Laboratory	**L&T Construction Research & Testing Centre, L &T Construction, TCTC GF, Mount Poonamallee Road, Manapakkam, Chennai, Tamil Nadu**		
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Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection

CHEMICAL TESTING

I.	**BUILDING MATERIAL**			
1.	**Bitumens & Asphalts**	Loss on heating	IS 1212-1978	0 to 2.5 %
		Matter soluble in trichloro ethylene	IS 1216-1978	0 to 100 %
2.	**Concrete Admixture**	pH value of liquid admixture	IS 9103-1999	3 to 12
II.	**WATER**			
1.	**Construction Water**	Acidity (0.02N of NaOH required to neutralize 100 ml sample of water using phenophthalein indicator)	IS 3025 (Part 22): 1986 IS 456-2000	0 to 50 ml
		Alkalinity (0.02N of H_2SO_4 required to neutralize 100 ml sample of water using mixed indicator)	IS 3025 (Part 23): 1986 IS 456-2000	0.1 ml to 100 ml
		Chlorides as Cl	IS 3025 (Part 32): 1988 IS 456-2000	5 mg/l to 16000 mg/l
		Inorganic solids (Non Volatile)	IS 3025 Part 18: 1984	20 mg/l to 5000 mg/l
		Organic solids (Volatile)	IS 3025 Part 18: 1984 IS 456-2000	20 mg/l to 1000 mg/l
		pH value	IS 3025 (Part 11):1983 IS 456-2000	3 to12

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		Sulphates as SO_4	IS 3025 (Part 24): 1986 IS 456-2000	5 to 2000 mg/l
		Suspended matter	IS 3025 (Part 17): 1984 IS 456-2000	0 to 3000mg/l
2.	**Industrial Water**	Alkalinity	IS 3025 (Part 23): 1986	1 mg/l to 10000 mg/l
		Ammoniacal Nitrogen, NH_3-N	IS 3025 (Part 34): 1988 (Nesslerisation & Titremetric method)	1 mg/l to 500 mg/l
		Biological Oxygen Demand @27 °C for 3 days	IS 3025 (Part 44): 1993	2 mg/l to 5000 mg/l
		COD	IS 3025 (Part 58): 2006	4 mg/l to 40000 mg/l
		Colour	IS 3025 (Part 04): 1983	1 Hazen to 500 Hazen
		Conductivity	IS 3025 (Part 14): 2013	0.1 micromohs/cm to 10000 micromohs/cm
		Dissolved phosphate as P	IS 3025 (Part 31): 1988 (stannous chloride method)	3 mg/l to 100 mg/l
		Nitrate Nitrogen, NO_3-N	IS 3025 (Part 34): 1988 (Nesslerisation & Titremetric method)	1 mg/l to 100 mg/l
		Oil & Grease	IS 3025 (Part 39): 1991	1 mg/l to 1000 mg/l
		pH	IS 3025 (Part 11): 1983 (electrometric method)	1 to 14
		Total silica	IS 3025 (Part 35): 1988	1 mg/l to 100 mg/l
		Total Dissolved Solids	IS 3025 (Part 16): 1984	1 mg/l to 50000 mg/l
		Total kjehldahl Nitrogen	IS 3025 (Part 34): 1988 (Macro kjedahl method)	1 mg/l to 500 mg/l
		Total suspended solids	IS 3025 (Part 17): 1984	1 mg/l to 10000 mg/l
		Turbidity	IS 3025 (Part 10): 1984	0.1 NTU to 1000 NTU

