonry with 140mm thick block shall be measured in sqm. nearest to two place of decimals of a metre. The rate quoted shall include cost of all materials, labour including frame work in casting the blocks, curing, transporting, handling, hoisting the blocks to proper level, curing masonry etc. complete.

12. STONE MASONRY

Scope of work :

The work covered under this specifications consists of supplying and erecting stone masonry walls with available best quality of stone in strict compliance with this specifications and applicable drawings.

Random Rubble Masonry :

Material :

The rubble shall be of the best quality trap / granite / ballast stones obtained from the approved quarry. The same of the stone, to be used shall be got approved from the Engineer-in-charge. All stones shall , generally be freshly quarried and shall be sound, dense, hard, free from segregation, cracks, weathered portions and other structural defects to requisite sections ad forms ad shall have fully dressed beds and joints. Atleast 50% of the stones shall be 0.015 cum. in content when reckoned individually. The length of stones for stone masonry shall not exceed three times the height not the breadth or base shall not be greater than thee fourth the thickness of wall, or not less than 15cm. thee height of stone may be upto 30 cm. stones shall be laid on the natural beds and shall run sufficiently inside the wall thickness. No hollow space shall be left out and inter spaces of stones being filled with mortar ad stone chips, driven hard ad not with mortar only.

All mortar to be used shall be of the type and proportion mentioned in the item. Cement, sand and water to be sued shall conform to their relevant specifications as described under cement concrete.

The masonry shall be laid plumb, lines levels, curves, shapes as shown in drawings. All required holes for passage o water or pipes are to be embedded during construction as specified.

All stones shall be wetted before laying in masonry. Concrete surfaces of columns, beams, lintels, chajjas etc. coming in contact with masonry shall be properly chipped, washed and wetted before start of masonry work. The concrete slurry as the masonry work progresses in height. Clean chips and spawls carefully selected to fit in the space shall be wedded into the mortar. Joints and beds wherever necessary to avoid thick beds or joints or mortar. However, proper shaping and dressing of stones shall be done prior to their laying in masonry and hammering shall not be resorted to often after the stones are laid in position. The bond stones shall be used in every square metre area of masonry wall ad shall extend from front to back to thin walls having width of 600 mm. and shall overlap by atleast 150 mm. in walls having thickness more than 600mm. when lid from both sides.

When the work has to be started on the old or the one competed a long while ago or in the previous working seasons, care shall be taken to roughen and clean old surface satisfactorily without disturbing the masonry before laying the new. It shall be wetted before laying the bedding mortar.

When practicable, the whole masonry in any structure shall be carried out upto a uniform level throughout. But when breaks are unavoidable in carrying the work continuously in uniform level, sufficiently long steps shall be left. All junction of walls shall be formed at the time when walls are being built. Cross walls should be carefully bonded in to the main walls. All masonry built in cement mortar shall be kept continuously wet for 14 days from the date of laying. Should the mortar perish i.e., becomes dry, white or powder through neglect of watering if the masonry shows hollow joints or non adherence of mortar to the stones or if the work does not conform to drawings and specifications, the work shall be pulled down ad rebuilt by the contractor at his own cost and risk. All masonry shall be thoroughly cleaned ad washed down on completion and all stains, adhering mortar removed from the surface and raking of joints carried out as the

scaffolding is being lowered and removed. Holes left in masonry for supporting scaffolding shall be filled and made good before pointing / plastering.

Mode of measurement :

All stone masonry shall be measured in cubic metres as actually done. All openings for widows, doors, lintels etc. shall be deducted to get the net quantity of actual work done. Openings or chases required for P.H. and electrical inserts less than 0.1 sqm. and bearings of precast concrete members shall not be deducted. The ate shall also include cost of corner stones, bond stone, scaffolding, labour, curing etc.

13. FLOORING

Scope of work :

The work covered under this specification consists of providing and laying at levels and floors, flooring of different types, strictly in accordance with these specifications and relevant drawings.

Cement Concrete Flooring (Indian Patent Stone) :

Materials :

The specifications for materials, grading, mixing and the quantity of water to be added shall generally conform to their relevant specifications described under plain and reinforced concrete. The maximum size of coarse aggregate shall be 10mm. The fine aggregate shall consist of properly graded sand. Concrete shall be mixed preferably by machine, and hand mixing shall be avoided as far as practicable.

Preparation of Base :

The base concrete surface shall be thoroughly chipped to remove laitance, caked mortar, loose sand, dirt etc. cleaned with wire brush and washed clean and watered until no more water is absorbed.

Where the base concrete has hardened so much that roughening the surface by wire brushes is not possible, the same shall be roughened by chipping or hacking at close intervals. The surface shall be soaked with water for atleast 12 hours and surface water removed and dried before laying the topping. Before laying the concrete, cement slurry at 2.75 kg/ sqm. of surface shall be applied before laying the topping. Before laying the concrete, cement slurry at 2.75 kg. / sqm. of surface shall be applied for better bond, / flush as per drawings. The edge of each panel into which the floor is divided shall be supported by wooden or metal strips duly oiled to prevent sticking. The panels shall be of uniform size and, unless otherwise specified, no dimension of panel shall exceed 2 m. and the area of a panel shall not be more than 2 sqm. However, the exact size of panel shall be decided by the Engineer-in-charge to suit the size of the room. The joints in the floor finish shall extend through the borders a skirting/ dado. The border shall have mitred joints at the corners of the room.

Where aluminium dividing strips are proposed to be provided, the same shall be fixed in cement mortar 1:2 @ 1200 mm. centers or as specified in the schedule for full depth of the finished floor.

The depth of dividing strips shall be the thickness as proposed for the finished floor in the item. In the case of flush joints, alternate panels only may be cast on same day. Atleast 48 hours shall elapse before the concreting of adjacent bay is commenced.

Mixing :

The topping concrete shall be of mix of one part of cement, two parts of sand and 4 parts of well graded stone chips of 10mm maximum size. the ingredients shall be thoroughly mixed with just sufficient water to the required plasticity, having water cement ratio not more than 0.4

Laying :

The free water on the surface of the base shall be removed and a coat of cement slurry to the consistency of thick cream shall be brushed on the surface. On this fresh grouted base, the prepared cement concrete shall be laid immediately after mixing. The concrete shall be spread and leveled carefully. The concrete shall be compacted and brought to the specified levels by means of a heavy straight edge resting on the side forms and down ahead with a

sawing motion in combination with a series of lifts and drops alternatively with small lateral shifts, either mechanically or manually as directed by the Engineer-in-charge.

While concreting the adjacent bays, care shall be taken to ensure that the edges of the previously laid bays are not broken by carelessness or hand tamping. Immediately after laying the concrete, the surface shall be inspected for high or low spots and correction needed shall be made up by adding or removing the concrete and whole surface is again leveled. When the layer is made even, the surface shall be completed by ramming or beating ad then screed to a uniform line and level. Before the initial set commences, the surface shall be sprinkled directly or empty gunny bags spread over the surface of the concrete to absorb excess water coming on top due to floating.

Finishing the surface :

After the concrete has been fully compacted, it shall be finished by toweling or floating. Finishing operations shall start shortly after the compaction of concrete an shall be spread over a period of one to six hours depending upon the temperature ad atmospheric conditions. The surface shall be trowelled intermittently at intervals for several times so as to produce a uniform and hard surface.

The satisfactory resistance of floor to wear depends largely upon the care with which troweliing is carried out. The object of trowelling is to produce as hard and close knit a surface as possible. The time interval allowed between successive trowelling is very important. Immediately after laying only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to work a layer rich in cement to the surface, some time. After the first trowelling, the duration depending upon the temperature, atmospheric conditions d the rate of setting of cement used, the surface shall be retrowelled many times at intervals to close any pores in the surface shall be retrowelled many times at intervals to close any pres in the surface, and to bring to surface and scrap off any excess water in concrete or laitance (it shall not be trowelled back into the topping). The final trowellign shall be done well before the concrete has become too hard but at such a time t hat considerable pressure is required to make any impression on the surface.

Trowelling of rich mix of dry cement. and fine aggregate on to the surface shall not be permitted. Trowel marks should not be seen on the finished surface.

Where broom finish is specified, after the concrete has been thoroughly compacted, and when most of the surface water has disappeared, the surface shall be given broom finish with an approved type of brass or M.S. Fiber. The broom shall be pulled gently over the surface from edge to edge in such a manner that corrugation shall be uniform in width and depth, the depth shall be not more than 1.5 mm. Bromming shall be done when the concrete is in such ac condition that the surface will not be torn or unduly roughened by the operation. Coarse or long bristles which cause irregularities or deep corrugation shall be timed out. Brooms which are worn or other wise unsatisfactory shall be discarded.

After the concrete in the bays has set, the joints of the panels should be filled with cement cream and neatly floated smooth or jointed. Care should be taken that just the minimum quantity of cream for joint is used a excess spilling over the already finished surface shall be removed when the cream is still green.

Incase of wide joints the same shall be filled with pigmented cement concrete (1:2:4) using approved pigment ad the joint shall be finished in perfectly straight line.

Steel Trowel Finish :

Areas where marblex tiles are proposed to be used are required to have base concrete finished smooth by steel trowel.

Curing :

The completed flooring shall be protected from sun, wind and rain for the first two days and movement of persons over the floor is prohibited during this period. The finished surface shall be covered and cured continuously from the next day after finishing, atleast for a period for 7 days.

Bunding with murrum for curing is prohibited as it will leave permanent stain on the finished floor.

Cure shall be done by spreading sand ad kept damp throughout the curing period of seven days minimum. The surface shall be protected from any damage to its whatsoever. The surface shall then be allowed to dry slowly. All corners, junctions of floor with plastered wall surface shall be rounded off when required at no extra cost.

Mode of measurement :

The rate for flooring and skirting shall be in square metre of the area covered. The length and width of the flooring shall be measured not between the faces of skiting or dado or plastered faces of walls which is the proudest.

All openings in flooring exceeding 0.1 sqm. in areas where flooring is not done shall be deducted and net areas only shall be measured a paid for. Flooring under dado, skirting or plaster shall not be measured for payment.

Nothing extra shall be paid for laying the floor at different levels in the same room.

The dimensions shall be measured upto places of decimals of a metre and area worked out upto two places of decimal of a square meter.

13.2 Terrazzo / Cement Tile Flooring, Skirting / Dado etc.

Mortars :

Cement Mortar :

This shall be prepared by mixing cement and sand in specified proportions given in schedule of quantities, in a mixer, Hand mixing will not be allowed.

Proportioning :

The unit of measurement for cement shall be a bag of cement weighing 50 kg. and this shall be taken as 0.035 cum. Sand in specified proportion shall be measured in boxes of suitable size. It shall be measured on the basis of its dry volume. Incase of damp sand, its quantity shall be increased suitably to allow for bulkage which shall be determined by the method given in lime mortar.

Mixing :

The mixing of mortar shall be done at site of work in mechanical mixer. Hand mixing, if permitted, shall be done as directed by the Engineer-in-charge.

Mixing in Mechanical Mixer :

Cement and sand in the specified proportion shall be mixed dry thoroughly in mixer. Water shall then be added gradually and wet mixing continued for atleast one minute. Care shall

be taken not to add more water than that shall bring the mortar to the consistency of a stiff paste.

Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time.Mixer shall be cleaned with water each time, before suspending the work.

Hand Mixing :

The measured quantity of sad shall be leveled on clean masonry platform and cement bags emptied on top. In hand mixing the quantity of cement shall be increased by 5% above the specified, with no extra cost to the Department. The cement and sand shall be thoroughly mixed dry by being turned over and over backwards and forwards several time till the mix is of a uniform colour, The quantity of dry mix which shall be used within 30 minutes shall then be mixed in thoroughly with just sufficient quantity of water to bring the mortar to the consistency of stiff paste. Mixing of mortar on floor slabs or landings of stair case shall not be allowed.

General :

Mortar Shall be used as soon as possible after mixing and before it has begun to set, and in any case within 30 minutes after the water is added to the dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from the site of work.

Materials :

The terrazzo / cement tiles for flooring and skirting shall be hydraulically pressed under a minimum pressure of 140 kg / sq.cm/ and shall conform to IS 1237-1959 in respect of constituent materials manufacture, shape, tolerances, wearing layers, colour, appearance, general quality of tiles, strength, resistance to wear, water absorption and other tests. The tile shall be nominal size and thickness as specified in the schedule for flooring, skirting, dado work etc. and shall be of approved Department shall be at liberty to inspect the manufacture of tiles even at the factory to ascertain whether the manufacture is as per the approved tiles for its quality of materials and manufacture.

Tiles to be used for skirting and dado shall be sampleshed before placing in position. Contractor shall submit samples for flooring and skirting tile for approval of the Engineer-in-charge. The Engineer-in-charge may direct new samples made with varying proportions, sizes d colour of terrazzo chips against varying base before conveying his decision about the approved samples. No claims will be entertained for rejected samples. The contractor shall ensure the terrazzo finish as per approved sample for the entire quantity of tiles, by dry mixing of the cement, marble chips, powder, white cement, pigments etc. in the same proportions. For wearing layer of all tiles, the contractors shall use the cement from one consignment only to ensure uniformity in background colour / shade.

If there is a doubt the quality of the tiles, they shall be tested from each consignment as specified in IS 1237-1959 and cost of testing shall be borne by the contractor. Sample tiles after being approved shall be kept with the Engineer-in-charge for reference till the completion of the work. All tiles which are to be incorporated in the work shall strictly conform to the approved samples.

The tiles shall be stored in room or under such cover as will prevent exposure to dampness, sun, rain, accidental injure or staining. Tiles to be incorporated in the work shall be immersed in water for a minimum period of 6 hours before use.

Bedding / Backing Coat :

In case of flooring, the mortar bedding shall be cement mortar of specified thickness ad mix.

Proportion of cement and sand etc. shall be as specified in the scheduled item. In case of skiting also backing coat shall be of cement mortar of thickness and mix proportion specified in the schedule item. All materials to be used in cement mortar shall be got approved by the Engineer-in-charge before incorporating in the work.

Cleaning of Surface and laying of mortar bedding :

Before laying the mortar bedding the concrete floor surface shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc. brushed, washed with water to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Unit and unless the surface is approved by the Engineer-in-charge, the flooring shall not be started. A bedding of cement mortar (1:3of 20mm, thickness or more if required to make up the level or grade) shall be laid evenly and to the require slopes as directed. The terrazzo tiles and evenly set in a thick slurry of cement applied to the sides and bottom and over the prepared base at the rate of 4.4 kg / sqm. The tiles shall than be tamped down with wooden mallet until they are exactly in true plane and line, with the adjacent tiles. Care shall be taken to ensure that the tiles are solidly bedded without voids and air pockets. All tiles shall be extended upto the unplastered surfaces of masonry walls/ RCC columns/RCC walls. The tile shall be close jointed in matching cement slurry ad the cement slurry oozing out thought the thin joints shall be immediately wiped clean. The joints between the tiles shall not be greater than 1.5mm and shall be kept in straight lines or to suit the required pattern. The junction between wall plaster and tile work shall be finished neatly and without any waviness. All tiles shall be laid as to have continuous lines from various rooms to the passage. No change of lines shall be permitted at junction between rooms and passage. The joints shall be fine and mace neatly indistinguishable by grouting of the joins in cement slurry mixed with suitable colouring pigments to match with the tiles. People should not be allowed to walk over the freshly laid tiles.

Adjustment of levels in thickness of mortar bedding due to different type of flooring if any, shall be done by the contractor within a reasonable limit/ distance as directed by the Engineer-in-charge without any extra cost tot eh Department.

Curing, Polishing and Finishing:

The day after the tiles are laid, all joints shall be cleaned of the gray cement grout with a wire bush or trowel to a depth of 5mm, and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shade of the topping of the wearing layer of the tiles.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be ground evenly with machine fitted with coarse grade frit blocks (no. 60). Water shall be used profusely with grinding. After grinding, the surface shall be thoroughly washed, remove all grinding, mud cleaned and mopped, and the joints opened out during grinding shall be grouted once again wherever necessary with matching cement. The surface shall be gain cured. The second grinding shall then be carried out with machine fitted with fine grade grit blocks (no.120) and shall be grouted again the opened out joints with matching cement.

The final grinding with machine fitted with the finest grade grit blocks (no.320), shall be carried out the day after the second grinding described in the preceding para or before handling over the floor as ordered by the Engineer-in-charge.

