

## Field and Laboratory Testing

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## SOIL TESTING

<u>TEST OR SERVICE</u>	<u>TEST METHOD</u>
<b>1. Classification and Index Properties (Soil)</b>	
a. Engineering Classification of Soil (includes Items c. and d.)	D2487
b. Classification of Aggregate for Road Construction (includes Items c. and d.)	D448
c. Grain Size Distribution	
1) Sieve Analysis With No. 200 Wash	D422 or D6913 T88 D1140
2) Hydrometer Analysis	D422 or D7928
d. Atterberg Limits (Liquid Limit, Plastic Limit, and Plasticity Index)	D4318 T89 T90
e. Shrinkage Limit (Wax Method)	D4943
f. Visual/Manual Description and ID	D2488
g. Portion of Soil Passing No. 200 Sieve (No. 200 Wash)	D1140
h. Specific Gravity	
1) Fine Aggregate	D854 T100
2) Coarse Aggregate	C127 T85
i. Organic Content (Loss on Ignition)	D2974 T267

**SOIL TESTING (Cont.)**

	<u>TEST TEST OR SERVICE</u>	<u>UNIT METHOD</u>
j.	Sieve Analysis of Aggregate	C136
k.	Coarse Aggregate Soundness by Use of Sodium Sulfate or Magnesium Sulfate	C88 PTM 510 T104
	1) With no extra sample Preparation	
	2) With crushing sample to No. 57 size	
	3) With crushing sample to No. 57, then to No. 8 size	
	4) With crushing sample to No. 8 size	
l.	Coarse Aggregate Resistance to Abrasion (LA Abrasion)	
	1) Small Size	C131 T96
	2) Large Size	C535
	3) Crushing to Size	C131 / C535
2.	<b>Density and Moisture</b>	
a.	Moist Density and Moisture (Natural Density - specimen obtained using Shelby Tube)	T233
b.	Moist Density and Moisture w/Strength or Consolidation Test (Natural Density - specimen obtained using Shelby Tube)	T233
c.	Moisture Content	D2216 T265
d.	Correction of Natural Density for Oversize Particles	D4718

**SOIL TESTING (Cont.)**

<u>TEST OR SERVICE</u>	<u>TEST METHOD</u>
<b>3. Compaction</b>	
a. Proctor Maximum Density – Sieve Analysis Required to determine Proctor Method (Sieve Analysis D422 or D6913 T88)	
1) Standard Soil Test (5.5 lb. hammer with 12" drop and 3 layers)	D698 T99
a) 4" Mold - Method A	
b) 4" Mold - Method B	
c) 6" Mold - Method C	
2) Modified Soil Test (10 lb. hammer with 18" drop and 5 layers)	D1557 T180
a) 4" Mold - Method A	
b) 4" Mold - Method B	
c) 6" Mold - Method C	
3) Standard Soil/Cement Mixtures Test (5.5 lb. hammer with 12" drop and 3 layers)	D558 T134
b. Relative Density for Free- Draining Soils	
1) Maximum Density	D4253
a) Wet Method	
b) Dry Method	
2) Minimum Density	D4254
c. Correction of Maximum Density for Oversize Particles (excludes cost of Specific Gravity Test)	D4718

## SOIL TESTING (Cont.)

<u>TEST OR SERVICE</u>	<u>TEST METHOD</u>
<b>4. Settlement and Expansion</b>	
a. Consolidation (1/4, 1/2, 1, 2, 3, 4, 8, 16 tsf) (includes: plot of strain vs. log pressure, strain vs. log of time)	D2435 T216
1) Rebound – Specified by Client	
2) Additional Loads beyond 16 tsf (each)	
b. One-Dimensional Swell or Collapse	D4546
1) Method A – 4 Points	
2) Method B – 1 Point	
3) Method C – 1 Point with D2435	
c. Expansion Index	D4829
d. Potential Expansion of Steel Slag	PTM 130
1) 1 Compaction Point	
2) Per Additional Point	
<b>5. Strength</b>	
a. Unconfined Compression (Soil) - Undisturbed - Remolded	D2166 / T208 D2166 / T208
b. Direct Shear (CD type, test results will include plots of shear stress vs. normal stress and shear displacement)	D3080 T236
1) 3 Points	
2) Per Additional Point	
c. Triaxial Compression/Shear (Tests will include plots of Mohr circle with failure envelope and stress vs. strain, and a sketch of the failure)	T234
1) Unconsolidated undrained test (a.k.a. UU or Q)	D2850