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MECHANICAL TESTING

I.	**BUILDING MATERIALS**			
1.	**Liquid Admixtures**	Dry material content	IS 9103:1999	1 % to 100 %
		Relative density	IS 9103:1999	1.00 to 1.30
2.	**Coarse Aggregates**	Aggregate abrasion value	IS 2386 (Part 4): 1963	5 % to 50 %
		Bulk Loose density	IS 2386 (Part 3): 1963	1 kg/L to 4 kg/L
		Bulk Rodded density	IS 2386 (Part 3): 1963	1 kg/L to 4 kg/L
		Combined Flakiness and Elongation index	IS 2386 (Part 1) :1963	5 % to 80 %
		Crushing value	IS 2386 (Part 4) :1963	5 % to 50 %
		Elongation index	IS 2386 (Part 1): 1963	5 % to 50 %
		Flakiness index	IS 2386 (Part 1): 1963	5 % to 50 %
		Impact value	IS 2386 (Part 4): 1963	5 % to 50 %
		Sieve analysis	IS 2386 (Part 1): 1963	1 % to 100 %
		Soundness	IS 2386 (Part 5): 1963	Upto 30 %
		Specific gravity	IS 2386 (Part 3): 1963	1.00 to 4.50
		Ten percent fines value	IS 2386 (Part 4): 1963	5 Tonnes to 50 Tonnes
		Water absorption	IS 2386 (Part 3): 1963	0.1 % to 20 %
3.	**Fine Aggregates**	Alkali aggregate reactivity	IS 2386 (Part 7): 1963	0.001 % to 1 %
		Alkali aggregate reactivity	ASTM C1260-14	0.001 % to 1 %
		Bulk Loose density	IS 2386 (Part 3): 1963	1 kg/L to 3 kg/L
		Bulk Rodded density	IS 2386 (Part 3): 1963	1 kg/L to 3 kg/L
		Materials finer than 75 micron	IS 2386 (Part 1) : 1963	1 % to 40 %
		Organic impurities in sand	IS 2386(Part 2): 1963	Qualitative Visual

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		Sieve analysis (Sieve Sizes are 0.075 mm to 4.75 mm)	IS 2386 (Part 1): 1963	1 to 100 %
		Soundness	IS 2386 (Part 5): 1963	Upto 30 %
		Specific gravity	IS 2386 (Part 3): 1963	1.0 to 3.5
		Water absorption	IS 2386 (Part 3): 1963	0.1 to 20 %
4.	**Anti-Stripping Agent**	Coating Retention Test	IS 14982 (Annex D) :2017	Qualitative Visual
		Flash point	IS 1209:1978	50 °C to 500 °C
		Pour point	IS 1448 (Part 10/Sec 2): 2013	Upto 100 °C
		Retained Indirect Tensile Strength	IS 14982 (Annex E): 2017	1 % to 100 %
		Solubility in high speed diesel oil	IS 14982 (Annex A): 2017	Qualitative Visual
		Specific gravity	IS 1202:1978	0.500 to 3.000
		Thermal Stability at 163°C, 24h	IS 14982 (Annex B): 2017	Qualitative Visual
		Wet Strength	IS 14982 (Annex E): 2017	0.01 Mpa to 10 MPa
5.	**Bitumen**	Absolute Viscosity	IS 1206 (Part 2): 1978	360 Poise to 100000 Poise
		Brookfield Rotational Viscosity	ASTM D 4402-15	10 cP to 100000 cP
		Elastic recovery	IRC SP 53 (Annex II) : 2010	1 % to 100 %
		Flash point	IS 1209:1978	100 °C to 500 °C
		Industrial viscosity	IS 1206 (Part 1): 1978	5 s to 50 s
		Kinematic Viscosity	IS 1206 (Part 3): 1978	30 cSt to 3000 cSt
		Penetration	IS 1203:1978	5 dmm to 300 dmm
		Rolling Thin Film and Thin Film Oven tests on Residue-Ductility at	IS 1208:1978 IS 73:2013 IS 1212:1978	5 cm to 150 cm