For small areas or where circumstances so required, hand polishing may be permitted in lieu of machine polishing after laying, entirely at the discretion of the Engineer-in-charge. For hand polishing, the following carborundum stone shall be used. The polishing shall be done in such a manner that there are no visible scratches on the terrazzo tiles. if scratches are observed, the tiles shall be observed, the tiles shall be removed and replaced by new tiles.

1st Grinding Coarse grade stone (no.60)
2 nd Grinding Coarse Grade Stone (No.60)
Final Grinding Fine grade stone (No. 120)

In all other respects, the process shall be similar as for machine polishing. After the final polish, oxatic acid crystals into powder shall be dusted over the surface (@ 2/3 Ib per 100 sq.ft or 32.5 gm. per sqm.) sprinkled water and rubbed hard with Namdah "block (pad of woolen rags).The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean. If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

Terrazzo / Cement Tile Skirting :

Terazzo tile in skirting shall be of size as specified in schedule of quantities or as directed by the Engineer-in-charge, hydraulically pressed and shall be obtained from the same source as for the terrazzo / cement tiles for flooring. The design and shade of the skirting tiles shall be exactly similar to that of flooring tiles. The specifications for material and workmanship shall be same as for flooring except that the skirting tile shall be laid against a 12mm. thick backing of cement mortar 1:3 to the full height of skirting, thus allowing uniform projection beyond the plastered surfaces. In case of dado, the back of tiles shall be buttered with a coat of grey cement slurry / paste and edges with grey or white cement slurry / paste as the case may be, with or without pigment to match the shade of tiles an set in the backing / bedding mortar. Any cutting of brick work, concrete etc. required due to unevenness of brick. surface shall be carried out at no extra cost to the Department to maintain this uniform projection beyond the plastered surfaces.

The skirting tiles shall be true in plane, line, level ad plumb or flooring the lines. The colour of the skirting tile ad floor tile shall match. The undone portion of plaster work left above the terrazzo tile skirting work shall be finished round or as directed by the Engineer-in-charge in the matching plaster. The item of plastering shall be inclusive of this plaster finishing above the skirting tiles, required to be done after laying of skirting tiles. No additional payment will be admissible for this extra operation.

Mode of measurement :

The length and / or width of the flooring / skirting / dado shall be measured net between the faces of skirting of dado or plaster faces of walls which is the products, and height of skirting / dado shall be measured from the finished level of floor. All openings exceeding 0.1 sqm. in area where tiling is not done shall be deducted and net areas only shall be measured and paid for. Flooring under dado, skirting or plaster shall not be measured for payment. Nothing extra shall be paid for use of cut tiles nor for laying the floor at different levels in the same room.

All dimensions shall be measured correct upto 2 places of decimal of a meter and area so worked out shall be correct upto two places of decimal of a sqm. for flooring, skiriging, dado etc.

Note : Wastage I tile cutting to get the required dimension of rooms etc. as specified in drawing or as directed by the Engineer-in-charge shall have to be taken into consideration by contractor while quoting the rate for work to be measured as above. No extra claim on this account will be entertained.

13.3 Kotah Stone Flooring / Skirting / Facia / Shelves

Materials :

Hand cut, machine cut for exposed edges and machine polished kotah stone shall be of the best quality and of the specified thickness, size and the shade which shall be got approved by the Engineer-in-charge. The size given in schedule of qualities are tentative and can vary only slightly as per the availability in the market. The thickness of the slab after it is dressed shall be 20,25,30 or 40 mm as specified in the item. Tolerance of + 2 mm shall be all allowed for the thickness. In respect of length & width, tolerance in length and width shall be permissible upto + 5mm for hand cut slabs ad + 2 mm for machine cut slabs. At its thinnest, no stone shall be thinner than the specified thickness. The stone shall be hard, sound, durable, resistant to wear, rectangular or square in shape ad as directed by the Engineer-in-charge. Uniformity of size shall generally be maintained for the stones used in any one room. The stone shall be without any soft, venis, cracks or flaws and shall have uniform colour. They shall have natural surface free from broken flakes non top and the exposed surface shall be machine polished to a smooth, even and true plane and the edges hand cut and dressed true and square. The evenness of the surface of slabs and edges of the slab shall not be marred by careless dressing or handling ad no patching up shall be allowed for the slab. The edges shall e quite straight. The under face maybe left as required or rough dressed. Before taking up the work, samples of stone slabs t be used and their dressing and polishing shall be got approved by the Engineer-in-charge and will keep them in his office for reference ad the stone slabs to be used shall conform to the approved sample.

Bedding / Backing coat :

In case of flooring as well as of skirting / dado, mortar bedding shall be cement mortar of thickness and mix specified in the schedule of item.

Construction Details :

Cement mortar as specified for bedding shall be uniformly mixed. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying ad satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that should interfere with the even bedding of the stones. Before spreading the mortar, the sub-floor or base shall be cleaned of all dirt, set mortar scum or laitance ad of loose materials by hacking ad brought to original levels and then well wetted without forming pool of water on surfaces.

Fixing the stone slab / tile :

Before laying the stone shall be thoroughly wetted with clean water, neat cement grout (2.75kg/sqm.) of honey like consistency shall be spread on the mortar bed over as much areas as could be covered with the slabs within half an hour. The specified type of stone shall be laid on the neat cement coat and shall be evenly and firmly bedded to the required level ad slope in the mortar bed. Each stone shall be gently tapped with wooden mallet sil it is firmly and properly bedded.

There shall be no hollows left. If there is a hollow sound on gently tapping off the slab, such slab shall be removed a reset properly. The joints shall be routed with matching cement slurry. Approved pigment shall be used in cement slurry to match with shade of stone. Pigment required to match the shade of stone shall be supplied by the contractor at no extra cost. The stone adjoining the wall shall go about 12mm (about 1/2 ") under the plaster, sorting or dado for the wall. All stone slabs, tiles shall be so laid as to have continues lines from various rooms to the corridors. No change of lines shall be permitted at junction between rooms ad corridors. Only one piece machine cut, Kotah stone shall be used for treads and risers.

Curing :

The flooring shall be kept well wetted with damp ad or water for seven days.

Polishing and cleaning :

When the bedding d joints have completely set d attained required strength, the surface shall be machine polished to give smooth, even ad true plane to the flooring. All flooring shall be thoroughly seaned and handed over free from ay mortar stains etc.

Skirting and dado / Facia :

The quality and type of stone shall be same as mentioned for flooring except of their weight and thickness or backing coat which shall be as mentioned in item schedule. The backing shall conform to the specifications for cement mortar specified in item of terrazzo tiles. Contractor should take into consideration the fact that touching up of the plaster at the junctioning skirting / dado is invariably done after the skirting /dado/facia work is completed and quote rates accordingly. No extra for this touching up will be entertained.

Fixing curing, polishing and cleaning shall be as specified herein before under cement / terrazzo tile skirting, polishing may be done by hand, but a smooth surface ad fine polishing shall be obtained.

Joints shall be done in neat matching cement slurry. The junction of plaster and the upper edges of the dado / skirting shall be finished smoothly as directed by the Engineer-in-charge without any extra cost.

Mode of measurements :

Flooring, skirting and dado/ facia shall be same as that for terrazzo cement tile, flooring / skirting /dado. Sometimes shall be paid on area basis in sqm. calculated to two places of decimal, where length and breadth shall be measured inclusive of bearing correct to a cm. The permissible tolerance in the specified thickness shall be (+) 2mm.

Note : Wastage in obtaining the required machine cut, hand cut sizes as specified from the commercial sizes available in market shall have been taken into consideration by contractor shall quoting the rate for work to be measured as above and no extra claim on this account will be entertained.

13.4 Glazed / Unglazed / Vitrified tile Flooring, Dado / Skirting / Facia

Materials

Tiles :

The tiles shall be of approved make as specified and shall generally conform to relevant Standards.

They shall be flat and true to shape free from cracks, crazing spits, chipped edges and comes. The glazing shall be of uniform shade.

The tiles shall be as specified in the schedule of quantity or drawings. The length of all four sides shall be measured correct to 0.1mm and average length breadth shall not vary more than +0.8 mm from specified dimensions. The variation of individual dimensions from average value of length/breadth shall nor exceed +0.5 mm. Tolerance in thickness shall be (+) 0.4mm.

The thickness of the tile shall not be less than as specified in the items and shall conform to in all respects. Samples of tiles shall be got approved by the Engineer-in-charge before use on the work.

Preparation of Surface and laying of vitrified Tiles :

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc. brushed, washed with water to remove mud, dirt etc. from the surface, wetted and mopped.

20/12 mm thick plaster of CM 1.3 shall be applied d allowed to harden minimum for 48 hours. The plaster shall be roughened with wire brushes or by scratching diagonal lines 1.5mm deep at 7.5 mm center both ways.

The back of tiles shall be buttered with a coat of grey cement slurry paste and edges with white cement slurry and set in the bedding mortar. The tiles shall be tapped and corrected to proper planes ad lines. The tile shall be butt jointed in pattern and joints shall be as fine a possible. The top of skirting /dado shall be truly horizontal ad joints truly vertical. The joints shall be pointed with cementations grout of matching colour of Bal/Roff make.

After a period of curing of 7 days minimum, the tiles shall be cleaned and shall not sound hollow when tapped.

The surface during laying shall be checked with a straight edge2m. long. The surface of skirting shall be kept flush with plaster with chipping of brick work / concrete wherever required.

After the tiles have been laid, surplus cement grout shall be cleaned off.

Mortar and Bedding :

Cement mortar for bedding shall be of proportion specified in items schedule ad shall conform to the specification for materials, preparation etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying.

Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned of all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be even ad smoothly spread over the base by use of screed battens to proper level or slope.

Cement mortar of thickness and proportion as specified in the schedule for dado shall be applied to the wall after preparing the wall surface as specified under cement plaster 20mm thick and brought to correct line and plumb and the surface left rough to receive the tiles.

Fixing of other ceramic tiles for flooring :

The tiles before laying shall be soaked in water for atleast 2 hours. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles which are fixed on the flooring adjoining the wall shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Neat cement mortar grout 1:2, using fine sand (table III, zone IV ad as per IS 383) of honey like consistency shall be spread over the bedding mortar just to cover as much area as can be tiled within half an hour. The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints, shall be kept as close as possible and in straight line. The joints between tiles shall not exceed 1.00 mm, in width. The joint shall be grouted with white cement slurry. After fixing the tiles, finally in an even place or slope, the flooring shall be covered with wet sand an allowed undisturbed for 14 days.

Fixing tiles for Dado and Skirting / Facia :

The dado work, shall be done only after fixing the tiles/slabs on the floor, the approved glazed tiles before laying shall be soaked in water for atleast 2 hors. Tiles shall be fixed when the cushioning mortar is till plastic and before it gets very stiff. The back of the tile shall be covered with this layer of cement mortar 1:3 using fine sand (table III, zone IV, IS383-1963), and the edge of the tile smeared with neat white cement slurry. The tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from bottom of wall upwards without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. The tiles shall be jointed tiles shall be arranged out in cushioning mortar so that all tiles faces are in one vertical plane. The joints between the tile shall not exceed 1.00mm in width and they shall be uniform.

While fixing tiles in dado work, care shall be taken to break the joints vertically. The top of the dado, shall be touched up neatly with the rest of the plaster above If doors, windows or other openings are located within the dado area, the comers, sills, jambs etc. shall be provide with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

Cleaning :

After the tiles have been laid in a room or the day fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting over shall be washed thoroughly clean, In the case of flooring, once the floor has set, the floor shall be carefully washed clean ad dried. When dry, the floor shall be covered with oil free dry saw dust. It shall be removed only after completion of the construction work and just before the floor is used.

Pointing and Finishing :

The joints shall be cleaned off with wire brush to a depth of 3mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement and floor kept wet for 7 days ad then cleaned. Finished floor shall not sound hollow when tapped with a wooden mallet.

Mode of measurement :

Dado / flooring / skirting shall be measured in sqm correct to two places of decimal. Length and breadth shall be measured correct to 1 cm between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening- of area upto 0.-1 sqm The rate shall include all the cost of labour and material involved.

14. WOOD WORK - FRAMES, SHUTTERS AND PANELLING

Wood work :

All timber mentioned in the item in schedule of quantities shall be from the heart of a sound tree of nature growth entirely free from sap wood. It shall be uniform in texture, straight in fibre and shall be well and properly seasoned. It shall be free from large, loose dead or cluster knots, wedges, injuries, open shakes, borer holes, rot, decay, discoloration, soft or spongy spot, hollow pockets, pith or center bore and all other defects or any other damages or harmful nature which will affect the strength, durability, appearance and its usefulness for the purpose for which it is required. Only properly seasoned timber shall be used.

The samples of species to be used shall be submitted by the contractor to the Engineer-in-charge before commencement of the work. The contractor shall produce cash vouchers and certificate from standard kiln seasoning plant as a proof for having been kiln seasoned by them, failing which it would not be accepted as kiln seasoned. Seasoning of timber shall be judged from its moisture content as laid down in I.S. 287-1960. The seasoning of timber shall conform to IS 1141-1993. Scantling of all type of timber shall be straight. Warped scantling shall not be used. Before use in works, the scantling shall be kept in covered and well ventilated place and shall be got approved.

The workmanship shall be of best quality. All wrought timber is to be sawn, planed, drilled or otherwise machine worked to the correct sizes and shall be as indicated in drawing or as specified. All joinery work shall fit truly and without wedging or filing. Wood work in frame work shall be wrought. All frame joints shall be put together with white lead and pinned with hard wood pins securing with corrosion resistant star shaped metal pins as approved by the Engineer-in-charge. If after fixing in position, any shrinking or substandard materials or bad workmanship is detected, the contractor shall, forthwith remove them and replace the same at his own cost, all as directed by the Engineer-in-charge.

Individual members shall be of continuous length. The finished size and sections shall be as per drawing or as specified. The heads and posts of frames shall be through tennoned into the mortises to the full widths as shown in the drawing. All necessary mortising, tennoing, grooving matching, tonguing, housing rebate and other necessary works for correct jointing shall be carried out, in the best workmanship like manner. Joints not specifically indicated shall be recognized form of approved joints for each position. All parts of wood work resting on or set in masonry or concrete shall be well painted with two coat of bituminous paint or solignum as directed by the Engineer-in-charge, prior to installations. All nails, screws, hold fasts, fasts, plates, plugs, pins required for wood work joinery and fixing work, shall be provided by the contractor, at his own cost. All materials shall be approved by Engineer-in-charge before using it in works. Painting of door frames shall be carried out as per specifications for painting for wood work.

All the embedded timber shall be given two coats of hot tar or solignum before erection. This is incidental to the item and shall not be measured for payment.

Teak Wood Glazed Shutters :

The beading required for glazing shall be of the best teak wood and shall be fixed as per the design shown in relevant drawing. Any moldings, carvings shown shall be worked out from the teak wood member of bigger size.

Glazing :

Glazing shall be generally with plain sheet glass of approved make with thickness as mentioned in the schedule of quantities. The detailed specifications for glazing given hereafter shall be followed generally.

Flush Door Shutters:

Solid core flush door shutters shall be of 5 ply construction and approved make generally conforming to the I.S. specification 2202-1991 (specification for wooden flush door shutter – solid core type). The finished thickness of the shutter shall be as mentioned in the schedule of items.

Face Veneers :

Commercial face veneers used in flush door shutter shall conform to the requirements laid down in IS 303-1989 specifications for plywood for general purposes (revised) interior grade.

Decorative face veneers used in flush door shutters shall be of grad-I and shall conform to the requirements of decorative veneered decorative plywood interior grade. Thickness of veneers shall not exceed 1mm.

Adhesives :

Phenol formaldehyde synthetic resin (liquid type adhesives) conforming to IS848-1974 specifications for synthetic resins shall be one piece of size not less than 25mm wide and depth equal to the thickness of core. In case of double leaf shutters, the meeting stiles still have lipping of not less than 35mm deep.

Workmanship and Finish :

All the faces of the door shutter shall be at right angles. The shutter shall be free from twist and warp in its plane. Both faces of the door shutters shall be sanded to a smooth even texture. The workmanship and finish of the face panels shall be in conformity with those specified in I.S. 303-1989 specifications for plywood for general purpose (revised) for commercial type and IS 1659-1990 specification for block boards for decorative type.

Department shall be at liberty to inspect the manufacture of shutters in the factory for its quality of materials and workmanship and all facilities shall be extended for such inspection. Cost of visits will be borne by the contractor.

Tests :

Tests shall be conducted, if required by the Department at contractors cost and acceptance criteria shall be as per IS 2202.

