

Section 2

Sampling and Testing

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2 SAMPLING AND TESTING

2.1 Process Control and Routine Testing

For the purposes of this Manual tests are defined as follows:

- (a) **Ordinary tests are tests which are constantly conducted by the Contractor on a regular basis,**

for which no specified pay items have been provided, and which include the following, inter alia:

- (i) Tests for determining the properties of all natural materials such as, inter alia, sand, stone, water, soil and gravel, inter alia, provided by the contractor for use in the works.
- (ii) Tests on processed natural materials such as aggregate for concrete, asphalt and seals, purchased or produced on the site by the Contractor.
- (iii) Tests for determining the properties of products such as concrete and asphalt, etc, produced specially for use on the works by the Contractor, or purchased from commercial producers or sub-contractors.
- (iv) Tests on completed elements of construction such as fills, pavement layers, concrete structures, etc, for establishing compliance with the specified properties.

- (b) **Special tests are tests which have to be conducted by the Contractor only at the specific request of the Engineer, and include the following:**

- (i) Tests on commercial products such as cement, lime, paint, bituminous products, pipes, valves, cranes and bridge bearings etc.
- (ii) The requirements are specified as a whole or in part by reference being made to the specifications of a standards organisation such as those given under Clause 2.3 .
- (iii) Special tests on structures or elements of structures to determine their efficacy, for the payment of which clear provision has been made in the specifications and the schedule of quantities.
- (iv) Any test requested by the Engineer purely for purposes of acceptance control. Such tests, however, will not be classified as a special test if the test is requested because the Contractor has neglected to conduct sufficient or proper tests in terms of Division 800, Sub-Clause 801.06 and with a view to submitting the result to the Engineer for his approval of completed work or materials.

Payment will be made under the pay items of 803.3.2(b)(iii) only in regard to special tests. Payment for ordinary tests shall be included in the rates tendered by the Contractor for the items of work to which the ordinary tests relate.

2.1.2 Routine Tests and Inspection by the Engineer

- The Engineer will inspect and test materials and completed work at regular intervals for compliance with the specified requirements and, where applicable, the various judgement plans specified will be applied. The testing frequencies and sample and lot sizes for routine testing shall as given under Sub-Clause 802.3.3-Minimum Sampling and Test Schedule.

Any further testing deemed necessary shall be entirely at the Engineer's discretion.

- All sections of completed work shall be submitted to the Engineer for routine inspection and testing, and the contractor shall not cover up or construct any work on top of sections of completed work before being advised by the Engineer of the outcome of his testing and inspection.

The Contractor shall make arrangements for the submission of work for testing in a manner which will afford the Engineer reasonable opportunity for inspecting and testing the work, but in any event the Engineer will consider not less than twenty four hours to be reasonable.

- For continuous concrete and asphalt-production processes, the Engineer may order the Contractor to augment the control system by introducing a system of process control for monitoring the various properties to be controlled. The specific system used shall be subject to the Engineer's approval, and the attention of the Contractor is drawn to Sub-Clause 102.5 The Contractor shall take immediate steps to rectify any deviation from the specified requirements indicated by his process-control system, and the Engineer shall have the right to inspect and be given all details of tests and testing procedures in order to satisfy himself that the contractor is implementing an adequate process-control system.

2.2 Test Methods

Where National or International Standards for materials or equipment are referred to in this specification, the test methods referred to therein shall be used.