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		25 °C	ASTM D 2872-12	
		Rolling Thin Film and Thin Film Oven tests on Residue - Elastic recovery of half thread in Ductilometer at 25°C	IRC SP 53 (Annex II): 2010 IS 1212:1978 ASTM D 2872-12	1 % to 100 %
		Rolling Thin Film and Thin Film Oven tests on Residue - Increase in softening point	IS 1205:1978 IS 15462:2004 IS 1212:1978 ASTM D 2872-12	1 °C to 150 °C
		Rolling Thin Film and Thin Film Oven tests on Residue - Reduction in penetration of residue @ 25 °C	IS 1203:1978 IS 15462:2004 IS 1212:1978 ASTM D 2872-12	0.1 % to 100 %
		Rolling Thin Film and Thin Film Oven tests on Residue - Viscosity Ratio at 60 °C	IS1206 (Part 2): 1978 IS 73:2013 IS 1212:1978 ASTM D 2872-12	0.1 to 10
		Separation	IS 15462:2004	Upto 50 °C
		Softening Point	IS 1205:1978	1 °C to 150 °C
		Specific gravity	IS 1202:1978	0.5 to 1.5
6.	**Bituminous mixture**	Asphalt content by Ignition method	ASTM D 6307:2016	1 % to 20 %
		Bulk Specific Gravity and density of Non-Absorptive Compacted Asphalt Mixtures	ASTM D 2726/2726M:2017	1.000 to 4.000
		Effect of Water on Bituminous-Coated Aggregate Using Boiling Water	ASTM D3625/3625M:2012	0 to 100 % (Visual)

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		Indirect Tensile Strength	ASTM D 6931-17	0.01 Mpa to 10 MPa
		Marshall flow	ASTM D 6927-15	Upto 25 mm
		Marshall stability	ASTM D 6927-15	2 kN to 50 kN
		Maximum specific gravity of the mix	ASTM D 2041-M:2011	1 to 3.5
		Polished-stone value	BS 812 (Part 114): 1989	20 divisions to 80 divisions
		Resilient Modulus of Bituminous Mixtures by Indirect Tension Test	ASTM D7369:2011	100 MPa to 50000 MPa
		Resistance of compacted asphalt mixtures to moisture-induced damage by Tensile Strength Ratio	AASHTO T 283:2018	0.01 to 1
		Retained Stability	MoRTH V Appendix 4: 2013	1 % to100 %
		Stripping value of aggregate	IS 6241:1971	Qualitative Visual
		Thickness or Height of Compacted Asphalt Mixture Specimens	ASTM D 3549/3549M:2018	5.00 mm to 500.00 mm
7.	**Emulsion**	Coagulation of Emulsions at Low Temperature	IS 8887 (Annex C): 2018	Qualitative Visual
		Coating Ability and Water Resistance	IS 8887 (Annex F): 2018	Qualitative Visual
		Ductility of Residue left after Evaporation	IS 8887 (Annex J): 2018 IS1208:1978	1 to150 cm
		Miscibility with water	IS 8887 (Annex H): 2018	Qualitative Visual
		Penetration of Residue left after Evaporation	IS 8887 (Annex J): 2018 IS1203:1978	5 dmm to 300 dmm

Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
		Residue by Evaporation	IS 8887 (Annex J): 2018	Upto 100 %
		Residue by seiving through 600 micron IS Sieve	IS 8887 (Annex B): 2018	0 to 5 %
		Stability to mixing with cement	IS 8887 (Annex G): 2018	0 to 10 %
		Storage Stability	IS 8887 (Annex D): 2018	Upto 10 %
		Viscosity	IS 3117 (Annex A): 2004 IS 8887:2004	1 to 600 s
8.	**Bricks**	Compressive strength	IS 3495 (Part 1): 1992	1 to 40 N/mm^2
		Efflorescence	IS 3495 (Part 3): 1992	Qualitative Visual
		Water absorption	IS 3495 (Part 2): 1992	0.1 % to 35 %
9.	**Concrete Blocks**	Compressive strength	IS 2185 (Part 1): 2005	2.5 N/mm^2 to 40 N/mm^2
		Density	IS 2185 (Part 1): 2005	100 kg/m^3 to 3000 kg/m^3
		Dimension	IS 2185 (Part 1): 2005	50 to 600 mm
		Water absorption	IS 2185 (Part 1): 2005	1 % to 30 %
10.	**Cement**	Compressive strength of hydraulic cement other than masonry cement	IS 4031 (Part 6): 1988	5 N/mm^2 to 100 N/mm^2
		Density	IS 4031 (Part 11): 1988	2.5 g/cc to 3.5 g/cc
		Fineness by Blaine air permeability method	IS 4031(Part 2): 1999	225 m^2/kg to 500 m^2/kg
		Fineness by dry sieving	IS 4031(Part 1): 1996	1 % to 100 %
		Setting time	IS 4031 (Part 5): 1988	10 min to 720 min
		Soundness by Le-Chatelier's Method	IS 4031(Part 3): 1988	0.1 to 15 mm
		Standard consistency	IS 4031 (Part 4): 1988	20 % to 35 %
11.	**Fresh concrete**	Setting time	IS 8142:1976	30 min to 1440 min
		Water bleeding	IS 9103:1999	0.50 % to 10 %
		Workability by slump	IS 1199:1959	5 mm to 200 mm

Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
12.	**Hardened Concrete**	Chloride Migration Coefficient Test	NT Build 492:2011	Upto 30 $x10^{-12}$ m^2/s
		Compressive strength of accelerated cured specimen	IS 9013:1978	5 N/mm^2 to 120 N/mm^2
		Compressive strength of core	IS 516:1959	5 N/mm^2 to 120 N/mm^2
		Compressive strength of cubical specimen	IS 516:1959	5 N/mm^2 to 120 N/mm^2
		Compressive strength of cylindrical specimen	IS 516:1959	5 N/mm^2 to 120 N/mm^2
		Drying shrinkage	IS 1199:1959	Upto 1 %
		Electrical indication of concrete's ability to resist chloride ion penetration	ASTM C 1202-18	100 Coulombs to 10000 Coulombs
		Flexural strength of moulded flexure test specimen	IS 516:1959	1 N/mm^2 to 25 N/mm^2
		Modulus of Elasticity	ASTM C469/C469M:2014	10000 N/mm^2 to 50000 N/mm^2
		Modulus of Elasticity	EFNARC specification - Sprayed concrete (1996)	10000 N/mm^2 to 50000 N/mm^2
		Split tensile strength	IS 5816:1999	1 N/mm^2 to 25 N/mm^2
		Water permeability	IS 516 (Part 2/Sec 1): 2018	1 mm to 160 mm
13.	**Sealant**	Adhesion and Cohesion properties at variable temperatures	BS EN ISO 9047:2003	Upto 12 mm
		Minimum application life - Tack free conditions	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	Qualitative
		Minimum application	BS EN 14187 (Part 2):	Qualitative

Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
		life - Tack free conditions	2017	
		Minimum application life - Time (min)	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	Qualitative 0 to 30 mins
		Minimum application life - Difference in depth of sealant surface	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	0 to 6 mm
		Penetration	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	Upto 10 mm
		Recovery	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	0 to 100 %
		Resistance to plastic flow	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	Upto 5 mm
		Rheological properties - Ability to flow using a horizontal mould at 5°C	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	Upto 10 mm
		Rheological properties - Ability to flow using a horizontal mould at 5°C	BS EN 14187 (Part 3): 2017	Upto 10 mm
		Rheological properties - Resistance to flow using a mould inclined at 2.5% slope at 23±2°C	BS 5212 (Part 3): 1990 BS 5212 (Part 1): 1990	Upto 10 mm
		Rheological properties - Resistance to flow using a mould inclined at 2.5% slope at 23±2°C	BS EN 14187 (Part 3): 2017	Upto 10 mm
		Tensile properties at maintained extension	BS EN ISO 8340:2005	Upto 12 mm