Tolerance :

Tolerance on nominal width and height shall be (+) 3mm. Tolerance on nominal thickness shall be (+) 1.5mm. The thickness of the individual shutter shall be uniform throughout.

Miscellaneous :

Wherever mentioned in the Schedule of quantities, vision panels, Venetians, plastic laminates, push slats etc. shall be provided in the flush doors.

The vision panels shall be of size mention dint eh drawing and shall be provided with teak wood lipping alround the glass. The glass shall be 4mm thick or as specified of best quality (M/s Triveni, I.A.G. Shree Vallath or equivalent approved) free from defects.

Teak wood Venetians or louvers shall generally conform to relevant specifications of timber. Necessary grooves and rebate in frames shall be provided as per drawing.

Formica or approved equivalent plastic laminate of required design, required shade ad colour shall be provided ad fixed on flush door to the required size on any side of the shutter as shown in drawing. It shall be fixed with Fevicol or any other approved adhesive. Fixing shall be done in such a way the there shall not be any air gap, warpage or undulations on the surface. Finished surface of formica shall be cleaned with wax polish.

The shutters shall be painted on commercial facing side with two coats of synthetic / flat oil paint of approved shade ad make over an approved coat of primer. The decorative veneer side of the shutter shall be melamine polished with two or more coats as specified in Schedule of Quantities so as to render a satisfactory surface.

The flush doors shall be single leaf or double leaf type as mentioned in the schedule of quantities. In case of double leaf shutters, the meeting of the stiles shall be rebated 20mm. and shall be either splayed door square type and the T.W. lipping around the meeting shall not be les than 35mm deep. The meeting stiles shall be in single piece.

Sufficient care shall be taken to prevent any damage and loss of shape during handling, transporting, stacking, fixing etc. The door shutters shall be handled with utmost care to prevent any surface damage, warping etc.

Mode of measurement :

The work covered under the respective items in schedule and the above specifications shall be measured as follows:

The cubic contents for wood work shall be measured for the finished size, limiting to those shown in the drawings or ordered by the Engineer-in-charge. The cross sectional dimensions shall be measured equivalent to nearest enclosing rectangle (least rectangle / square) for wrought and planed sizes. The cubical metre. The frames embedded below finished floor shall not be measured.

The square metre areas for shutters shall be measured for the exposed surfaces of shutter between frames from inside or outside whichever is more. The linear dimensions shall be measured upto two places of decimals of a meter. The area for payment shall be worked out correct upto two places of decimals of a square meter. The rate for shutters shall include :

- Cost of supply assembly and erecting in position.
- Cost of polishing, painting, supplying wood preservative, screws, nails, holdfast etc.
- Cost of labour for making adjustments in frames, if required, shutters and also for fixing required fittings and fixtures.

In case of flush doors, the rate for individual item mentioned in the schedule of quantities shall include cot of shutters, labour for provision of glass for vision panel, plastic laminate sheet push plate, teak wood louvers etc. transporting charges and labour for fixing of fixtures and fastening except fixing of door closers and painting and polishing as specified.

19. ALUMINIUM WINDOWS, VENTILATORS, COMPOSITE UNIT ETC

Scope of work :

The scope of work in the tender item includes fabrication supply and installation of anodized matt finished aluminium windows, ventilators, composite units, glazing etc. strictly in accordance with these specifications and relevant detailed approved shop drawings.

General :

The contractor shall submit six copies of shop drawings covering all types. Details of work as generally shown in Architectural drawing and envisaged under these specifications before manufacture. The drawing shall show all dimensions, details of construction, installation, fixtures and relation to adjoining and related work. No fabrication work shall be undertaken prior to the approval of the shop drawings from the Engineer-in-charge. The tenderer shall intimate at the time of tendering, the types of sections he proposes to use on the works.

Materials :

The aluminium alloy used in the manufacture for extruded window section shall correspond to IS 733- 1966 (or any further revision thereof). Extruded sections shall conform to IS designation HE9-WP and Hollow sections shall conform to IS Designation HV9-WP. The frame work, stiles, mullions, beadings, transoms, hinges, pegstays, handles etc. shall be structurally suitable to withstand all the load, the members have to sustain. Contersunk screws, nuts, bolts, washers, rivets and other miscellaneous fastening devices shall be of approved cadmium plated or stainless steel as specified in the approved drawings.

Fabrication :

The frames shall be manufactured square and flat. The corners of the frames shall be fabricated to true right angles. All the fixed, sliding, openable frames shall be constructed from sections which have been cut to length, mitred and mechanically jointed or welded at the corners. Where hollow sections are used with welded joints, argon are welding or flash butt welding shall be employed (Gas welding or brazing not to be done). Sub-dividing bars of units shall be tennoned an riveted into the frames. Water bar in aluminium section shall be provided. The dimensions shown in the drawings are overall heights and widths to the outside of frames of aluminium windows. The side hung shutters shall have projected friction type hinges of aluminium alloy. Concealed projected hinges having structural stability and of good quality will also be considered only after the inspection of the sample submitted by the tenderer. The necessary pegstays, handles, windows fasteners etc. shall be of aluminium. The handle shall be mounted on a handle plate riveted to the opening frame. The pegstays shall be 300mm. long or as required complete with peg and locking bracket and shall have holes for keeping the shutters open in three different positions. No field fabrication of frames is permitted. The complete fabricated assembly shall be anodized in approved satin finish with minimum film thickness of 0.015 mm. for the entire surface. A thick layer of clear transparent lacquer based on methacrylate or cellulose butyrate shall be applied on the finished sections for the aluminium windows etc. by the supplier to protect the surface from wet cement, lime, dirt, dust etc. during the installation. This lacquer coating shall be removed after installation is complete, if approved by the Engineer-in-charge and all sections of the windows shall be protected by the Engineer-in-charge and all sections of the windows shall be protected by P.V.C. film covering.

Hardware :

All cut outs, recesses, mortising or milling and operation required for fixing the hardware shall be accurately made reinforced with packing plate as required to ensure adequate strength of the connection. All the hardware, accessories shall be of best approved type and of anodized finish same as for the frame and other sections. All hardware shall be free from defects which may affect the appearance and serviceability. All hardware shall be fixed after obtaining the prior approval of the Engineer-in-charge. Approved samples of hardware shall be kept in the custody of Engineer-in-charge.

Fixing :

The window frames shall be accurately fixed in the brick masonry or R.C.C. work. The fixing of the frame shall be done with cadmium plated brass counter sunk screws driven on the teak wood rough grounds if required or fixed tot eh walls with holdfasts. All aluminium windows shall be fixed in position as per IS 1081-1960 (or any revision thereof): Code of practice for fixing and glazing of aluminium windows. All joints between metal and masonry / rough ground wooden frame shall be fully caulked and mastic or polysulphide compound in order to ensure water tight joints. Joints shall be neatly painted with matching cement an excess materials shall be removed. Hardware shall be fixed in workman like manner all as directed by the Engineer-in-charge.

Samples :

The sample of different windows shall be submitted to the Engineer-in-charge for approval.

Glazing :

The glazing shall be of Indian make plain sheet / frosted figured glass of special selected quality and size as mentioned in item description and drawings shall be of M/s Triveni / Saint Gobain / I.A.G./ Modi make The specifications specified herein before shall hold good as far as applicable Glazing will be paid on square metre basis.

Mode of measurement :

Payment will be made on the basis of weight of fabricated anodized aluminium frames/ members/fixtures along with all fittings actually installed in position without any extra allowance for wastage.

Guarantee :

All materials and workmanship in above work shall be guaranteed for a period of one year (unless otherwise specified) from the date of handling over. Unqualified performance guarantee for smooth operations of the windows, doors, wall spans and precautionary measures against leakages etc. shall be furnished by the contractor on stamped paper. If so specified, in schedule of quantities. Any defect found during the guarantee period shall be replaced / made good to the original conditions/positions entirely at the cost of the contractor.

Testing:

All windows shall be tested for water tightness. Any leakage found during testing shall be rectified by the contractor without extra charge.

20. M.S. GRILLS/RAILING

General :

The contractor shall submit 6 copies of shop drawings shall show all dimension, details of construction, installation relating tot eh adjoining work.

Materials :

All structural steel shall conform to IS 226-1963 sections for grills and shall be free from loose mill scales, rusts, pitting or any other defects affecting its strength and durability.

Fabrication :

The grills shall be fabricated to the design and pattern shown in the drawings. All joints shall be made in best workman like manner with slotting and welding as required to the specified size and shape. The edge of the M.S. flats shall be suitably mitred before welding to get the desired shape. The joints shall be filled to remove excess stay after welding screws, nuts, washers, bolts, rivets and any other miscellaneous fastenings devices shall be of steel and shall be provided by the contractor.

Manufactured M.S. Grills then be fixed in between the posts, balusters, M.S. frame work etc. to correct alignment. Any undulations, bends etc. found shall be rectified by the contractor at his own cost. The complete assembly of rill / railing so fixed shall be firm and there shall not be any lateral movements.

Samples :

Samples of grill and railings shall be submitted for approval of the Engineer-in-charge and to be got approved before taking up for mass fabrication.

Installation:

The approved grills shall be fixed in position where specified and shown in drawings including in masonry walls, teakwood frames, hand railings etc. Any damages to walls, frames etc. caused during fixing the grills shall be made good by grouting with cement mortar/packing /repairing properly at the contractors cost.

Painting :

Painting shall be done as per the specification specified under painting.

Mode of measurement :

Actual area of M.S. grill manufactured and fixed in position shall only be measured in square metre for payment. All measurements shall be taken to two places of decimal of a metre and area shall be calculated to second place of decimals of a square metre. The rate is to include the cost of all materials, labour, transporting, fabricating, installing, scaffolding if necessary, grouting etc. complete.

Finishing / Painting/Polishing for railing :

Teak wood hand rail shall be polished with wax polish / French polish / melamine with two or more coats over one coat of wood/primer or painted with two coats of synthetic enamel paint / flat oil paint of approved make and shade over one coat of approved primer. M.S. grills, balusters, etc. also to be painted as per specifications specified under Painting/ Polishing.

Mode of measurements (hand rails) :

Hand railing shall be measured for payment in running metre. The lengths shall be measured along the top center line of the hand rail and shall be measured between ends of balusters, newels, posts as the case may be upto two places of decimals of a metre. Rates shall include fabrication, leaving suitable pockets, grouting the same, providing an fixing suitable teak wood plugs, fixing, all labour, materials, transport, painting/polishing, finishing and scaffolding if necessary.

22. CEMENT PLASTERING FOR WALLS AND CEILINGS & SAND FACE PLASTERS

Scope of work:

The work covered under these specification consists of supplying all material for rendering all types of plaster / pointing finishes strictly in accordance with these specifications, applicable drawings etc.

General :

Cement, sand and water required for the work shall conform to specifications laid down herein before under section cement concrete (plain and reinforced), except that sand for finishing coat shall generally conform to IS 1542-1960. the plastering works shall generally conform to IS 1661-1987(pt.III) Code of practice for cement plaster finish on walls and ceilings). All general precautions as specified in I.S. 1661-1987 (pt.III) clause 8, shall be taken and preparation of the background shall be done as laid down in IS 1661 clause 12 and IS 2402-2963 shall be generally followed for sand faced plaster work. Scaffolding required for facility of working shall be provided by the contractor at his own cost. This may be double or single according to the requirement and shall be approved by the Engineer-in-charge stage scaffolding shall be erected when ceiling plastering is done. The contractor shall be responsible for accidents if any, take place. The contractor shall co-operate with the other agencies for fixing switch boxes at specified locations so that the boxes are fixed properly in line with finished plaster surface. All finishing in and around these boxes as also around the conduit boxes in ceiling shall be done by plastering contractor without any extra cost to the Department. The decision of the Engineer-in-charge in this regard shall be final and binding on the contractor.

Preparation of Surface :

The surface to be plastered shall first be thoroughly cleaned of all muck and cleaned down. All joints shall be racked to in case of brick work / stone masonry and closely hacked in case of concrete as the work proceeds. The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing to work. The mortar for all plaster work shall be cement mortar of mix as specified in the schedule of quantities.

After erection of scaffolding and before commencement of plastering work, top most junctions / joints / sides with beam / column shall be thoroughly packed with cement mortar to prevent cracks.

Before commencement of plastering operation, the contractor shall ensure that all the service pipes, electrical conduits, boxes, switch boxes etc. have been installed in position by other agencies and the plastering surface is duly approved by the Engineer-in-charge. In order to enable other service contractors to fix the electrical conduit boxes, EDB's, pipes, outlets etc. in proper level and line with reference tot eh finished surface of the plaster. Thiyyas and Tapanis i.e. finished plaster patches shall be given by the main civil contractor on walls, ceiling at regular intervals well in advance of his plaster work at no extra cost to the Department. The entire work of preparation of surface before plastering shall thus be co-ordinated by the main civil contractor with all other agencies working at site.

Just before actual plastering work is taken up in hand, all the ceilings and walls etc. shall be marked with plaster buttons indicating the thickness of plaster required and which shall be in true line, level and plumb. The contractor shall get these marks approved by the Engineer-in-charge before starting the plastering work. The contractor shall also be responsible to render the final surface true to line, level and plumb etc.

All building operations like construction of walls, concreting etc. shall have been completed before plastering is taken up. The plastering operation should be taken up only after the service pipes etc. that are to embedded in the wall or ceiling are completed and suitably protected against crossion by other agencies and okayed by the Engineer-in-charge. Damage if

caused to any of the existing fittings, fixtures, including doors and windows etc. during the plastering operation shall be made good
by the contractor at his own cost.

If the surface which is to be plastered either internally or externally is out of plumb and not in lien and level and if the plastering to be done is more than specified thickness to bring the plastered surface to perfect lien and levels in such specific cases, chicken wire mesh is to be provided by the on contractor at his own cost and the plaster should be done to required lien an level with no extra cost whatsoever.

The finished plastered surface shall be free from cracks, fissures, crevices, hair cracks, blistering, local swellings and flaking. The finished surface shall be true to line, level, plumb and plain and durable. The adhesion of the mortar with the background surface is of prime importance as this affects durability of plaster. Preparation of surface which has to take plastering work the surface should be got approved by the Engineer-in-charge.

In order to avoid the formation of deep and side cracks an for dispersion for cracks at the junctions between concrete surfaces and brick masonry works, cautionary measures such as fastening and lapping of chicken mesh over the junction areas should be carried out over which the plastering work has to be taken up as required by the Engineer-in-charge.

The minute gap between window / door frames with cills and jambs should be filled up / caulked by plaster of Paris / epoxy putty / silicon sealants, Rubber based sealants (brand name TECHMAT /TECHCOAT) by caulking guns or by approved methods as instructed / approved by Engineer-in-charge.

Groves :

The grooves shall be of required dimensions. The same shall be made to turn wherever necessary. The finish, inside, shall be of the same finish as that of the plaster. The lines of the grooves shall be well defined and rounded. The grooves are to be provided in plastering in internal and external surfaces shall be included in the rates wherever mentioned in the schedule of quantities.

Mix Proportion :

The mortar for plastering shall be of proportion as specified in the item schedule. The mixes specified in the schedule are volumetric.

Mixing :

Cement and fine aggregates shall be mixed dry in the required proportions to obtain a uniform colour. Water shall then be added tog et the required consistency for the plaster.

Mixing shall be done mechanically. However, manual mixing will be allowed only in exceptional circumstances at the discretion of the Engineer-in-charge. Manual mixing, where adopted, shall be carried out on a clean water tight platform. After water is added during mixing, the mix shall be held back and forth for 10 to 15 minutes.

In machine mixing, the mixer shall run atleast placing all the ingredients in the drum. Only so much quantity of mortar which can be used within half an hour after the addition of water shall be prepared at a time. Any mortar for plaster which is set or partially set shall be rejected and shall be removed for the with from the site.

10mm Plaster :

The plaster shall be laid with somewhat more than 10mm, thickness and pressed and leveled with wooden ruler to a finished thickens of 10mm. Straight edges shall be freely used to

ensure a perfectly even surface. All exposed angles and junctions of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

15mm Plaster:

The proportions of sand and cement shall be as specified an shall cover all irregularities, undulations, depressions due to chasing etc. in the surface o be plastered. The mortar shall be applied slightly more than 15mm thick and pressed and leveled with wooden ruler or straight edge to finished thickness of 15mm. Straight edges shall be freely used to ensure a perfectly even surface. The finished surface shall be true and even and present uniform texture throughout and all joining marks shall be eliminated. All corners, edges and angles shall be made perfectly to line, place and plumb. All exposed angles and junction of walls, doors, windows, beams, slabs etc. shall be carefully finished so as to furnish a neat and even surface.