Reference Number	Test Numbers	Description of the Tests
Recommended Test Methods For Soils and Stabilisation		
1	AASHTO T87	Dry Preparation of Disturbed Soil and Soil-Aggregate Samples
2	AASHTO T146	Wet preparation of Disturbed Soil Samples for Test
3	ASTM D 2216	Laboratory Determination of Moisture Content of soils.
4	AASHTO T 27	Sieve Analysis of fine and Coarse Aggregates
5	AASHTO T 88	Particle Size Analysis of Soils
6	AASHTO T 11	Amount of Material Finer 0.075 mm Sieve in Aggregate
7	AASHTO T 100	Specific Gravity of Soils
8	AASHTO T 90	Determining The Plastic Limit and Plasticity Index of Soil
9	AASHTO T 89	Determining the Liquid Limit of Soils
10	AASHTO M 145	The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
11	AASHTO T 180	Moisture-Density Relations of Soils Using a 4.54 kg Rammer and a 457 mm Drop
12	ASTM D 1883	The California Bearing Ratio
13	ASTM D 2049	Relative Density of cohesion-less soils
14	AASHTO T 191	Density of Soil In-place by the Sand Cone Method
15	AASHTO T 224	Correction for Coarse Particles in the Soil Compaction Test
16	AASHTO T 217	Determination of Moisture in Soils by means of a calcium Carbide Gas pressure Moisture Tester
17	AASHTO T 238	Density and Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
18	AASHTO T 203	Soil Investigation and Sampling by Auger Borings.
19	AASHTO T 206	Penetration Test and Split-Barrel Sampling of Soils
20	AASHTO T 207	Thin walled Tube Sampling of Soils
21	AASHTO T 225	Diamond Drilling for Site Investigation
22	AASHTO T 223	Field Vane Shear Test in Cohesive Soil
23	AASHTO T 258	Determining Expansive Soils and Remedial Actions
24	AASHTO T 208	Unconfined Compressive Strength of Cohesive Soil
25	AASHTO T 216	One Dimensional Consolidation Properties of Soils
26	AASHTO T 226	Triaxial Compressive Strength of Undrained Rock Core Specimens Without Pore Pressure Measurement
27	AASHTO T 234	Strength Parameters of Soils by Triaxial Compression
28	AASHTO	Direct Shear Test of Soils Under Consolidated Drained Conditions
29	AASHTO T 235	Bearing Capacity of Soil for Static Load on Spread Footings
30	AASHTO T 252	Measurements of Pore Pressure in Soils
31	AASHTO T 254	Installing, Monitoring and Processing Data for the Travelling Type Slope Inclinometer
32	AASHTO T 221	Repetitive Static Plate Load Tests of Soils and Flexible Pavement Components, for Use in Evaluation and Design of Highway Pavements.
33	AASHTO T 256	Pavement Deflection Measurements
34	AASHTO T 215	Permeability of Granular Soils (Constant Head)
35	ASTM D 3441	Deep, Quasi-Static, Cone and Friction-Cone Penetration Test of Soils

Serial Number	Test Numbers	Description of The Tests
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Recommended Test Methods For Aggregates

1	AASHTO T 112	Clay Lumps and Friable Particles in Natural Aggregates
2	AASHTO T 113	Lightweight Pieces in Aggregate Moisture Induced Damage
3	AASHTO T96	Resistance to Abrasion of Small Size Coarse Aggregate
4	AASHTO T 104	Soundness of Aggregate by Use of Sodium Sulphate or Magnesium Sulphate.
5	AASHTO T 27	Sieve Analysis for Course and Fine Aggregates
6.	AASHTO T 21	Organic Impurities in fine Aggregates for Concrete.
7.	AASHTO T71	Effect of Organic Impurities in Fine Aggregate on Strength of Mortar Aggregates by Washing.
8	AASHTO T11	Material Finer Than 75µm(No.200) sieve in Mineral Aggregates by washing
9	AASHTO T 19	Unit Weight and Voids in Aggregate
10	AASHTO T 84	Specific Gravity and Absorption of Fine Aggregate
11	AASHTO T 85	Specific Gravity and Absorption of Coarse Aggregates
12	AASHTO T 142	Surface Moisture in Fine Aggregates
13	AASHTO T 248	Reducing Field Samples of Aggregate to Testing size
14	AASHTO T 255	Total Moisture Content of Aggregate by Drying
15	AASHTO T2	Sampling Aggregates
16	AASHTO T 176	Plastic Fines in Graded Aggregates and Soils by use of Sand Equivalent Test
17	AASHTO T 165	Effect of Water on Cohesion of Compacted Bituminous Mixtures
18	AASHTO T 283	Resistance of Compacted Bituminous Mixture to Moisture Induced Damage

Recommended Test Methods For Bituminous Materials

1	AASHTO T40	Sampling Of Bituminous Material
2	AASHTO T 44	Solubility Of Bituminous Materials
3	AASHTO T 47	Loss on Heating of Oil and Asphaltic compound
4	AASHTO T 48	Flash and Fire Points by Cleveland Cup
5	AASHTO T 49	Penetration of Bituminous Materials
6	AASHTO T 50	Float Test for Bituminous Materials

2.3 Laboratory Equipment

2.3.1 Preamble

The quality control of materials used in roadway construction projects requires the use of specialised test equipment and laboratories, which shall be equipped with the necessary test equipment to control the materials to be used on the project.