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II.	**WOOD & WOOD PRODUCTS**			
1.	**Plywood**	Glue Shear strength	IS 1734 (Part 4) : 1983	100 to 15000 N
		Static Bending Strength	IS 1734 (Part 11) : 1983	15 N/mm^2 to 150 N/mm^2
		Water resistance (Glue shear strength)	IS 1734 (Part 6) : 1983	100 to 15000 N
2.	**Timber**	Moisture content	IS 1708 (Part 1):1986	0.1 % to 30 %
III.	**MECHANICAL PROPERTIES OF METALS**			
1.	**HSD Rebar**	Nominal mass of HSD rebar	IS 1786:2008	0.075 kg/m to 15 kg/m
		Percentage of elongation	IS 1608 (Part 1): 2018 IS 1786:2008	3 % to 30 %
		Tensile stress	IS 1608 (Part 1): 2018 IS 1786:2008	200 N/mm^2 to 1000 N/mm^2
		Yield stress	IS 1608 (Part 1): 2018 IS 1786:2008	200 N/mm^2 to 1000 N/mm^2
2.	**Mechanical splice**	Cyclic tensile test	IS 16172:2014 IS 1608 (Part 1): 2018	20 N/mm^2 to 600 N/mm^2
		Low cycle fatigue test	IS 16172:2014 IS 1608 (Part 1): 2018	-173 N/mm^2 to +173 N/mm^2
		Percentage elongation	IS 16172:2014 IS 1608 (Part 1): 2018	0.3 to 30 %
		Static tensile strength	IS 16172:2014 S 1608 (Part 1): 2018	200 N/mm^2 to 1000 N/mm^2
3.	**Prestressing Strands**	Breaking Load	IS 14268:2017	50 kN to 500 kN
		Percentage of elongation	IS 14268:2017	0.25 % to 10 %
		Yield load	IS 14268:2017	50 kN to 500 kN
		Relaxation Test	IS 14268:2017	0 to 3.5 %

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4.	**Structural steel**	0.2% Proof strength	IS 1608 (Part 1): 2018	200 to 1000 N/mm^2
		Percentage of elongation	IS 1608 (Part 1): 2018	3 % to 30 %
		Tensile strength	IS 1608 (Part 1): 2018	200 N/mm^2 to 1000 N/mm^2
IV.	**SOIL & ROCK**			
1.	**Soil**	CBR (Soaked)	IS 2720 (Part 16): 1987	0.5 % to 200 %
		CBR (Unsoaked)	IS 2720 (Part 16): 1987	0.5 % to 200 %
		Consolidation properties - Coefficient of Compressiblity	IS 2720 (Part 15): 1986	0.01 to 2.0
		Consolidation properties - Initial Void Ratio	IS 2720 (Part 15): 1986	0.01 to 3.0
		Density index of cohesion less soils	IS 2720 (Part 14): 1983	40 % to 85 %
		Direct shear (Gravel) - Angle of Internal Friction	IS 2720 (Part 39): 1977	1° to 60°
		Direct shear (Gravel) - Cohesion	IS 2720 (Part 39): 1977	Upto 40 kg/cm^2
		Direct shear (Soil) - Angle of Internal Friction	IS 2720 (Part 13): 1986	1° to 60°
		Direct shear (Soil) - Cohesion	IS 2720 (Part 13): 1986	Upto 10 kg/cm^2
		Free swell index	IS 2720 (Part 40): 1977	Upto 900 %
		Grain size analysis (Hydrometer)	IS 2720 (Part 4): 1985	Upto 100 %
		Grain size analysis (Wet sieve)	IS 2720 (Part 4): 1985	Upto 100 %

Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
		Heavy compaction - Maximum Dry Density	IS 2720 (Part 8): 1983	0.5 g/cc to 3.0 g/cc
		Heavy compaction - Optimum Moisture Content	IS 2720 (Part 8): 1983	1 % to 50 %
		Light compaction - Maximum Dry Density	IS 2720 (Part 7): 1980	0.5 g/cc to 2.5 g/cc
		Light compaction – Optimum Moisture Content	IS 2720 (Part 7): 1980	1 % to 50 %
		Liquid limit	IS 2720 (Part 5): 1985	10 % to 600 %
		Permeability (Falling head)	IS 2720 (Part 17): 1986	10^{-2} to 10^{-15} cm/s
		Permeability Using Triaxial Cell	CRD-C 163-92	10^{-2} to 10^{-15} cm/s
		Plastic limit	IS 2720 (Part 5): 1985	5 % to 300 %
		Shrinkage limit	IS 2720 (Part 6): 1972	1 % to 50 %
		Soil classification	IS 1498:1970	Qualitative Visual
		Specific gravity	IS 2720 (Part 3): 1980	1 to 3
		Swelling pressure	IS 2720 (Part 41): 1977	0.01 kg/cm^2 to 40 kg/cm^2
		Triaxail UU (without pore pressure) - Angle of Internal Friction	IS 2720 (Part 11): 1993	1° to 60°
		Triaxail UU (without pore pressure) - Cohesion	IS 2720 (Part 11): 1993	0 to10 N/mm^2
		Triaxial CU (With Pore Pressure) - Angle of Internal Friction	IS 2720 (Part 12): 1993	1 ° to 60 °
		Triaxial CU (With Pore Pressure) - Cohesion	IS 2720 (Part 12): 1993	0 to 10 N/mm^2
		Unconfined	IS 2720 (Part 10): 1991	0.01 N/mm^2 to 15 N/mm^2