Plastering items amongst all other things as described in various items also include:

1) Preparation of surface to receive the plaster, providing cement plaster of he specified average thickness and proportions with specified number of coats.
2) All labour, materials, scaffolding, use of tools and equipment to complete the plastering work as per specifications.
3) Curing for 10 days.
4) Cleaning the surface of doors, windows, floors or any other surfaces where plastering might have splashed.
5) Finishing the portion of plaster left above the terrazzo, Plain cement tiles, ironite or any type of skirting work to be finished rounded or as directed by the Engineer-in-charge, in a separate operation after laying of floor tiles skirting.

Sand Faced Cement Plaster :

General :

Materials and preparation of surfaces and scaffolding etc. for sand faced plaster wherever applicable shall conform to specification laid down herein before under section cement plastering and the following specifications are also to be complied with.

Preparation of Surface :

The surface to be plastered shall first be thoroughly cleaned down. All joints shall have been raked out in case of brick work/stone masonry as the work proceeds. Concrete surface shall also be clearly hacked and wire brushed if not already done before plastering is taken up. The surface to be plastered shall be well wetted for a minimum period of 6 hours before commencing the work. The mortar for all plaster work shall be cement sand mortar of mix as specified in the schedule of quantities.

Double scaffoldings required for facility of construction shall be provided by the construction at his own expenses wherever directed by the Engineer-in-charge, Scaffolding shall be erected with pipes or bellies or bamboos of adequate strength so as to be safe for all the dead, live and impact loads likely to sustain by it during construction operations. The contractor shall take all measures to ensure the safety of the work and workmen. Any instruction of the Engineer-in-charge in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to Government property or injury to persons, resulting from faulty scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach for workmen and supervisory staff to every part of the work Ballies, Bamboos etc. for scaffolding shall not be tied to the windows, doors, mullions, ventilators etc. Any damage done to the windows, doors, etc. shall be made good by the contractor to the original conditions at his own cost. For better safety, steel pipe scaffolding is preferred.

Workmanship :

The surface to be plastered shall first be dubbed out with cement mortar to cover all irrgulatities and faces upto proudest part. The dubbing coat which shall be of proportion as specified in schedule and a 12mm thick (1/2") layer shall then be applied/scored and keys shall be formed on the surface by thoroughly combing it with heavy horizontal lines about 12mm (1/2") apart and about 3mm (1/8") deep when mortar has just set.

The cement mortar for sand faced plaster shall have washed and approved sand with slightly larger proportions of coarse materials, but not exceeding 3mm. The proportion of cement to sand shall be as specified in the schedule. The water is gradually added to make the mixture homogenous. The thickness of finishing coat excluding key shall be 8mm (about 5/16"). After application the surface should be finished with a wooden float lined with a wooden float lined with cork closely pricked on with a wet sponge tapped gently to bring sand particles into prominence.

The chajjas and any other horizontal portions shall be cleaned and set mortar that might have been fallen at the time of plastering at higher elevation, before plastering the same is taken up. Vatas shall be done simultaneously with chajja plaster.

Mode of Measurement :

Area of plastering will be measured net and shall be paid for. The measurement of length of wall plastering shall be taken between walls or partitions (dimensions before plastering shall be taken) for the length and from top of the floor or skirting or dado as the case may be to the under side of ceiling for the height. All openings more than 0.1 sqm. shall be deducted and all jambs, so fits, sills of these openings if done, will be measured to arrive to the net area for payment. No opening less than 0.1 sqm. shall be deducted and no jambs etc. for such openings shall be measured for payment. The rate hall include the cot of finished all the edges, corners, cost of all materials, labour, scaffolding, transport, curing etc.

The rate shall include the cost of finishing all the edges, corners, cost of all materials, labour, transport, scaffolding, curing etc. and grooves if so specified in the item of schedule of quantities.

The rate for plastering should include the cost of work towards the following items for co-ordination with electrical item:

- Neatly plastering around DB's junction boxes, M.S. boxes etc. should be done and made matching with the wall finish after installation of electrical equipments.
- All BD's service boxes, covers etc. should be covered by a plastic cloth of other suitable covering material such that water or materials should not splash the same during brick work and plastering work. This is to be done in such a way that electrical equipments as well as painted surfaces are not spoiled.
- For fixing M.S. boxes, DB's etc. Thiya should be given such that the required face of the M.S. box, DB covers etc. in line with final finished plastered surface.
- The rate for the item shall also include rounding up of corner and angles making sharp corners and angles finishing around ceiling rose and electrical fittings etc. fixed by other agencies, finishing of top of dado and skirting (zad finishing), junctions of roof and wall or beam with the finish as specified in the item. Plastering of brick and concrete cornice and copings and plastering in restricted areas if any shall not be measured separately. Architectural bands and narrow widths of plaster over structural as well as non-structural and the line when prepare dint eh same thickness of plaster shall not be measured separately and shall be covered by respective plaster items.

24. PAINTING

Scope of work :

The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail hereinafter with the item of schedule of quantities.

Materials :

Paints, oils varnishes etc. of approved brand and manufacture shall be used. Ready mixed paints as recovered from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-charge shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or atleast a fortnights work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-charge. The empties shall not be removed from the site for work, till the relevant item of work has been completed and permission obtained from the Engineer-in-charge.

The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

Commencing Work :

Scaffolding :

Wherever scaffolding is necessary, it shall be erected on double supports ties together by horizontal pieces, over which scaffolding planks shall be fixed. No bellies, bamboos or planks shall rest on or touch the surface which is being painted.

Were ladders are used, pieces of old gunny bags shall be ties on their tops to avoid damage or scratches to walls.

For painting of the ceiling, proper stage scaffolding shall be erected.

Painting shall not be started until and unless the Engineer-in-charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

Painting, except the priming coat, shall generally be taken in hand after all other builders work, practically finished.

The rooms should be thoroughly swept out entire building cleaned up atleast one day in advance of the paint work being started.

Preparation of Surface :

The surface shall be thoroughly cleaned. All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches if any in plastered / form finished surfaces shall be repaired and finished in line and level in C.M/ 1:1 and cracks and crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Engineer-in-charge after inspection, before painting is commenced.

Application :

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.

The external surfaces of the buildings under reference including he R.C.C. Jalli, fins and the panels above and the panels above and below the window etc. shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Departments approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Departments approval for the same.

The painting shall be laid on evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing and laying off consists of covering the area with paint, brushing the surface hard for the first time and then brushing alternately in opposite directions two or three time 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 will constitute one coat.

Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails.

Each coat shall be allowed to dry cut thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation.

Each coat except he last coat, shall be tightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly closed.

The final painted surface shall present a uniform appearance and no streaks, blisters, 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.

In case of cement based paints / primers, the absorbent surfaces shall be evenly damped so as to give even suction. In any weather, freshly painted surfaces shall be kept damp for atleast two days.

In painting doors and windows, the putty around the glass panes must also be painted, but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out while painting. Prospect covers of electrical switch boxes have to be painted from inside by removing them. Care shall be taken while removing them in position after painting with respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

The additional specifications for primer and other coats of paints shall be as in accordance to the detailed specifications under the respective headings.

Any damage caused during painting work to the existing works / surfaces shall be made good by the contractor at his own cost.

Brushes and Containers :

After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall be kept at a place free from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean and can be used again.

Measurement :

Painting, unless otherwise stated shall be measured by area in square metre. Length and breadth shall be measured correct upto two places of decimal of a metre.

No deduction shall be made for opening not exceeding 0.05 sqm. and no addition shall be made for painting to the beading, moulding edges, jambs, soffits, sils, architraves etc. of such openings.

In measuring painting, varnishing, oiling etc. of joinery and steel work etc. the co-efficient as in the following table shall be used to obtain the areas payable. The co-efficient shall b applied to the areas measured flat and not girthed in all cases.

In case of painting of door shutter with push plates in plastic laminate, deduction will be made for area of such laminations.

Precautions :

All furniture, lightings, fixture, sanitary, fittings, glazing, floors etc. shall be protected by covering and stains, smears, splashing, if any shall be removed and any damage done shall be made good by the contractor at his cost.

Rates :

Rates shall include cost of all labour and materials involved on all the operations described above and in the particular specifications given under the several items.

24.2 Painting, Priming coat on Wood, Iron of Plastered Surfaces

Primer

The primer for wood work, iron work or plastered surface shall be as specified in the description of the item.

Primer for wood work / Iron & Steel / Plastered / Aluminium surfaces shall be as specified below:

Sl.No.	Surfaces	Primer to be used
a)	Wood work (hard and soft wood)	Pink conforming to IS 3536 – 1966
b)	Resinous wood and ply wood	Aluminium Primer
c)	Iron & Steel, aluminium and galvanized steel Work :	Zinc chromate primer conforming to IS 104-1962
d)	Plastered surfaces, cement brick work, Asbestos surfaces for oil bound distemper and paint	Cement primer

The primer shall be ready mixed primer of approved band and manufacture.

Preparation of Surface

Wood work :

The wood work to be painted shall be dry and free from moisture.

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material with same shade as paint shall be used where so desired by the Engineer-in-charge.

The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glaziers putty or wood putty (for specifications for glaziers putty and wood putty – refer as mentioned herein before). Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.

Iron and Steel Work :

All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.

All dust and dirt shall be thoroughly wiped away from the surface.

If the surface is wet, it shall be dried before priming coat is undertaken.

Plastered Surface :

The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall be taken in had. Before primer is applied, holes and undulations, shall be filled up with plaster of Paris / putty and rubbed smooth.

Application :

The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described herein before.

Other details :

The specifications for Painting (General) shall hold good so far it is applicable.

24.3. Painting with superior quality and Flat Oil ready mixed paints on new Surface

Paint :

Ready mixed paints shall be of approved brand and manufacture and of the required shades. They shall conform in all respects tot eh relevant IS specifications.

Preparation of Surface

Wood work :

The surface shall be cleaned and all unevenness removed as in para 32.10.2 (a). Knots if visible shall be covered with a preparation of red lead. Holes and indentations on

the surface shall be filled in with glaziers putty or wood putty and rubbed smooth before painting is done. The surface should be thoroughly dry before painting.

Iron and Steel work :

The primer coat shall have dried up completely before painting is started. Rust and scaling shall be carefully removed by scraping or by brushing with steel wire brushes. All dust and dirt shall be carefully and thoroughly wiped away.

Plastered Surfaces :

The priming coat shall have dried up completely before painting is started. All dust or dirt that has settled on the priming coat shall be thoroughly wiped before painting is started.

Application :

The specifications mentioned herein before shall hold good as far as applicable.

The number of coats to be applied will be as stipulated in the item. The painted surface shall present a uniform appearance and glossy / semiglossy finish, free from streaks, blisters etc.

Other Details :

The specifications for painting (general) specified herein before shall hold good in so far as they are applicable.

24.4. Painting with synthetic enamel / Semi glossy Paint on new work

Paint :

Synthetic enamel / semi glossy paint of approved brand and manufacture and required shade shall be used for the top coat and an under coat of shade to match the top coat as recommended by the manufacturer shall be used. The paint shall be conforming to IS : 1932-1964.

Preparation of Surface :

This shall be as per painting with superior quality ready mixed paint as mentioned herein before.

Application :

The number of coats including the under coat shall be as stipulated in the item.

Under Coat :

The coat of the specified paint of shade suited to the shade of the top coat shall be applied and allowed to dry over night. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface free from brush marks and all loose particles shall be dusted off. All the cracks, crevices, roughness etc. will be filled with approved putty as per manufacturers recommendations.

Top coat :

Finishing coats of specified paint of the desired colour and shade shall be applied after the under coat is thoroughly dried. Additional finishing coats shall be applied if found necessary to ensure a proper and uniform semi glossy surface.

Other Details :

The specifications for "Painting (General)" mentioned herein before shall hold good as far as they are applicable.

24.5. Painting with Acrylic Emulsion / Plastic Emulsion Paint

This shall be polyvinyl based Acrylic / plastic emulsion paint of approved manufacture of the required shade conforming to IS 5411-1969.

Primer :

The primer to be sued for the painting with acrylic emulsion on cement concrete surfaces, plastered surfaces, A.C. sheets, timber and metal surfaces, if necessary shall be of approved base and as per recommendations of he manufacturers.

Putty :

Plaster filler to be used for filling up (putting) uneven surfaces, small cracks and holes etc. shall be of approved compound and as per recommendations of the manufacturers. No oil based putty shall be used. The putty should be made from a mixture of whiting and plastic emulsion paint or as per manufacturers recommendations.

Finishing coats:

All the finishing coats shall be of matt finish or any other finish as required by the Engineer-in-charge. The number of finishing coats shall be as specified in the item.

Mode of measurement:

All the measurements for payment shall be taken on net surface area actually painted, unless otherwise specified. Deduction will be made form the areas for fixtures, frills, ventilation, outlets, electrical boxes and such obstructions not painted, if they are individually more than 0.05 sqm.

Acrylic emulsion paint is required to be provided on plastered and concrete surfaces in portions of the building. The Department shall reserve the option to delete or increase quantities in full or part from the scope of contract during progress of work.

All wood surfaces are to be pointed with semi glossy synthetic enamel paint with an approved primer.

All shades and colours of paints shall be subjected to review and prior approval of Engineer-in-charge shall be taken before the application.

White Washing with lime

Preparation of surface :

Before new work is white washed, the surface shall be thoroughly brushed free from mortar dropping and foreign matter.

In the case of old work, all loose pieces and scales shall be scrape off and holes in plaster as well as patches of less than o.5 sqm. area each shall be filled up with mortar of the same mix. Where so specifically ordered by the Engineer-in-charge, the entire surface of

old white wash shall be thoroughly removed by scrapping and this shall be paid for separately.

Preparation of lime wash :

The wash shall be prepared from fresh lime stone white lime. The lime shall be thoroughly slaked on the spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 40 gm. of gum dissolved in hot water or Fevicol DDL Binder which shall be added to each 10 cubic decimeter of the cream. The approximate quantity of water to be added in making the cream will be 5 litres of water to one kg. of lime.

Indigo (Robin Blue) upto 3 gm per kg. of lime dissolved in water, shall then be added and wash stirred well. Water shall then be added at the rate of about 5 litres per kg. of lime to produce a milky solution.

The lime shall be tested in a chemical laboratory and test certificate submitted, to conform the quality of lime with regard to its physical and chemical properties. The cost of testing lime shall be borne by the contractor.

White washing:

The white wash shall be applied with brushes or by spray in the specified number of coats. The operation for each coat in the case of brush application shall consist of a stroke of the brush given from the top downwards, another from the bottom upwards over the first strike, and similarly one stroke horizontally from the right and another from the left before it dries.

Each coat shall be allowed to dry before the next one is applied. Further reach coat shall be inspected and approved by the Engineer-in-charge before the subsequent coat is applied. No portion of the surface shall be left out initially to be patched up later on.

For new work, three or more coats shall be applied till the surface present a smooth and uniform finish through which the plaster does not show. The finished dry surface shall not show any sign of cracking and peeling nor shall it come off readily on the hand when rubbed.

For old work, after the surface has been prepared as described hereinbefore, a coat of white wash shall be applied over the patches and repairs. Then a single coat or two or more coats of white wash as stipulated in the description of the item shall be applied over the entire surface. The white washed surface should present a uniform finish through which the plaster patched do not appear. The washing on ceiling should be done prior to that on walls.

Protective measures :

Doors, windows, floors, articles of furniture etc. and such other parts of the building act to be white washed shall be protected from being splashed upon. Splashing and droppings, if any, shall be removed by the contractor at his own cot and the surfaces cleaned. Damages, if any to painted surfaces, furniture or fittings and fixtures etc. shall be recoverable from the contractor.

Measurements :

All measurements for payment shall be taken on net surface areas actually white washed, unless otherwise specified. Deductions will be made from the areas for fixtures, grills, ventilation, outlets, electrical boxes and such obstruction not painted if they are individually more than 0.05 sqm. Length and breadth shall be taken correct upto two places of decimal of a metre and areas so worked out shall be correct upto two places of decimals of a square metre.

Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the percentages to allow for the girthed area :

Corrugated asbestos cement sheets : 20%

Semi-corrugated asbestos cement sheets : 10%

The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.05 sqm. each with materials similar in composition to the surface to be prepared.

Rate :

The rate shall include the cost of all materials and labour involved in all the operations described above.

Colour Washing :

In the case of colour washing, mineral colours, not affected by lime, shall be added to white wash with proper glue. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Engineer-in-charge. The colour shall be of even tint or shade over the whole surface. It is patchy or otherwise, badly applied, it shall be redone by the contractor, at no extra cost to the Department.