The following listing of both general and specific test equipment is given as a check list of required items and is keyed to the type of construction control expected on a project similar to which would be undertaken by the AACRA. The equipment listed and the number of individual item is considered a minimum requirement.

This list is organised to present firstly those items of general testing, which every laboratory would be expected to have. They are items that are used in a number of different test areas. Following the list of general testing equipment are lists of additional test equipment required in specific areas of control testing, including the soils analysis of the Addis Ababa area. Compaction, aggregate quality, bituminous materials and Portland cement concrete testing is also included.

In addition to the items listed it is expected that a project laboratory will also have available copies of the latest AASHTO, ASTM and BS specifications and test procedures, with necessary papers and drawing materials, as well as such rudimentary tools as hammers, saws, pliers, screwdrivers, gloves etc.



Table 2-1: General Testing Equipment

Number Required	Description			Remarks
2	Set of standard ISO sieves, 203 mm diameter, to include the following sieve sizes complete with pan and cover:			
	75 mm	12.5 mm	0.60mm	
	63 mm	9.5 mm	0.425 mm	
	50 mm	4.75 mm	0.30 mm	
	37.5 mm	2.36 mm	0.18 mm	
	25.0 mm	2.00 mm	0.15 mm	
	19.0 mm	1.18 mm	0.075 mm	
Set of standard ISO sieves, 305 mm diameter to include the following range.				
1	75 mm	12.5 mm		
	63mm	9.5 mm		
	50 mm	4.75 mm		
	37.5 mm	Pan and cover		
	25 mm			
	19 mm			
1	Motorized, Dynamic sieve shaker for 203 mm (8 in.) sieve			
1	Timer for Motorized sieve shaker			
1	Brass Wire Brush			
1	Stiff Bristle Brush			
2	Small Paint Brush			
1	Sample Splitter, coarse			
1	Quartering Canvas 2m x 2 m (approximately)			
2	Laboratory Oven, 500x500x500 mm minimum volume, 110 °C minimum.			
2	Hot Plate, 150 mm square, 400 °C			
1	Platform Scale, 115kg capacity, sensitivity $\pm$ 50gm			
1	Balance, Class E,			
2	Balance, Class D,			

(Cont.) General Testing Equipment

Number Required	Description	Remarks
1	Balance, Class B,	
1	Stop watch, 60 minutes, graduated in one fifth second increments	
2	Calculator, scientific	
4	Thermometer, general lab, 0-200°C, $\pm 0.5^{\circ}\text{C}$	
6	Pans, metal, 500x300x100 mm (approx.)	
2	Drying Pans, 600x900x100 mm (approx.)	
3(Ca)	Beaker, glass, 250ml, 50ml, 1000ml, capacity	
24(Ca)	Metal Tin with lids, 150ml and 75ml Capacity	
1(Ca)	Metal straight edge, 300 mm and 1 m with bevelled edge	
1	Micrometer Callipers, 25mm	
2(Ca)	Volumetric flask, 500ml and 1000ml	
1	Desiccators, 200mm (minimum) diameter	
1	Aspirator	
1	Testing Machine, 1375 kN, (140,211 kg.force) capacity	
12	Metal Cans, 4 litre (approx.) with lids	
48	Sample Sacks, Canvas, 50kg. capacity	
2	Wash bottle, 1000ml complete	
2	Graduated Cylinder, 100ml capacity	
2	Tamping Rod, 16 dia. x 610 mm	
3	Thermometer, armoured, 250°C	
20	Distilled Water, 1 litre bottle	
10	Standard weights, 25.0 kg.	
1	Callipers 40 cm opening	
4	Mixing bowls, stainless steel, 1 ½ to 2 ½ litre	
2(Ca)	Tongs, Beakers and Crucibles	
2	Scoop, grain	
2	Shovel, square	
2	Brush bench	
2	Bucket, 12 litre (approximately)	
2(Ca)	Trowel, large and small	
3	Spoons, heavy mixing	
2	Ruler, folding or retractable, 1 m.	
1	Rubber Mallet, Approximately 1 kg.	
1	Micro test Gauge (for galvanized coating)	
1	Filler Gauge, 0.25 mm	