## SOIL TESTING (Cont.)

	<u>TEST OR SERVICE</u>	<u>TEST METHOD</u>
	2) Consolidated undrained test (a.k.a. CU or R)	D4767
	3) Consolidated undrained test with pore pressure measurement	D4767
	4) Consolidated drained (a.k.a. CD or S)	D7181
6.	<b>Permeability</b>	
a.	Constant Head (Coarse Material, $k > 1 \times 10^{-5}$ cm/sec)	D2434 T215
b.	Flex Wall Permeability (Falling head rising tail water) (Fine Material, $k < 1 \times 10^{-5}$ cm/sec)	D5084
7.	<b>Corrosivity</b>	
a.	pH	T289
b.	Minimum Resistivity	T288
c.	Sulfate (soil)	T291
d.	Chloride (soil)	T290
e.	Sulfate (Water)	D516
f.	Chloride (Water)	D512
g.	Conductivity (Water)	D1125
8.	<b>Pavement Design</b>	
a.	California Bearing Ratio (CBR) (includes Standard or Modified Proctor)	D1883 T193
1)	1 compaction point	PTM 113
2)	Per additional point	

## ROCK TESTING

<u>TEST OR SERVICE</u>	<u>TEST METHOD</u>
1. <b>Classification/Index Properties (Rock)</b>	
a. Visual Description (Rock)	
b. Slake Durability	D4644
2. <b>Density and Moisture (Rock)</b>	
a. Moisture Content (Rock)	D2216
b. Chunk Moist Density	
3. <b>Deformation (Rock)</b>	
a. Elastic Moduli with Unconfined Compression (test results include plot of axial stress vs. strain)	D7012
1) Add for Poisson's Ratio (test results include plot of axial stress vs. diametric strain)	
4. <b>Strength (Rock)</b>	
a. Unconfined Compression (Core) (Includes Unit Weight)	D7012 (Method C)
b. Point Load Test (Core)	D5731
1) Per Point	
2) 10 Specimens	
c. Mohs Hardness of Rock	
5. <b>Miscellaneous Rock</b>	
a. Specimen Preservation (per specimen)	D5079
b. Potential for Expansive Sulfides	N/A
c. Percent Pyritic Sulfur	Industry Standard

## CONCRETE, ASPHALT AND FIELD TESTING

	<u>TEST OR SERVICE</u>	<u>TEST METHOD</u>	<u>UNIT COST</u>
1.	<b>Concrete Strength</b>		
a.	Unconfined Compression (Concrete)		
	1) Cylinder (each molded specimen)	C39	
	2) NX to 6" Diameter Structural Core with Unit Weight	C39	
	2a) Neoprene Caps	C39	
	2b) Sulfur Capping	C617/C39	
b.	Beams (Concrete – each molded specimen)	C78	
c.	2" x 2" Cube (mortar/grout)	C109	
2.	<b>Concrete Field Testing</b>		
a.	Slump	C143	
b.	Air Content (pressure meter)	C231	
c.	Air Content (roller meter)	C173	
d.	Fresh Concrete Unit Weight	C138	
e.	Flow Cone (grout/mortar)	C939	
f.	Mold Cylinders (6"x 12", 4"x 8", 3"x 6")	C31	
g.	Temperature	C1064	
3.	<b>Asphalt Laboratory Testing</b>		
a.	Asphalt Content & Gradation	PTM 757A	
b.	Bulk Specific Gravity of Asphalt Core	D2726	
4.	<b>Field Density Testing with Troxler Nuclear Gauge</b>		
a.	Soil Field Density	D6938	
b.	Asphalt Field Density	D2950	
5.	<b>Concrete/Asphalt Pavement Coring (2", 3", 4", 6", 8")</b>		
6.	<b>Dynamic Cone Penetrometer</b>	D6951	