For new work, the priming coat shall be of white wash lime or with whiting as specified in the description of the item. Two or three coats, shall then be applied as specified on the entire surface till it represents a smooth and uniform finish. Each coat after applying shall be got approved from the Engineer-in-charge.

The finish dry surface shall not be powdery and shall not readily come off on the hand when rubbed. Other specifications as detailed for Whitewashing with lime shall be applicable. Indigo (Neel) shall however, not be added.

Distempering

a) Distemper:

Dry distemper (IS 427 – 1965) of approved brand and manufacture, colour and required shade shall be used. The distemper shall be stirred slowly in clean water using 0.6 litre of water per kg. Of distemper or as specified by the manufacturers. Warm water shall preferably be used. It shall be allowed to stand for at least 30 minutes before use. The mixture shall be invariably well stirred before and during use to maintain an even consistency.

b) Preparation of Surface :

This shall be as for painting work mentioned herein before in so far as it is applicable.

c) Application :

In case of new work, the treatment shall consist of priming coat followed by the application of two or more coats of distemper till the surface shows an even colour.

Priming coat:

- Priming coat of whiting shall be applied over the prepared surface. The whiting (ground white chalk) shall be dissolved in sufficient quantity of warm water and thoroughly stirred to form a th9icn slurry which shall then be screened through a clean coarse cloth. Two kg. of gum and 0.4 kg. of copper sulphate dissolved separately in hot water shall be added for every cum. of the slurry which shall then be diluted with water to the consistency of milk so

as to make a wash ready for used. No white washing coat shall be used as a priming coat for distempering.

- The application of each coat as mentioned in the specifications for painting (General) herein before, shall hold good, as far as it is applicable.

24.6. Oil Emulsion (oil bound) Distempering / Acrylic Distemper

a). Oil bound distemper :

(IS 428-1969) of approved brand and manufacture, colour and required shade shall be used. The primer where used as on new work shall be cement primer or distemper primer as specified in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by manufacture. Only s quality of distemper required for days work shall be prepared.

b) Preparation of surfaces :

The surface shall be prepared as described herein before for painting work in so far as it is applicable and approved putty / filler shall be applied to the entire area to get uniform and smooth surface before application of primer.

Application :

The cement primer or distemper primer shall be applied by brushing and not by spraying. Hurried priming work shall be avoided, particularly on absorbent surfaces. New plaster patches in old work before applying oil bound distemper primer. The surfaces shall be finished as uniformly as possible leaving no brush marks, priming coat shall be allowed to dry for atleast 48 hours before oil bound is temper is applied. Before applying distemper, the surface shall be lightly sand prepared to make it smooth for receiving, the oil bound distemper, taking care not to rub out the priming coat. A time interval of atleast 24 hours shall be allowed between consecutive coats to permit the proper drying of the preceding coat. Two or more coats of distemper as are found necessary shall be applied over the priming coat to obtain an even shade.

Other details :

The specifications for "Painting (General)" mentioned herein before shall hold good as far as it is applicable.

24.7 Water Proofing Cement based paint

a) Material :

Cement based paint (IS 5410-1969) of approved manufacture, quality, shade and colour only shall be used.

b) Preparation of surfaces :

The surface shall be thoroughly cleaned off all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing the surfaces. The surface shall be thoroughly wetted with clean water before the water proof cement paint is applied. The prepared surfaces shall be got approved before painting is commenced.

The water proof cement paint shall be mixed in such quantities as can be used up with in an hour of its mixing as other wise the mixture will set and thicken, affecting flow and finish.

Water proof cement paint shall be mixed with in two stages. The first stage shall comprise of 2 parts of water proof cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the water proof cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one

part of water to the mix and stirring thoroughly to obtain liquid of workable and uniform consistency. In all cases the manufacturers instruction shall be followed meticulously.

c) Application :

The solution shall be applied on the clean and wetted surface with brushes spraying machine. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun during painting, the cement based paint shall be applied on the surfaces already treated with white wash, dry or oil distemper, varnishes, paints etc. it shall not be applied on gypsum, wood and metal surfaces.

d) Other details :

The specifications for painting (general) mentioned herein before shall hold good as far as they are applicable.

e) Mode of measurement for dry distemper, oil bound distemper and water proof cement Paint:

All measurement for payment shall be taken on net surface area actually paint unless otherwise specified and no co-efficient shall be applied for working to areas. Deduction will be made from areas for opening / obstructions not painted, if they are individually more than 0.05 sq.m. Length and breadth shall be taken correct upto two places of decimal of a meter and areas shall be worked out correct upto two places of decimal of a square meter.

Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentage to allow the girthed area a) Corrugate asbestos cement sheets – 20% b) Semi corrugated asbestos cement sheets – 10%. The number of coats of each treatment shall be stated in the schedule of quantities. The whole surface shall be applied with approved putty / filler to get uniform and smooth surface at no extra cost tot eh Department.

Rates :

The rate shall include cost of all materials and labor involved in all the operation described above.

24.8. Bees Waxing of Polishing with Readymade Wax Polish (New Work):
Materials :

The polishing shall be done with bees waxing prepared locally or with ready made wax polish of approved brand and manufacture, as stipulated int eh description of item.

Where bees waxing is to be prepared locally, the following specifications for the same shall apply :

Pure bees wax free from paraffin or stearing adulterants shall be sued. Its specific gravity shall be 0.965 to 0.969 and melting point shall be 63 0 C. The polish shall be prepared from a mixture of bees wax, linseed oil, turpentine and varnish in the ratio of 2:1.5:1:05 by weight.

The bees wax and boiled linseed oil shall be heated over a slow fir. 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 the entire mixture shall be well stirred.

24.9 Preparation of Surface :

Preparation of surface will be as mentioned herein under para 32.20.2 with the exception that knotting, holes and cracks shall be stepped with a mixture of fine saw dust

formed of ht wood being treated, beaten, beaten up with sufficient bees wax to enhance cohesion.

Application :

The polish shall be applied evenly with a clean soft pad of cotton cloth in such way that the surface is completely and fully covered. The surface is then rubbed continuously for half an hour.

When the surface is quite dry, a second coat shall be applied in the same manner and rubbed continuously for one hour or until the surface is dry.

The final coat shall then be applied and rubbed for two hours (more if necessary) until the surface has assumed a uniform gloss and is dry showing no sign f stickiness.

The final polish depends largely on the amount of rubbing which should be continuous and with uniform pressure with frequent changes in the direction.

Other details :

The specifications for painting (general) as mentioned herein before shall hold good as far as they are applicable.

French Spirit Polishing (On new work with a coat of wood filler):

Polish :

Pure shellac 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.

Preparation of surface :

The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted off. Knots if visible shall be covered with a preparation to red lead and glue size laid on while hot. Holes and indentations on the surface shall be stopped with glaziers putty. The surface shall then be given a coat of wood filler made by mixing whiting (ground chalk)in methylated spirit The surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.

Application :

The number of coats of polish to be applied shall be as described in the item.
A pad of wooden cloth covered by fine cloth shall be used to apply the polish. The and shall be moistened with the polish and rubbed hard on the wood, in a series of overlapping circles applying the mixture sparingly but uniformly over the entire area to give an even level surface. A trace of linseed oil on the face of the pad facilitates this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cotton cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.

Measurement, Rate and other details :

These shall be as for painting (general) mentioned herein before as far as they are applicable.

24.10. Resin based Thermo Plastic Paint (Decorative and Protective Finish) :
Materials :

Resin based thermo plastic paint such as Sandtex Matt or other equivalent approved manufacture, colour and shade shall only be used.

Preparation of Surface and General :

The specifications for painting (General) described herein before shall hold good as far as they are applicable.

Protective Coatings :

On surfaces such as ferrous metals, brass, copper and phosper bronze, a protective coating of suitable bituminous compound or chomated redoxide should be given. New wood should be treated with a leafing grade aluminium primer or a water based acrylic emulsion primer.

The surfaces with algae growth thoroughly cleaned down to remove as much growth as possible and effective solution of stabilized house hold bleach (calcium hypochloride) of approved quality with approximate 35% chlorine content @ 2 kgs. per 50 litres (or as per manufacturers recommendations) should be used to treat the surfaces.

On chalky or friable surfaces after removing the loose materials by stiff brushing or scraping the surface should be treated with one coat of advanced solvent based materials such as snowsol stabilizing solution or other approved equivalent with white spirit.

Application :

The ready mix Sandtex Matt or other equivalent approved resin based there plastic paint shall be applied on clean and wetted surfaces by means of brushes or roller. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun, the paint shall be applied on the side in shade.

On rough and textured, one under coat of cement based paint such as snocem or other equivalent shall be applied before application of undiluted sandtex Matt finish coat. In case of application of two coats of sandtex matt at normal temperatures, the first one shall be diluted by addition of 25% water and the second coat direct. In extremely hot environs, the second coat shall be diluted @ 2.5 litres of water to 20 litres of paint or as directed.

Painting with resin based thermo plastic shall be carried out generally as per manufacturers specifications.

Other details :

The specification for painting (general) mentioned herein before shall hold good as far as they are applicable.

Snowsol stabilized solution shall not be applied over bitumen. Snowsol stabilized solution treated surfaces shall be left unpainted for more than 2 (two) days. Gypsum based materials shall not be used for filling of exterior cracks while preparation of surfaces.

Mode of measurement :

The painting unless otherwise mentioned shall be measured by area in sqm. upto two places of decimal. Length and breadth shall be measured correct upto two places of decimal of a meter. Deduction will be made from the areas of fixtures, grills, ventilation, outlets individually more than 0.05 sqm.

The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.1 sqm each with materials similar in composition to the surface to be prepared.

Rate :

The rate shall include the cost of all materials and labour involved in all the operations described above.

24.11 Consumption of paint for different Painting items:

Sl.No	Brief description of painting work	Consumption per 10 sqm. of net area
1.	***Oil Bound Distemper on plastered surfaces:***	
1.	Cement primer (one coat)	0.91 Litre
2.	Two finishing coats	1.60 Kgs.
3.	Three finishing coats	2.4 Kgs.
2.	***Flat oil paint to plastered surfaces:***	
1.	Cement primer (one coat)	0.91 Litre
2.	Cement primer (two coats)	1.82 Litres
3.	Two finish coats	1.72 Litres
3.	***Acrylic Emulsion paint***	
1.	Cement primer (one coat)	0.91 Litre
2.	Cement primer (two coats)	0.87 Litre
3.	Two finish coats	1.30 Litres
4.	***Cement Paint (old surface)***	
1.	Two coats on sand faced plastered surface	4.10 Kgs.
2.	Two coats on rough cast plastered	7.70 Kgs.
5.	***Cement paint (old surface)***	
1.	Two coats on sand faced plastered surface	4.50 Kgs.
2.	Two coats on rough cast plastered surface	8.50 Kgs.
6.	***Enamel paint to wood / steel***	
1.	Wood primer (one coat)	0.90 Litre
2.	Steel primer (one coat)	0.75 Litre
3.	Two finishing coats on wood	1.40 Litres
4.	Two finishing coats on steel	1.35 Litres
7.	***Flat oil paint to wood / steel work***	
1.	Wood primer (one coat)	0.90 Litre
2.	Steel primer (one coat)	0.75 Litre
3.	Two finishing coats on wood	1.70 Litres
4.	Two finishing coats on steel	1.75 Litres
8.	***External painting with flat oil paint***	
1.	Cement primer (one coat)	1.00 Litre
2.	Two finishing coats	1.74 Litres
9.	***Repainting old painted surface***	
1.	Two coats of emulsion paint	0.86 Litre
2.	Two coats of flat oil paint	1.59 Litres
3.	Two coats of enamel paint	1.35 Litres

25. FLASE CEILING WITH GYPBOARD AND G.I. FRAMEWORK

Scope of work :

The work envisaged under these specifications refer to supplying and fixing in position false ceiling at any floor, any location and at any height.

a) Providing and fixing suspended G.I. frame work

b) Providing and fixing one layer of 12.5 mm gypboard over this frame work.

c) Jointing the board flush, applying two coats of primer suitable for gypboard and two coats of acrylic emulation matt finish paint of approved shade and make.

d) Making necessary cut out for light fitting, A.C. grills diffusers and other necessities. The work shall include horizontal, vertical and inclined surfaces depending upon the various requirements.

Material

G.I. Frame work :

The system consists of G.I. frame work suspended form the soffit of the RCC ceiling. The following G.I. components shall be used for grid work (or) as specified in the drawing.

1. Ceiling section of 80X26X0.5 mm
2. Perimeter channel of 20X27X20X0.5mm
3. Intermediate channels of 15X45X0.9mm
4. Ceiling angel of 25X10X0.55mm
5. Connecting clips of 2.64 mm dia.
6. Soffit cleat 22X37mm
7. Anchor fasteners 6 mm

All the G.I. components shall be of standard approved make.

The G.I. grid work system shall be suspended from the soffit of RCC ceiling using anchor fasteners of 6mm of approved type and make and connected to siffit cleats and ceiling angle by means of necessary nuts, bolts and washers etc.

Gyp Board

Gyp Board of plain series 12.5 mm manufactured by India gypsum shall be used. The Gyp board shall conforms to IS 2095. The longitudinal edge of the Gyp board shall be of tapered / square edges, so as to have flush joints while fixing.

Handling and transporting of Gyp board shall be done carefully and as recommended by the manufacture's. The board should always be kept in a dry an d covered place sheltered from rain and to avoid dampness from flow, they should be supported on wooden battens which should not be more than 45cm apart on a flat surface. The material shall be stacked in piles of smaller heights and should not be stacked on edges. Gyp board which have deformed due to poor stacking should not be used.

Cutting of board should be made in faced side of the board by means of retractable knife or by using a normal saw and the edges of the boards shall be planned using proper files.

Finishing materials:

All jointing compounds, paper tapes, primer and paints shall be with materials manufactured / recommended by India Gypsum.

Insulation :

Perimeter channels are leveled at the required position of the finished ceiling line and fixed to the wall at 610 mm center with the screws and nylong plugs. The remaining G.I. grid component are installed to form a regular grid suspended from the soffit of RCC slab using soffit cleats ceiling angle and anchor fasteners as specified. Extra frame for various cutouts of different shapes, light fittings, AC grills, diffusers, smoke detectors and other necessities have to be provided frame work has to be made with perimeter channel of specified size and shall be suitably supported. The line and level of the grid work has to be checked for perfection and prior clearance of the grid work has to be checked for perfection and prior clearance of the grid work has to be obtained from the Engineer-in-charge before the placement of Gyp board.

The Gyp board are fixed with bound edges at right angles to ceiling section with all joints staggered. All joints of Gyp board has to be fixed on ceiling section. The Gyp boards are screwed to the ceiling section and perimeter channels with Gyp board dry wall screws with joints staggered. Spotting of screws and jointing are then carried out according to India Gypsum recommendations to give a flush and smooth joint.

Necessary door openings of hinged type of suitable sizes has to be provided with a suitable frame work for control valves and for access above false ceiling / AC duct boxing at not extra cost. Joints at horizontal, vertical and inclined surfaces shall be suitably strengthened with additional G.I. frame work as required.

Finally the boards are jointed and finished so as to have a flush look which includes fling and finish gin the tapered and square edges of the board with a jointing compound, paper tape and two coats of primer suitable for gyp board (all as per recommended practices of Indian Gypsum). Then, the finished Gyp board has to be painted with 2 coats of acrylic emulsion matt finish paint of approved color and make.

The rate shall includes providing all materials, erecting, suspending, G.I. grid work, jointing the boards, providing required cutouts and open able doors and painting including providing necessary fittings and fixtures etc. complete as per the specifications and all other activities related to the completion of the above job.

Details of A.C. grills, diffusers, recessed type electrical fittings to be erected in false ceiling will be as per specifications and as shown in drawings.

The quantities indicated are approximate and is likely to vary depending upon the site conditions. Samples of light fittings are available with Engineer.

The scope of works includes fixing with screws, fixtures etc. the recessed electrical light fittings in the grid work of false ceiling/ boxing, Marine plywood (6mm thick)/special G.I. sections, if required, shall also be provided at no extra cost. The rate quoted shall include all the above mentioned activities related to the completion of the above job.

Mode of measurement:

Measurements will be made on flat plan area basis in Sq.m calculated to 3 places of decimal. Length and breadth shall be measured corrected to a cm. No deduction shall be made for cutouts made for A.C. grills, diffusers, electrical fittings, smoke detectors etc.