Table 2-2: Soil Testing Equipment

Number required	Description	Remark
1	Mortar, porcelain, 200mm diameter, with rubber-cover pestle	
1	Stirring apparatus	
1	Hydrometer, 152 H	
2	Graduated cylinder, 1000ml	
1	Water Bath, thermostatically controlled	
1	Porcelain dish, 115mm diameter (approximately) with handle	
1	Liquid limit device complete	
1	Spatula, 75mm long x 20mm wide (approximately) with handle	
1	Vibrating table	
1	Mould, metal cylindrical, 2,830 ml capacity (mould to be accompanied by guide sleeves, base plates, surcharge mass, dial indicators, calibration bar and pouring device)	
1	Mould, metal cylindrical, 14,160 ml capacity (mould to be accompanied by guide sleeves, base plates, surcharge mass, dial indicators, calibration bar and pouring device)	
1	Hoist, 136kg capacity (minimum)	
2	Pycnometer jar with top, 500ml capacity	
2	Pycnometer jar with top, 100ml capacity	
4	Mould, Proctor	
1	Hammer, Proctor, 4.54kg. with 457 mm drop	
1	Sample Extruder	
3	Mould,CBR,with plate, collar, penetration piston and expansion measuring device	
1	Water Tank, 1 x 2 x 1 metre (approx.)	
4	Sand Cone Density Apparatus	
1	Speedy Moisture Tester, Complete (Optional)	
1	Nuclear Moisture Density Gauge (Optional)	

Table 2-3: Aggregate Testing Equipment

Number required	Description	Remark
1	Sand Equivalent Test Set, complete	
4	Graduated Sand Equivalent , plastic cylinders	
1	Sand Equivalent Shaker, manual or mechanical	
12	Stock Solution, Sand Equivalent Shaker	
1	Unit Mass Measure, 30 litre capacity, with glass cover plate	
1	Set, Organic Impurities Test	
1	Sank Moisture Test Mould and Tamper	
1	Wire Mesh Basket, 3.5 litre volume (approximately)	
1	Los Angeles Abrasion Machine	
1	Sieve, 203 mm diameter 4.00 mm	
1	Glazed porcelain cork, 20 litre (approximately)	
1	Pycnometer, glass	
1	Aggregate Accelerated Polishing Machine (when Specified)	
1	British Portable Pendulum Tester (when specified)	

Table 2-4: Bituminous Test Equipment

Number Required	Description	Remarks
48	Sample Can, 1 litre, with screw caps	
6	Marshall Specimen Mould Assembly	
1	Marshall Specimen Extractor	
1	Marshall Compaction Hammer	
1	Marshall Specimen Mould Holder	
1	Marshall Breaking Head	
1	Marshall Ring Dynamometer Assembly	
1	Marshall Flow meter	
1	Mechanical Mixing Apparatus	
1	Water Bath, thermostatically controlled to $60^{\circ} \pm 1^{\circ} \text{C}$	
6	Glass Plates, 150 x 150 x 0.5 mm	
1	Bituminous Extraction Apparatus, complete	
1	Specific Gravity Apparatus for compacted bituminous mixtures.	
1	Laboratory Oven, 500 x 500 x 500 mm (approximately), to 200°C	
48	Sample Box, 300 x 300 x 100 mm, card board	
3	Mixing pan, rounded corners, 500ml capacity	
3	Glass Pycnometer with top, 1000ml capacity	
2	Specific gravity bottle, 24 to 30ml capacity	
2	Thermometer, -8 to 32°C , ASTM E1 No. 63C	
1	Test Set for Penetration of Bituminous Materials	
1	pH Meter	
1	Core Drilling Apparatus with bits	
6	101.6 mm . Compression Moulds with top and bottom plungers	