Sl.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
		compressive strength		
		Vane shear test	IS 2720 (Part 30): 1980	0.03 kg/cm^2 to 2.0 kg/cm^2
		Water content	IS 2720 (Part 2): 1973	1 % to 300 %
2.	**Clays & Soils**	pH of soil	IS 2720 (Part 26): 1987	3 to12
		Sulphates of soil	IS 3025 (Part 24): 1986	5 mg/l to 5000 mg/l
3.	**Rock**	Density by Saturation and Buoyancy Techniques	IS 13030:1991	1000 kg/m^3 to 4000 kg/m^3
		Indirect Tensile strength by Brazilian Test	IS 10082:1981	4 MN/m^2 to 100 MN/m^2
		Modulus of elasticity	IS 9221:1979	5 GPa to 100 GPa
		Point load strength index	IS 8764:1998	0.02 N/mm^2 to 35 N/mm^2
		Poisson's ratio	IS 9221:1979	0.01 to 0.50
		Porosity by Saturation and Buoyancy Techniques	IS 13030:1991	0.1 % to 20 %
		Rock triaxial - Angle of internal friction	IS 13047:1991	1° to 60°
		Rock triaxial - Cohesion	IS 13047:1991	Upto 60 N/mm^2
		Specific gravity	IS 2386 (Part 3): 1963	1 to 4
		Unconfined compressive strength of rock	IS 9143:1979	0.1 N/mm^2 to 400 N/mm^2
		Water absorption of rock	IS 2386 (Part 3): 1963	0.10 % to 10 %
V.	**TEXTILE MATERIALS**			
1.	**Geosynthetics**	Breaking Force of Textile Fabrics (Strip Method)	ASTM D 5035:2011	1 N to 90000 N
		Elongation of Geogrids	ASTM D 6637:2015	0.001 % to 25 %

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		by Single or Multi-Rib Tensile method		
		Elongation of Geotextile by wide width strip method	ASTM D 4595:2017	0.001 % to 100 %
		Elongation of Textile Fabrics (Strip Method)	ASTM D 5035:2011	0.001 % to 100 %
		Index Puncture Resistance of Geotextile	ASTM D 4833:2007	0.001 kN to 90 kN
		Mass per square metre of Geotextile	ASTM D 5261:2010	10 g/m^2 to 1000 g/m^2
		Static Puncture Strength of Geotextile	ASTM D 6241:2014	0.001 kN to 90 kN
		Tensile Properties of Geogrids by Multi-Rib Tensile method	ASTM D 6637:2015	1 kN/m to 1000 kN/m
		Tensile Properties of Geogrids by Single-Rib Tensile method	ASTM D 6637:2015	0.005 kN/m to 450 kN/m
		Tensile Properties of Geotextile by wide width strip method	ASTM D 4595:2017	5 N/m to 450000 N/m

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NON – DESTRUCTIVE TESTING

I.	**BUILDING MATERIALS-REINFORCED CONCRETE STRUCTURES**			
1.	**Reinforced Concrete Structures**	Cover Meter	BS 1881 (Part 204): 1988	1 mm to 150 mm
		Rebound Hammer	IS 13311 (Part 2): 1992	10 to 80
		Ultrasonic pulse velocity	IS 516 (Part 5/Sec1): 2018	0.5 km/s to 5 km/s

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