26. WATERPROOFING

26.1 Water proofing plaster in toilet area

General :

The guarantee for water proofing treatment in prescribed proforma must be given by the specialized agency which shall be given by the specialized agency which shall be countersigned by the contractor in token of his over all responsibility. The guarantee for waterproofing treatment in the prescribed proforma shall also cover horizontal expansion joint and vertical expansion joint.

Water proofing plaster in Toilet area :

The following specification shall be followed unless otherwise stated in schedule of quantities. This shall be 20mm thick cement plaster 1:3 including an under coat not exceeding 13mm thick, for walls upto slab level and further above finish floor level upto 600 mm high and for floor the thickness of cement plaster shall be 25mm. Approved water proofing compound like CICO No.1 or other approved equivalent shall be added @ 3% by weight of cement in cement mortar or as per manufacturers specifications in both the coats. The workmanship and material shall be same as describe din plaster work in general. All exposed surfaces shall be finished smooth with a coat of neat cement as directed.

Brick bat Coba Water Proofing on Terrace :

Materials :

The aggregate for brick bat coba shall be broken from good and thoroughly well burnt bricks. These shall be approved by the Engineer-in-charge before use.

Brick bat coba shall be in Cement Mortar 1:2

Laying :

The concrete surface shall be thoroughly rubbed, cleanced of all set mortar, all dirt and dust and slightly wetted. The brick aggregate shall be soaked in water before mixing with lime. The brick bat coba shall be laid in an even layer and to the required thickness and slope so as to form ridge, hip or valley line as may be necessary and as indicated in the drawing or as directed by the Engineer-in-charge. The compaction shall be started immediately kept wet by sprinkling water observing the following precautions :

a) Brick bat coba shall not be rammed with heavy iron rammers as brick aggregates are likely and rapidly with wooden beaters to get the required compaction and to obtain complete integration of brick bats and lime.

b) White beating, fresh fracture may take place which may cause absorption of water from the mortar. Additional water may be sprinkled with beating in such causes as considered necessary by the Engineer-in-charge. The beating work shall continue for atleast 7 days.

c) The average thickness of coba shall be as specified in the items and the top of the coba shall be given slope or made level and edges taken into the brick masonry parapet or rounded off at junctions (vatas) as shown in the drawing and as directed by the Engineer-in-charge.

Mode of measurement :

The length and breadth of the surface area shall be measured to two places of decimals of a metre from the finished surface of wall and parapet and cubic contents to be worked out with average thickness of coba provided. Vatas shall not be measured separately. Rated shall include cost of preparation of surface, cost of materials, labour, making vatas etc.

China Mosaic Water Proofing

General :

This type of water proofing shall consist of setting in thick cement slurry selected colour / white glazed tile broken pieces of approved make and size over cement mortar (1:3) 20mm. thick bedding to the required slope an level, over brick bat coba and finishing with neat cement and cleaning to the required degree of fineness and evenness.

The different materials and workmanship shall conform to the relevant IS. Specifications and shall be got approved before incorporating in the work.

The surface of brick bat coba shall be thoroughly cleaned of dust, dirt and loose particles removed and adequately watered. Thick coat of cement slurry of the honey like consistency shall be sprayed on the base before cement mortar screening of specified thinness is laid.

Laying :

Over the prepared surface of brick bat coba, a layer of cement mortar 1:3, 20 mm thick screed mixed with approved water proofing compound by weight of cement shall be laid and cement slurry of consistency of honey shall be spread over it using cement at a rate of not less than 0.01 cum per 10 sqm. while the bed is fresh, broken pieces of 6mm thick selected white / colour glazed tiles not less than 25mm and not more than 50mm in any direction shall be set closely by hand at random. The glazed tile pieces shall be soaked din water before setting in position. The glazed surfaces shall be kept exposed and pressed with wooden mallet. Over the glazed tile pieces a neat cement slurry using cement not less than 0.01 cum. per 10 sqm. shall be spread and the surface brushed in and lightly rolled with wooden roller, taking care that no air pocket is left between brick bat coba and china mosaic flooring.

The top surfaces shall be cleaned with saw dust an cotton waste. Finally the surface shall be cleaned with weak acid solution to remove cement marks over the white glazed tile pieces. The finished work shall be cured for atleast 7 days. Care shall be taken to see that cements in joints does not get dissolved due to acid washing. At corners and junctions with parapet, the water proofing coarse shall be rounded off in the form of vata with cement mortar bedding as per drawing and shall be included in the quoted rate.

Mode of measurement :

The length and breadth shall be measured to two places of decimal of a meter, alongside the surface including vata curves etc. and area worked out in square metre. Vatas shall not be measured separately. The rain water outlets shall be finished as directed and no deduction shall be made for the same (area upto 0.02 sqm.) while arriving at the net area for payment.

26.4 Cement based Water Proofing of W.C. and Baths Areas

General :

The water proofing treatment for the Bath and W.C. shall be essentially of cement based water proofing treatment with admixture of proprietary water proofing compound similar to M/s India Water Proofing Companys treatment or any other equivalent approved cement based water proofing treatment. The waterproofing treatment shall consist of providing cement slurry mixed with proprietary water proofing compound after preparation of surfaces, providing water proofing treatment etc.

Preparation of Surface :

The surface to receive water proofing treatment shall be thoroughly cleaned, of scales, laitance, set mortar etc. for receiving water proofing treatment, and necessary preparation of the surface for providing water proofing treatment shall be done by the contactor. If any honey combs are observed in beams and slab of Bath and W.C. the same shall be grouted with cement slurry mixed with water proofing compound and the cracks and crevices, filled with injection method.

Sequence of Treatment :

All cutting an chasing in the floor and walls for plumbing work shall be done by the plumbing agency. Water proofing agency shall then provide CETROOF or equivalent approved cement based water proofing compound according to the plaster treatment mixed with the water proofing compound according to the recommended specifications of the water proofing agency. Waterproof cement plaster 1:3 of 225mm thick for floor and sides of walls upto slab level and about 20mm thick for walls, above finished floor level upto 600mm high.

The plumping agency shall then lay and fix the pipes, W.D. pans, traps etc. without disturbing the water proofing treatment. However, the joints of water supply and waste connections including holes drilled for clamps shall be treated by water proofing agency.

Waterproofing agency shall t hen fill in the depression in the floor with their "CETROOF" or equivalent approved waterproof brick bat coba with the admixture of water proofing compound according to waterproofing agency's specification and process which should be furnished in writing to the Engineer-in-charge for effective supervision of completeness of the process while executing the works.

Finishing :

The surface of the exposed plaster shall be finished smooth with neat cement. The plaster surface where tiling is to be provided as well as brick bat coba filling where flooring to be provided, shall be finished to proper line, level, plane and plumb to receive the floor/dado finish. Curing of the waterproofing treatment shall be carried out for 14 days.

Testing and Guarantee:

The contractor shall test the surface where waterproofing treatment is provided for the bone dry condition by filling with water inside the depressed plastered portion. No wet patches or leaks shall appear on the surrounding plastered walls or at the underside of the slabs. The testing shall be carried out to the entire satisfaction of the Engineer-in-charge. The contractor shall furnish guarantee in the proforma for the waterproofing treatment for maintaining the under side of the waterproofed surface in bone dry condition for a period of minimum ten years. During this period, contractor shall attend to all leakages, defects etc.

if noticed, free for cost, starting his work of checking up and rectification within a weeks time from the date of receipt of information about such leakages etc. by him.

The contractor shall submit the guarantee bond appropriate stamp paper and as per the enclosed proforma.

Mode of measurement :

1. Waterproof plaster shall be computed by taking the length and breadth of the area actually plastered corrected upto two decimal places of a metre. NO deduction shall be made for W.C. pans, pipes etc. in the measurement.
2. The filling with waterproof brick bat coba shall be computed by noting the levels and dimensions of the filled up depression before and after the filling, upto two decimal places of a metre and also no deductions shall be made for W.C. pans, pipes etc.

26.5 Cement Based Waterproofing of roof terraces

General :

The waterproofing treatment shall be essentially a cement based waterproofing treatment similar to that of M/s Indian Waterproofing Companys CETROOF or any other approved waterproofing treatment. The waterproofing treatment shall consist of providing cement slurry mixed with waterproofing compound, at desired proportions including grouting the cracks and crevices with cement slurry mixed with waterproofing compound, laying brick bats over cement mortar bedding to the required slopes for roof drainage, filling and grouting the joints with cement mortar, finishing the surface smooth/chequered with cement plaster mixed with waterproofing compound etc. as directed.

Preparation of Surfaces :

All the rubbish, debris and other materials left over by other agencies will be got removed by the Department through other agencies. After removal of this rubbish, debris etc. the surface to receive the waterproofing treatments shall be thoroughly cleaned with wire brushed including removing of scales and laitance, set mortar etc. by the waterproofing contactors. If any honey combing including cracks and crevices are observed at coloumn junctions / and elsewhere, the same shall be grouted with cement slurry mixed with approved water proofing compound.

Treatment :

The waterproofing treatment shall be generally as per manufacturers own specifications, method and procedure. A typical cross section of the waterproofing treatment shall generally consist of the following:

1. Applying cement slurry mixed with waterproofing compound for the entire surface to be treated.
2. Laying of broken brick bat of required thickness over cement mortar bedding to give proper roof drainage, joints grouted with cement mortar with waterproofing compound.
3. Laying of joint less cement based waterproofing cement mortar layer of average thickness as specified in the item.
4. Final rendering to give a smooth finish of cement colour with false lines at 300 X 300 mm or nearer convenient dimensions. Tenderer shall give complete details of

waterproofing treatment proposed by him, in writing viz. details including roof fill materials, waterproofing compound, minimum and maximum thickness etc. for effective supervision of the departmental Engineers, while the work is executed at site.

The contractor shall ensure that sufficient slope for effective roof drainage is provided within the average thickness of waterproofing treatment proposed by the contractor. Incase the average specified thickness of treatment exceeds, the fact shall be specifically brought to the notice of the Engineer-in-charge, before adopting to extra thickness.

The rain water down take pipes if any, shall be fixed by the other agency prior to commencement of waterproofing operation. Curing of the finished surface by ponding shall be done for 7 days atleast.

Testing and Guarantee :

The contractor shall test the surface for the bone dry condition by ponding water over roof for minimum seven days period to the entire satisfaction of the Engineer-in-charge. Alternately, the curing of the finished surface done by ponding of water on the entire surface for seven days, can also be used for testing water tightness. After a period of two months, once again the roof should be ponded with water to check its efficiency of waterproofing treatment against leakage. The contractor shall furnish guarantee in the proforma specified for the waterproofing treatment provided by them for maintaing the underside of the roof in bone dry condition for a minimum period of ten years.

During this period, the contractor shall be liable to attend all the leakages, defects etc. if noticed, free of cost, starting his work of checking and rectification within a weeks time from the date of receipt of intimation of such leakages etc. by him.

26.6. Internal Waterproofing for Overhead Water/Lift Pit/Underground Sump or Tanks

General :

The waterproofing treatment for overhead water tanks shall be essentially a cement based waterproofing treatment similar to that of M/s India Water Proofing Company, consisting of providing water proof cement plaster after preparing the surface, filling the cracks and crevices by means of injection and surface method, using proprietary waterproofing compound as per their own specifications and as per recommended proportions etc. and testing of water tightness of the water proofing treatment and furnishing guarantee as specified.

Preparation of surfaces

The surface to receive the waterproofing treatment shall be thoroughly cleaned of scales, laitance, set mortar etc. The surface shall be roughened with close hacking to provide adequate key for the waterproofing treatment. All honey combs in concrete surface shall be carefully hacked and loose materials removed and all pockets plugged suitably well before commencing waterproofing treatment.

Treatment :

Before any work of waterproofing is taken in hand, all the surface preparation mentioned above shall be got approved from The Engineer-in-charge. All plumbing work will be got completed by the Department before commencing the treatment.

The treatment shall then be commenced with injection into RCC members wherever required by cement slurry mixed with waterproofing compound of appropriate consistency to fill up all cracks and crevices if any. A layer of waterproofing mix recommended by the specialization agency with admixture of approved manufacture waterproofing compound, shall then be laid over floor from inside and will be continued along the sides and partition walls to their full height. The thickness of this treatment on the floor shall not be less than 50mm. and that on walls not less than 20mm. The entire surface shall be finished smooth with steel trowel in cement colour. The plastered surfaces shall be kept continuously wt immediately after 24 hours so as to cure it properly for atleast seven days.

Testing :

The tank will thereafter be got filled into the full height immediately by the Department and water stored for a minimum period of seven days so as to observe any leakages / defects for necessary compliance by the waterproofing contractor.

In the case of tanks whose external faces are exposed, the requirements of the test shall be deemed to be satisfied if the external faces shown no sign of leakage and remain apparently dry over the period of observation of seven days after allowing a seven days period for absorption after filling the tank for full height. If the structure does not satisfy the conditions of test, the period of test may be extended for a further period of seven days and if specified limit is then reached, the structure may be considered a satisfactory. Suitable remedial measurers shall be taken by the contractor at his own cost till the test as specified above is carried out satisfactorily.

In the case of tanks whose external faces are exposed or can be left exposed prior to testing all leakages, wet patches and the like, shall be marked out on the outside of walls during test. The tank shall then be dewatered and the defects made good by grouting, waterproofing, plastering etc. as necessary to the entire satisfaction of the Engineer-in-charge, at no extra cost tot eh Department. The tank shall again be tested for leakage after rectification. The work shall not be accepted unless the water tightness is established.

Back filling in case of underground sump and waterproofing the roof where specified, shall be carried out after testing and rectification of defects. The completion certificate shall not be given unless the test for water tightness as described above is carried out to the entire satisfaction of the Engineer-in-charge. After a period of two month after the tank is left dry, once again the tank should be filled with water to check the efficiency of the waterproofing treatment done. If there is any leakage or wet patches, the same shall be rectified, with no extra cost, by the contactor.

Mode of measurement:

Measurement for payment of waterproofing treatment shall be as per actual area covered by waterproofing treatment including offset, overlapping, vata, haunch etc. as provided at site. The length and breadth of the surface actually treated with waterproofing treatment shall be measured upto two places of decimal or a metre. No deduction shall be made for inlet, outlet, scour connection, by out the same shall be finished as required. The rate quoted shall include all the cost of materials, labour, transportation, testing of water tank for water tightness, furnishing necessary guarantee for waterproofing so provided, all as detailed above.

28. RUBBER / PVC WATER STOPS

General :

The corrugated Rubber / PVC water stops with center bulb of specified width, shall be of approved manufacture and shall satisfy all the normal tests such as tensile strength, elongation etc.

Sample :

A sample of Rubber / PVC water stops shall be got approved from the Engineer-in-charge before procurement of bulk quantity.

Placing in Position :

The eater stops shall be provided in available maximum length and as far as possible, jointing shall be avoided. All the joints when unavoidable, shall be field jointed for water tightness as per manufacturers specifications.

The eater stops shall be positioned with suitable temporary supports so as to render adequate rigidity to the water stops while concreting. The exposed surfaces of water stops revealed after first concreting shall be cleaned thoroughly of all the droppings, mortar splashing, timber scantlings sticking etc. before the next pour of concrete is taken up in hand. Any damaged caused to water stops shall be made good by the contractor at his own cost.

Mode of measurement :

The mode of measurements shall be in running meter, of water stop actually laid without any allowance for taps, wastage etc. measured correct to one centimeter.

Rate shall include supply, transport, fixing, welding, supporting arrangements, cleaning etc. all as described above.

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34. ROAD AND PAVEMENTS

Scope of work :

The work contemplated under these specification refers to Earth Work in excavation. Forming Embankments, soling W.B.M. Bituminous Macadam. Wearing course / sealing coat etc. for road an pavement works.

Approximate quantities of materials to be used in the work are listed below for reference :

i) Soling stone :
   a) For 230 mm thick consolidated thickness 2.65 cum / 10sqm.
   b) For 150 mm thick consolidated thickness 1.725 cum / 10 sqm.

ii) Stone aggregate 50mm nominal size for 75mm thick consolidated WBM:0.975cum/ 10 sqm.

iii) Murrum for 75mm thick consolidated WBM : 0.305 cum/ 10 sqm.

iv) Bituminous macadam for premix carpets for 38mm consolidated thickness : 11 sqm / mt.

v) Seal coat (Bituminous concrete for wearing course) for 12mm consolidated thickness : 33 sqm/mt.

Earth work in excavation :

The specifications for "Excavation, Fill and Back fill" under chapter-I, specified herein before shall hold good as far as they are applicable.