Table 2-5: Portland Cement Concrete Test Equipment

Number Required	Description	Remarks
12	Cylinder Moulds, 150 x 300 mm reusable	
2	Slump Cone, complete	
1	Air Meter, complete	
1	Cylinder Capping equipment	
2	Concrete Capping Compound, 23 kg bag	
1	Mixing Pan, heavy gauge metal, 100 litre (approximately)	
1	Core Drilling Apparatus	
2	Evaporating Dish, 200ml capacity	
1	pH Meter	
1	Conductivity Meter	
1	Unit Mass Measure, 0.014 cu. m. with cover plate	
1	Tube Sampler	
1	Melting Pot for cylinder capping compound	
2	Cube Moulds, Set of Three, 50 x 50x 50 cm	
1	Tamper, 13 x 25 x 150 mm	
1	Chace Air Indicator	
1	Quality of Water Test Set	
1	Schmidt Concrete test hammer	
1	Vicat Apparatus	
1	Steel Straightedge, 46 cm	
1	Curing Tank, with temperature control	
1	Gilmore Apparatus	
1	No. 325 Sieve	
1	Mechanical Mixer for PCC pestles and mortars	

2.4 Sampling and Testing Frequency

The following Table 2.7 contains the recommended sampling and testing frequencies for different materials and works.

Table 2-6: Minimum Sampling and Test schedule

Test Frequencies					Sample Size and Location	
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
Roadway and Borrow Excavation	Classification	One per source	-	-	Fifty (50) kg. sample from borrow pit or road way excavation for source approval	-
	California Bearing Ratio (CBR)	or Material type	-	-		-
	Moisture Density or Relative Density	"	-	-	Use same sample	-
		"	-	-	"	-
Embankment	Moisture Density or Relative Density	See Road way and Borrow Excavation	-	-	One per layer per 50,000 m ²	In place, immediately prior to placement
	Field Density	"		One per layer per 50,000 m ²	"	of next layer
Sub-grade	Classification	"	One per 5,000 m ² of completed sub-grade	One per 50,000 m ² of completed sub-grade	-	Fifty (50) kg. sample from roadway
	California Bearing Ratio (CBR)	"	-	One per 5,000 m ² of completed sub-grade	-	Use same sample
	Moisture Density	See Road way and Borrow Excavation	-	One per layer per 20,000 m ²	-	"
	Field Density	"	One per layer per 2,000 m ²	"	-	In place, immediately prior to the placement of another layer.
Lime treated sub-grade	Source Approval	One per source or combination of source	Certificates of guarantee for lime	-	-	-
	Moisture Density	"	-	-	-	Same as sub grade.
	Field Density	-	One per layer Per 2,000 m ²	One per layer per 20,000 m ²	-	In place after final compacting

Table 2-7: Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
Back fill for Structures	Classification	See roadway and borrow excavation	One per layer per 5,000 m ²	-	-	-
	Moisture Density	"	-	-	-	-
	Field Density	-	One per layer per 2,000 m ² -	One per layer per 20,000 m ²	-	In place immediately prior to placement of next layer
Untreated Granular Sub-base and Base courses	Sieve Analysis	One per source	One per 1,000 m ³	One per 10,000m ³	Seventy five (75) kg. sample from pit or crusher	Thirty five (35) kg from central mix plant.
	Plasticity Index	"	"	"	Use same sample	Use same sample
	Loss by Abrasion	"	-	"	"	"
	Moisture Density	"	-	"	"	"
	California Bearing Ratio (CBR)	"	-	"	"	"
	Field Density	-	One per layer per 2000 m ²	One per layer per 20,000 m ²	-	In place immediately prior to placement of next layer
	Thickness	"	One per completed 2,000 m ²	-	-	In place
	Fractured Faces	One per sources	-	One per 10,000m ³	Use same sample	Use same sample
	Thin and Elongated pieces	"	"	-	"	"
	Soundness	-	-	"	"	"

Table 2-8: Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
Aggregate for cement treated Base Course	Sieve Analysis	One per source	One per 1,000 m ³	One per 10,000 m ³	Seventy five kg. sample from pit or crusher	Thirty five (35) kg. sample from central mix plant
	Plasticity Index	"	One per 5,000 m ³	One per 10,000m ³	Use same sample	Use same sample
	Loss by Abrasion	-	"	"	"	"
	Soluble Sulphates and Chlorides	"	-	One per 50,000 m ³	"	"
Cement for Cement treated Base Courses	Quality	"	Certificates of Guarantee	One per 50,000 m ³ of base course	Five (5) kg. of sample from several bags or silo	Five (5) kg. of sample from several bags or silo
Water for Cement Treated Base Courses	Quality	"	-	"	One litre sample from source	One litre sample from source
Aggregates for cement treated Base Courses	Mix Verification	One per source or combination of sources	-	One per 5,000m ³	Use same sample	Use same sample
	Moisture Density	"	-	"	"	"
	Field Density	-	One per layer per 20,000 m ²	-	-	"
	Thickness	-	One per layer per 2,000 m ²	-	-	In place
Asphalt Cement	Quality	-	Certificates of Guarantee	-	-	-
	Penetration	-	"	One per plant per production week	-	One litre sample from plant line
Liquid Asphalts	Quality	-	"			