Forming embankment :

The work shall include preliminaries of clearing site, setting out and preparing the ground and thereafter forming embankment for the rods, paths etc. with approved materials available form excavations under this contract (excavation paid separately under respective items) or elsewhere, spreading in layers, watering and compacting to the required density and lines, curves, grades, camber and cross section and dimensions shown in the plan or as directed by the Engineer-in-charge. When the embankment is to be laid on hill sides or slopes, the existing slopes are to be ploughed deeply. If the cross slopes are steeper that 1 on 3, steps with reverse slope shall be cut into the slopes to give proper hold and seating to the bank as directed by the Engineer-in-charge. The tope 15cm. of soil shall be scarified and watered if directed and compacted to the same density as specified for the embankment before any material is laid for the embankment work.

Only the approved excavated earth shall be placed in the embankments in successive horizontal layers not exceeding 200mm. extending to the full width of the embankment including the slopes at the level of the particular layer and 30 cm. more on both sides to allow compaction of the full specified section. The extra loose stuff at the edges shall be trimmed later after completion of the bank work without extra cost leaving the correct section fully compacted.

Keeping the width of the bank initially less and widening it later by dumping loose earth on the slope shall not be permitted as the additional width and slopes will remain loose and uncompacted. Similar procedure to extend the embankment by dumping the material longitudinally shall also not be allowed. Each layer of the embankment shall be watered, leveled and compacted as specified hereinafter, before the succeeding layers are placed. The surface of the embankment shall at all times during construction, be maintained in such a manner so as to prevent ponding. Water to be used shall be free from all harmful elements which may cause efflorescence etc. and approved by the Engineer-in-charge.

If the material for embankment contains moisture less than the optimum moisture, water shall be added in the 100mm layers of the embankment to bring moisture uniformly upto

requirement. If the excavated material contain more than required moisture, it shall be allowed to dry until the moisture is reduced to required moistures, it shall be allowed to dry until the moisture is reduced to required to the appropriate amount by exposure, embankment work shall be suspended till suitable conditions prevail at no extra claim / compensation.

When loose layer is leveled manually or mechanically and moistened or dried to a uniform moisture content suitable for maximum compaction, it shall be compacted by 8 to 10 tone power roller or sheep foot rollers or heavy hauling or dozing equipment to give the specified 90% of the proctor density. It on testing, the density is found to be less than 90% of the proctor density, the contractor shall do additional compaction necessary to get the specified density after adding water if required. if the density cannot be improved by such reasonable efforts, the work may be accepted as substandard work by the Engineer-in-charge, if he thinks it is not harmful for the purpose and paid for at a reduced rate. Test shall be made to determine the maximum density of the material to be used by the proctor method before starting the work. Density test shall be carried out for the embankment work during the progress of the work. One set of three core samples for every 1000 sqm. (about 1000 sq.yd) area of each layer of embankment work shall be taken and tested. The average density shall not be less than 90% of the proctor density, obtained in the laboratory.

Arrangement for obtaining the samples and transporting the same to laboratory, shall be made by the contractor at his own cost.

Embankment not accessible to rollers, such as those adjoining bridges, culverts and other works shall be carried out independently of the main embankments and shall have the layers placed in 150mm to 200mm height and each layer shall be moistened and thoroughly compacted with mechanical or manual tamper. Before placing the next layer, the surface of the under layer shall be moistened and scarified so as to provide a satisfactory bond with the next layer.

The embankment shall be finished and dressed smooth and even in conformity with the alignment levels and cross sections and dimensions shown on the drawing. On curves section shall be provided with super elevation and increased width as shown in to plans as directed by the Engineer-in-charge.

Joining of old and new embankments shall be done by stepping in an overall slope of about 1 to 5.

The contractor shall be responsible for maintaining the embankment work in satisfactory conditions at his own cost till finally accepted including making good any damage.

Measurement and Rate :

The contract rate shall be pre cubic metre of the finished embankment. Measurements shall normally be taken by taking cross sections at suitable intervals. The measurements of the section shall be limited to the mentions shown on the drawing or those ordered by the Engineer-in-charge in writing. The sectional area shall be worked out correct up to two places of decimal of square metre and the quantity worked out to two places of decimal to cubic metre on lines similar to those specified for earth work hereinbefore.

Sub Grade :

Preparation of sub-grade :

The surface of the formation for a width of sub-base, which shall be as per drawing shall first be cut to and depth equal tot eh combine depth of sub-base and surface courses below the proposed finished level (due allowance being made for consolidation). It shall then be cleaned of all foreign substances. Any ruts or soft yielding patches that appear due to improper drainage

conditions, traffic hauling or from any other cause, shall be corrected and the subgrade dressed off parallel to finished profile.

Consolidation :

The sub-grade shall be consolidated with a power road roller of 8 to 12 tonnes. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass (the roller shall pass a minimum of 5 runs on the sub grade). All undulations in the surface that develop due to rolling shall be made good with fresh material or quarry spoils as the case may be and the sub grade is re-rolled.

Surface Regularity :

The finished surface shall be uniform and conform to the lines, grades and typical cross sections shown in the drawings. When tested with the template and straight edge, the variation shall be within the tolerances specified in the table below:

Permissible Tolerances or Surface Regularity :

Longitudinal Profile	Cross Profile
Maximum Permissible undulation when measured with a 3 metre straight edge.	Maximum permissible variation from specified profile when measured with a camber templates
24 mm	15mm

Where the surface irregularity of the subgrade falls outside the specified tolerances, the contractor shall be liable to rectify these with fresh material or quarry spoils as the case may be and the sub-grade rerolled to the satisfaction of the Engineer-in-charge.

Measurement and Rate :

The length and width shall be measured correct to a cm. The area shall be worked out in square metre, correct to two places of decimal. The rate shall include the cost of materials and labor required for all the operations mentioned above, unless specified otherwise.

Sub-bases :

Water Bound Macadam sub-base wit stone aggregate :

Stone aggregate of size 90mm to 45mm shall be used. This consists of clean crushed coarse aggregate mechanically interlocked by rolling using power road roller of 8 to 10 tones and voids thereof file width screening and blinding materials with the assistance of water, laid on a prepared sub-grade / sub-base.

Specifications for laying :

Quantities of materials :

Quantities of coarse aggregate, screening and blinding material required to be stacked for 100 mm approximate compacted thickness of WBM sub base course for 10 sqm. shall be as per table given below :

Coarse Aggregate			Stone Screenings		
Classification	Size Range	Net Qty.	Grading / Classifi-cation and size	Net Qty.	Blinding Material
Grading – I	90mm to 45mm	1.2 cum to 1.28 cum	Type A 13.2 mm	0.27 cum to 0.30 cum	0.08 cum to 0.10 cum.

Note : Net Quantity = Loose Quantity measure din stack minus 7.5%.

Preparation of Foundation :

In the case of an existing un surfaced road, where new materials is to be laid, the surface shall be scarified and reshaped to the required grade, camber and shape as necessary. Weak places shall be strengthened, corrugations removed and depression and pot holes made good with suitable materials, before spreading the aggregate for WBM.

Spreading Aggregate :

The coarse aggregate shall be spread uniformly and evenly upon the prepared base in required quantities with a twisting motion to avoid segregation. In no case shall these be dumped in heaps directly on the area where these are to be laid not shall be spread uniformly to proper profile by using templates placed across the used to spread the aggregate uniformly. The level along the longitudinal direction upon which the metal shall be laid shall be first obtained at site to the satisfaction of Engineer-in-charge and these shall be adhered to.

The surface of the aggregate spread shall be carefully trued up and all high or low remedied by removing or adding aggregate as may be required.

The WBM sub-base shall be normally constructed in layers of 115 mm compacted thickness. No segregation of large or fine particles shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

The coarse aggregate shall normally not be spread in lengths exceeding three days average work ahead of the rolling and blending of to proceeding section.

Rolling :

Immediately following the spreading of the coarse aggregate, it shall be compacted to the full width by rolling with wither a three wheel power roller of 8 to 10 tonnes capacity or an equivalent vibratory roller. Initially, light rolling is to be done which shall be discontinued when the aggregate is partially compacted with sufficient void space in them to permit application of screenings.

The rolling shall begin from the edges with the roller running forward and backward and adding the screenings simultaneously until the edges have been firmly compacted. The roller shall then progress gradually from the edges to the center parallel to the center line of the road and overlapping uniformly each preceding rear wheel track by one half width an shall continue until the road metal is thoroughly keyed with no creeping of metal ahead of the roller, Only slight sprinkling of water my be done during rolling, if required. On super elevated curves, the rolling shall proceed from the lower edge and progress gradually continuing towards the upper edge of the pavement.

Rolling shall not be done when the sub-grade is soft or yielding or when the rolling causes a wave like motion in the sub-grade. When rolling develops irregularities that exceed 12mm when tested with a three metre straight edge the irregular surface shall be loosened and the aggregate added to or removed from it as required and the area rolled until it gives a uniform surface conforming to the desired cross-section an grade. The surface shall also be checked transversely by template for camber and any irregularities corrected in the manner described above. In no case shall the use of screening to make up depressions be permitted.

Application of screenings :

After the coarse aggregate has been lightly rolled to the required true surface, screenings. Dry rolling shall be continued while the screenings are being spread so that the jarring effect of the roller causes then to settle into the voids of the coarse aggregates. The screenings shall not be dumped in piles on the coarse aggregate but shall be spread uniformly in successive then layers either by the spreading motion of the hand, shovels or a mechanical spreader.

The screenings shall be applied at a slow rate (in three or more applications) so as to ensure filling of all voids. Rolling and booming shall continue with the spreading of the screenings. Either mechanical brooms or hand brooms or both may be used. In no case shall the screenings be applied, so fast and thick as to form cakes, ridges on the surface making the fitting of voids difficult, or to prevent the difficult, or to prevent the direct bearing of the roller on the coarse aggregates. The spreading rolling and brooming of screenings shall be performed on sections which can be completed within one day's operation and shall continue until no more screenings can be forced into the voids of the coarse aggregate. Damp and wet screenings shall not be used any circumstances.

Sprinkling and Grouting :

After spreading the screening and rolling, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to weep the wet screening into the voids and to distribute then evenly. The sprinkling, sweeping and rolling operations shall be continued and additional screenings applied where necessary until a grout has been formed of screenings and water that will fill all voids and form a wave of grout has been formed of screenings and water that will fill all voids and form a wave of front ahead of the wheels of the roller. The quantity of water to be used during the construction shall not be excessive so as to cause damage to the sub-base or sub-grade.

Application of Blinding Material :

After the application of screenings and rolling, a suitable blinding material shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of blinding materials, the surface shall be copiously sprinkled with water and the resulting slurry swept in with hand brooms or mechanical brooms or both so as to fill the voids properly. The surface shall then be rolled by a 8-10 tonne roller, water being applied to the wheels in order to wash down the blinding materials that may get stuck to the wheels. The spreading of blinding material, sprinkling of water, sweeping with brooms and rolling shall continue until the slurry that is formed well, after filling the voids form a wave ahead of wheels of the moving roller.

Setting and Drying :

After final compaction of the course, the road shall be allowed to cure overnight. Next morning defective spits shall be filled with screenings or blinding material, lightly sprinkled with water, if necessary and rolled. No traffic shall be allowed till the macadam sets.

Surface Evenness :

The surface evenness of completed W.B.M. sub-base in the longitudinal and transverse direction shall be as specified in the table given below:

Size of coarse aggregate	Longitudinal profile	Cross profile
45-90 mm	when permissible undulation when measured with a 3 M straight edge	Max. permissible undulation when measured with a camber template
	15 mm	12 mm

The longitudinal profile shall be checked with a 3 m long straight edge at the middle of each traffic lane along a line parallel to the center line of the road. The transverse profile shall be checked with a series of three camber boards at intervals of 10m.

Rectification of Defective Construction :

Where the surface irregularity of the WBM sub-base course exceeds the tolerances specified in the table given above or where the course is otherwise defective due to sub-grade soil mixing with the aggregates, the layer to its full thickness shall be scarified over the affected

area, reshaped with added material or removed and replaced with fresh material as applicable, and recompacted. The area treated in the aforesaid manner shall not be less than 10 sqm. In no cases shall depressions be filled up with screenings and blinding material.

Measurements and Rate :

The length and breadth shall be taken to the nearest centimeter and thickness to the nearest half centimeter. The consolidated cubical contents shall be calculated in cubic metres correct to two places of decimals. The rate shall include the cost of all labour and materials involved in all the operations described above.

Rubble Soling :

Rubble soling for road work including foot paths, culverts side drains etc. shall be carried out as specified hereinbefore under chapter, 3, para 3.3 for Rubble stone soling, as far as they are applicable, with the following additions :

Subgrade for soling shall be prepared by cleaning of all foreign substances including rank vegetation, if any. Any ruts or soft yielding places that appear due to improper drainage conditions, traffic, hauling or from any other cause shall be dressed off parallel to the finished profile and the same shall be approved by the Engineer-in-charge before laying of soling. Soling shall be laid in regular lines and staggered joints. The stones shall be laid as closely as possible and packed well. The stones shall be so laid as to have their bases and the largest area resting on the subgrade and in contact with each other.

Soling shall be laid to proper gradient and camber which shall be checked frequently to ensure accuracy. Rolling shall then be carried out by a 8 to 10 tonne power roller and soling consolidated properly shall be lightly sprinkled during rolling, if ordered by the Engineer-in-charge.

The surface thus prepared shall first be passed by the Engineer-in-charge, after which to mm to 50mm thick layer of selected hard murrum available from excavation shall be spread over the soling as directed by the Engineer-in-charge and rolled again such that the hard murrum gets into the interstices. It shall, however, be ensured that a thin layer of murrum / grit shall remain on the finished surface of soling.

The area of soling actually done of specified consolidated thickness limiting to the dimensions as per drawing shall be measured in square metre upto two decimal places.

a) Damages to the Department's Property :

Any damage to the Deptt's property due to negligence of the contractor while executing the work shall be made good to the original condition at his own cost.

b) Mode of Measurement :

The areas of water bound macadam road surfaces of required thickness actually completed as per above specifications limiting to the areas as per drawing shall be measured in square metre upto two places of decimal for payment.

The item includes laying, Spreading, watering, consolidation, blinding etc. but excluding the cost of 50mm size I.R.C. metal and graded murram which will be paid under relevant item. However murrum obtained from excavation work under this contract and used as blinding material as above on instructions/ approval of ht Engineer-in-charge shall not be paid.

35 FENCING WORK WITH BARBED WIRE, CHAIN LINK ETC.

The work shall generally be carried out as per these specifications, relevant drawings and as directed by the Engineer-in-charge.

M.S. Posts and Struts :

All the M.S. posts / struts shall be free from rust, scale, cracks, twists and other defects and shall be fabricated to the required shape and size out of the specified sections. The posts and struts shall be conforming to relevant specifications stipulated hereinbefore under relevant sections. All the posts an struts shall be of sizes and lengths as specified in the tender schedule. The exposed surfaces of the posts and struts shall be painted with two coats of approved primer.

R.C.C Posts and Struts :

All the posts and struts shall be of standard size as specified in schedule. These shall be coasted on suitable places/platforms in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm. nominal size) as per relevant specifications stipulated hereinbefore. The reinforcement shall be provided as hereinbefore under relevant sections. To posts and struts shall be free from honeycombing, cracks and other defects.

After casting, the posts / struts shall be left at the same place and cured for a minimum period of 7 days. After 7 days curing the same shall be shifted to a leveled ground and stacked for further curing for 14 days. After 21 days of curing only, the posts/ struts shall be transported to work site without any damage, for fixing in position.

Spacing of the Posts and Struts :

The spacing of posts shall be 3 m. center to center unless other wise specified or as directed by the Engineer-in-charge, to suit the dimensions of the area to be fenced. E very 10th posts, last but one end posts, corner posts, and posts where the level of fencing changes in steps and end post when the fencing changes its direction shall be strutted on both dies or as directed by the Engineer-in-charges. End posts where barbed wire fencing is discontinued shall be strutted on one side only.

Fixing of M.S. / R.C.C. Posts and Struts :

Pits of size 45 X 45 X 45 cm. deep or sizes mentioned in the drawings, shall first be excavated centrally in the direction of proposed fencing work, true to line and level to receive the posts. In case of struts, the pits shall be so excavated, as to receive minimum 15cm. concrete cover at any point of the struts to suit its inclination or as shown in the drawing.

The pits shall be filled with a layer of 15cm. thick cement concrete of specified mix. The posts and struts shall then be placed in the pits, the posts projecting to the specified height above ground level, true to line, plumb and position, by providing adequate supports temporarily, and cement concrete of specified mix, shall then be filled in so that the posts are embedded in cement concrete blocks of specified sizes. The concrete in foundation shall be watered for atleast 7 days to ensure proper curing.

Barbed Wire :

The barbed wire shall be of M.S. or G.I. as specified and it shall generally conform to I.S. 278-1978.

The base metal of the line and point wire shall be of good commercial quality mild steel. The line and point wire shall be circular in section, free from scales and other defects and shall be uniformly galvanized if specified.

The line wire shall be in continuous lengths and shall generally be free from signs of welds. It shall be able to withstand wrapping and unwrapping 8 turns round its diameter.

The barbed wire shall consist of two splices per reel. The barbed wire shall be formed by twisting two lines wires one containing the barbs.

The barbed wire and its weight shall be as given in the table below:

Type	Nominal diameter of wire		Nominal distance between two barbs in mm	Mass of complete barbed wire (in gm./m)
	Line wire (in mm)	Point wire (in mm)		
1.	2.50 (12G)	2.50 (12G)	75	146 (136-155)
2.	2.50	2.50	150	114(108-120)
3.	2.50	2.00 (14 G)	75	117(108-125)
4.	2.50	2.00	150	96(89-103)
5.	2.24 (13G)	2.00	75	102(97-106)
6.	2.24	2.00	150	82(78-85)

The barbs shall carry four points and shall be formed by twisting tow point wires, each two turns, tightly round one line wire, making altogether 4 (four) complete turns. The barbs shall be so finished that the four points are set and locked at right angles to each other.

The barbs shall have a length of not less than 13mm and not more than 18mm. The points shall be sharp and well pointed. Barbed spacing shall be as given in the above table. Wherever required for every 50 reels or part thereof, samples of the barbed wire and the individual line wires shall be put to tensile test and in case of failure to conform to tensile properties given below, two additional tests of each kind shall be made on the samples cut from other reels.

Tensile Properties :

Size of lien wire Nominal dia (in mm)	Breaking load of line wire		Min. breaking load of complete barbed wire (in Kg.)
	Min. (in Kg.)	Max. (in Kg.)	
2.50 (12G)	216	302	444
2.24 (13G)	128	179	263

On the results of these additional tests, the whole or portion of the barbed wire shall be accepted or discarded as the case may be.

Fixing of Barbed Wire :

The barbed wire shall be stretched and fixed in number of rows and two diagonals as specified. The bottom row shall be 140mm above ground and the rest at 125 mm or at given

spacing as per drawing. The diagonals shall be stretched between adjacent posts from top wire of one post to the bottom wire of the 2nd post. The diagonal wires will be interwoven with horizontal wires by fixing the odd rows of wires, then the diagonal cross wires and lastly the even rows of wires. The jointing of the barbed wire in between the posts shall not be permitted.

Necessary holes should be tapped in the posts and the barbed wire shall be fixed in position by means of "U" clamps or bolts and nuts as specified in drawings. In case of fixing with "U" clamps, the legs of the "U" clamps passing through the 10mm dia hole in the RCC post to hold barbed wire shall be turned up and down to get an overlap of 25mm on the face of RCC post. Turn buckles and straining bolts shall be used at the end posts if specified.

Mode of Measurement :

The work shall be measured in running metre length of fencing correct to a centimeter for the finished work, from center to center of the posts.

The rate shall include the cost of labor and material involved in all the operations described above including the cost of barbed wire, turn buckle, straining bolts, bolts and the nuts / U clamps including excavation and foundation concrete or as specified in item description for the work.

Chain Link :

The chain link shall be of approved manufacture and of correct size, gauge etc. It shall be of M.S. or G.I. as specified of approved manufacture and of required size, gauge etc. The base materials of the wire shall be of good commercial quality mild steel. The wire shall be circular in section, free from rust, scale, cuts, welds and together defects and shall be uniformly galvanized if specified.

Fixing of the Chain Link Fencing to MS or RCC post:

The chain link of specified height of fencing shall be fixed first to the end post with necessary G.I. approved type U clamps threaded t both the ends and G.I. nut, bolts, washers etc. and with 6 mm dia full height M.S. /G.I. anchor bar. After fixing the chain link at the end post, it shall be stretched tightly and fixed to next post one after the other by the above mentioned clamps and bars etc. leaving 50 mm clearance from the ground and 20mm clearance in the case of concrete coping at bottom to avoid rusting. The point at the change in level of the fencing. top/bottom, necessary links shall be adjusted suitably as per the manufacturers specification or as directed by the Engineer-in-charge. The entire link fence shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer or as specified in the item / drawing.

Measurement :

The work shall be measured in running metre length of fencing correct to a centimeter for the finished work from centre to center of the posts.

The rate shall include the cost of labor and material involved in all the operation described above including the cost of barbed wire, turn buckle, straining bolts and bolts and the nuts / U clamps, 6mm dia M.S. / GI anchor bar etc. including excavation and foundation concrete or as specified in item description for the work.

36 DRAINAGE WORK WITH NP 2 CLASS R.C.C. HUME PIPES

RCC Spun Pipes :

The pipes shall be RCC spun pipes NP2 class, conforming to IS 458-1971 and shall be approved by the Engineer-in-charge for soundness before incorporation the work.

Laying RCC spun pipes :

The work consist of providing, laying, jointing and testing RCC spun pipe storm water drain of required diameter as mentioned in the schedule to discharge storm water to the main nallh as shown in the drawing.

After the cement concrete cradle has been laid properly, if specified or as directed by he Engineer-in-charge, the pipes shall be lowered gradually into the trenches over the concrete cradle or bed. Necessary working space / gap for collars shall be made at every joint. Laying of pipe shall proceed upgrade of a slope. The collars shall be slipped on before the next pipe is laid.

The pipe drain shall rest on the bed at every point through its length. To ensure this the space between the underside of the pipe on the invert of the cradle shall be carefully grouted solid with cement slurry consisting of one part of cement to one part of clean washed sand in such a manner that no void is left. It shall be ensured t hat the load of the pipes and the super imposed load of the earth filling is evenly distributed on the cradle or bed.

The contractor shall take precautions to see that no dirt, earth or other foreign matter is allowed on the surface of the cradle or bed of the pipe resting thereon, all to the full satisfaction of the Engineer-in-charge. After the alignment and grading of the pipes is checked by the authorized representative of the Department, the grouting shall be done with specified stiff mix of cement mortar.

The cradle of concrete shall be allowed to set atleast for thee days before any pipe is placed on it and the contractor shall take due care in setting the pipe in the cradle so that no damage is occurred to the cradle. If any damage to the cradle occurs, it shall be rectified to the satisfaction of Engineer-in-charge and in any particular case where damage to the cradle is beyond repair in the opinion of the Engineer-in-charge, the contractor shall cut out the damaged section of the cradle and redo the same at his own expenses tot eh complete satisfaction of the Engineer-in-charge.

No pipe shall be laid or placed till the alignment of the pipe drain and its levels and gradient have been carefully checked and found correct / approved by the Engineer-in-charge.

Joints :

The joints for the pipes shall be made by loose collars and the connecting space shall be as minimum as possible. The collars shall be specifically roughened inside to provide a better grip.

The two adjacent pipes will be so designed and manufactured that when butted together concentrically, a dowel is left between the two ends. In this dowel, cement mortar

of (1:1) proportion or mix, as specified in the schedule be filled and then between the ends a paste of cement mortar of the same proportions will be placed. The space remaining between the pipe ends and the collar being then caulked with cement mortar of (1:1) or other specified proportion so that an even space appears all round the external diameter of the pipes. All the joints shall be finished off smooth at an angle of 45 0 with the longitudinal axis of the pipe on either side of the collars.

The interior of the pipe drains shall be cleaned off all dirt, cement mortar and superfluous materials and joints shall be cured for atleast 7 days.

Testing of RCC spun pipes :

After sufficient interval has been allowed for the joints to set, the pipe drains will be tested under a water head of atleast 1.2m and in no case under a head greater than 1.8m of water above the top of the pipes. In addition, the pipe drains shall be examined for leaks of land / sun soil water making its way through the joints. The contractor shall make the pipe drains water tight against the entrance of land/ sub soil water from outside and also against the leakages of water from the inside of the pipe drains at the test heads specified above to the full satisfaction of the pipes, in order to detect any leakage easily. The cost of testing of the pipe drain shall be borne by the contractor and is deemed to be included in the rates quoted by the contractor.

Engineer-in-charge may order concrete to be increased or diminished :

The Engineer-in-charge may increase or decrease the concrete on the pipe drains as to the quantity and quality to omit the same entirely according to the nature of the ground that may be revealed when the storm water drain trenches are excavated.

Back filling / filling trenches :

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. Where the trenches are excavated in soil, the filling shall be done with earth on the sides and top of pipes in layers not exceeding 20 cm. watered, rammed and consolidated taking care that no damage is caused to the pipe below. In case of excavation of trenches in rock, the filling upto a depth of 30 cm. above the crown of pipe or barrel shall be done with fine material such as earth, murrum or pulverized decomposed rock according to the availability at site. The remaining filling shall be done with rock filling or boulders of size not exceeding 15cm. mixed with fine material as available to fill up the voids, watered, rammed and consolidated in layers not exceeding 30cm.

Mode of measurement :

The length of pipes shall be measured in running metre nearest to a centimeter along the center lien of the pipes over all fittings such as collars, bends, junctions etc, Fittings / specials shall not be measured separately.

The rate shall include the cost of materials an labor including jointing, grouting, cutting of pipes to the required lengths, wastages etc. involved in all the operations described above.

Excavation back filling, shorting and timbering in trenches and cement concreting wherever required shall be measured separately under relevant items of work.

37. THEORETICAL, STANDARD REQUIREMENT OF CEMENT FOR VARIOUS ITEMS OF WORK FOR GUIDANCE OF CONTRACTOR.

Sl. No.	Brief description of item	Unit	Qty. of cement in bags
1	Cement Concrete 1:5:10	Cum	2.60
2	Cement Concrete 1:4:8	Cum	3.40
3	Cement Concrete 1:3:6	Cum.	4.40 *
4	Cement Concrete 1:2:4	Cum	6.40 *
5	Reinforced Cement Concrete 1:2:4	Cum.	6.40 *
6	Reinforced Cement Concrete: 1:1 1/2 :3	Cum.	8.00 *
7	Reinforced Cement Concrete 1:1:2	Cum.	12.20 *
Note : For controlled concrete items like M-10, M-15, M-20, M-25 etc. the Consumption of cement will have to be assessed by the Engineer-in-charge on the basis of design mixes approved for individual work.			
8	Brick Masonry in C.M. 1:4	Cum.	1.90
9	Brick Masonry in C.M. 1:6	Cum.	1.25
10	Half brick masonry in C.M. 1:4 with RCC 1:2:4 stiffeners	Sqm.	0.27
11	Half brick masonry in 1:4	Sqm.	1.21
12 a.	R.R. Masonry in C.M. 1:6	Cum.	1.65
b.	C.R. Masonry in C.M. 1:6	Cum.	1.56
13	IPS Flooring (C.C. 1:2:4, Finished smooth)		
a.	30 mm thick	Sqm.	0.23
b.	40 mm thick (smooth / broom finish)	Sqm.	0.30
c.	50 mm thick	Sqm.	0.36
	(+) 20 mm thick skirting /dado in cm. 1:3	Sqm.	0.30
14	Hardonate flooring – 50 mm thick (C.C. 1:2:4, finished smooth)	Sqm.	0.41
15	Kota Stone :		
a.	Flooring (with lime mortar bedding pointed with matching cement slurry)	Sqm.	0.13
b.	Skirting with 20mm thick C.M. 1:3 backing	Sqm.	0.27
c.	Coping	Sqm.	0.13
16	Terrazzo Tile :		
a.	Flooring (with lime mortar bedding and pointed with cement slurry)	Sqm.	0.18
b.	Skirting with 20 mm thick C.M. 1:3	Sqm.	0.28
c.	Treads, hydraulically pressed with C.M. 1:3 bedding	Sqm	0.37
d.	Treads in one piece	Sqm.	0.28
e.	Risers, hydraulically pressed with C.M. 1:3 backing	Sqm.	0.28

f.	Risers in one piece	Sqm.	0.23
17	Cast in situ terrazzo :		
a.	Flooring 40 mm thick (28 mm C.C. 1:2:4 + 12mm with marble chips & powder)	Sqm.	0.26
b.	Skirting, 20mm thick (12mm C.M. 1:3 + 8 mm marble chips with cement & marble powder)	Sqm.	0.25
18	White glazed tile flooring and dado over 20mm C.M. 1:3 bedding	Sqm.	0.31
19	Cement tile :		
a.	Flooring (Lime mortar bedding)	Sqm.	0.18
b.	Skirting with 20 mm thick C.M. 1:3	Sqm.	0.28
20	Plaster skirting, 20 mm thick in C.M. 1:3	Sqm.	0.30
21	Cuddapah stone kitchen platform over 20mm thick C.M. 1:4	Sqm	0.30
22	Cuddapah stone window sill over 20mm thick C.M. 1:4	Sqm.	0.27
23	Fixing hold fasts in cement concrete 1:3:6 of size 300 X 100 X 150mm for door & windows	100 nos.	2.20
24	Cement plaster in C.M. 1:4 / 1:5 with neeru finish		
	A. Cement mortar 1:4		
	a. 12 mm thick	Sqm.	0.11
	b. 15 mm thick	Sqm.	0.13
	c. 20 mm thick	Sqm.	0.17
	B. Cement mortar 1:5		
	a. 12 mm thick	Sqm.	0.09
	b. 15 mm thick	Sqm.	0.11
	c. 20 mm thick	Sqm.	0.14
25	Cement plaster in C.M. 1:4 in two coats with neat cement punning		
a.	12 mm thick 10 mm + 5 mm (for ceiling)	Sqm.	0.18
b.	15 mm thick 15 mm + 5 mm (for internal walls)	Sqm.	0.22
26	Cement plaster in C.M. 1:4, 20 mm thick rough finish (for external brick / concrete surfaces	Sqm.	0.17
27	Sand faced plaster, 20 mm thick (12 mm C.M. 1:4 + 8mm C.M. 1:3)	Sqm.	0.21
28	Rough cast plaster, 25mm thick (12 mm C.M. 1:4 + 13mm C.M. 1:3)	Sqm.	0.27
	(+) (+) 10 mm wide & 18 mm thick plain or moulded cement mortar band in CM 1:4	100 RM	0.152
29	Cement plaster in C.M. 1:3 with water proofing compound finished smooth with neat cement		
	a. 12 mm thick	Sqm.	0.19

	b. 20 mm thick	Sqm.	0.27
30	Cement pointing in C.M. 1:3		
	a. Ruled pointing (groove pointing)	Sqm.	0.02
	b. Raised & cut pointing	Sqm.	0.04
31	Cement based waterproofing works (M/s India water-proofing or equivalent :		
	a. Terrace type average 115mm thick	Sqm.	0.45
	b. Basement type (Box type)		0.70
	c. Basement type (surface)	Sqm.	0.60
	d. In sunken floor of toilets, chajjas, parapets	Sqm.	0.30
	e. Brickbat coba in toilets, extra in roof terrace	Cum.	3.00
	f. O.H. water tanks	Sqm.	0.50
	g. Expansion joints	RM	0.50
32	Damp proof course in CC 1:2:4		
	a. 25 mm thick	Sqm.	0.16
	b. 38 mm thick	Sqm.	0.24
33	Laying R.C.C. spun pipes in C.M. 1:1 / 1:2		
	A. 100 mm dia	10 m	0.10
	B. 150 mm dia	10 m	0.12
	C. 250 mm dia	10 m	0.18
	D. 300 mm dia	10 m	0.22
	E. 450 mm dia	10 m	0.48
	F. 600 mm dia	10 m	0.64
34	Cement mortar 1:4 screed		
	a. 20 mm thick	Sqm.	
	b. 50 mm dia	Sqm.	
35	Chain link fencing / barbed wire fencing C.C. 1:3:4 pockets of 45 X 450 X 600 mm		
	a. Angle iron posts	m	0.21
	b. Cement concrete 1:2:4 posts	m	0.37
36	Kerb stone in CC 1:3:6 of size 125 X 375 mm	m	0.21
37	Shahabad stone paving, pointed in C.M. 1:3 15 X 10 mm groove	Sqm.	0.02
38	Pointing & grouting stone pitching in CM 1:3	Sqm.	0.14