Table 2-9: Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
Aggregates for Bituminous Surface Treatments and Seal Coats	Sieve Analysis	One per source	One per production day	One per production week	Fifty (50) kilogram sample from crusher or pit	Twenty-five (25) kilogram sample from stockpile
	Flakiness Index	"	-	"	Use same sample	Use same sample
	Loss by Abrasion	"	-	"	Fifty (50) kilogram sample from crusher or pit	Fifty (50) kilogram sample from crusher or pit
	Soundness	"	-	-	Use same sample	-
	Stripping	"	-	-	"	-
Aggregates for Sand Sub-base Courses and Open Graded Sub-base Course (Stockpiled)	Sieve Analysis	One per source	One per week during production and stockpiling	-	Twenty-five (25) kilogram sample	Twenty-five (25) kilogram sample from stockpile
	Liquid Limit (3)	One per source	One per week during production and stockpiling	One per week from the cold feed during mix production	Use same Sample	Use same sample
	Plasticity Index (3)	"	"	"	"	"
	Sand Equivalent	"	"	"	"	"
	(3) Loss by Abrasion	"	"	"	"	"
	Stripping	"	"	"	"	"

Minimum Sampling and Test schedule

Test Frequencies					Sample Size and Location	
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
(cont.) Aggregates for Bituminous Sand Sub-base Courses and Open Graded Sub-base Course (Hot Bins) Bituminous Sand Sub-base Courses	Sieve Analysis	-	One set per plant per production day	One set per week from the cold feed during mix production	-	Ten (10) kilogram sample from each bin
	Marshall Mix Design	One per source	-	-	Fifty (50) kilogram plus ten (10) litres asphalt cement	-
	Marshall Stability	-	One per plant per production day	-	-	Ten(10) kilogram sample from plant
	Effect of Water	One per source	-	One per plant per production week	-	Fifteen (15) kilogram sample from plant
	Extracted Asphalt Content	-	One per 500 cubic metres (not less than one per production day)	One per 5,000 cubic metres	-	Ten (10) kilogram sample from roadway behind paver
	Gradation of Extracted Aggregate	-	"	"	-	Use same sample
	Thickness	-	one per 1000 cubic metres (not less than one per production day)	-	-	Roadway
	Field Density	-	One per 1000 cubic metres (not less than one per production day)	-	-	Use roadway sample

Table 2-10: Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
Aggregates for Bituminous Base Course (Stockpiled)	Sieve Analysis	One per source	-	One per week during production and stockpiling	Twenty-five (25) kilogram sample from pit or crusher	Twenty-five (25) kilogram sample from pit or crusher
	Fractured Faces	One per source	-	One per week during production and stockpiling	Use same sample	Use same sample
	Sand Equivalent (3)	One per source	One per week during production and stockpiling	One per week from the cold feed during mix production	Use same sample	Use same sample
	Plasticity Index (3)	One per source	"	"	"	"
	Soundness	"	-	-	"	"
	Loss by Abrasion	"	-	One per week during production and stockpiling	"	"
	Thin and Elongated Pieces	"	-	"	"	"
Aggregates for Bituminous Base Course (Hot Bins)	Stripping	"	-	-	Ten (10) kilogram sample from bins	-
	Sieve Analysis	-	-	One set per plan per production day	-	Ten (100 kilogram sample from each bin
	Sieve Analysis	-	One per 500 tonnes of filler	-	Five (5) kilogram sample	-
	Marshall Mix Design	One per Source	-	-	Five (50) kilogram each size aggregate and ten (100 litres asphalt cement	-

Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
(Cont.) Aggregates for Bituminous Base Course(Hot Bins)	Marshall Stability	-	One per plant per production day	-	-	Fifteen (15) kilogram sample from roadway behind pavers
	Gradation of Extracted Aggregate	-	One per 500 cubic metres (not less than one per production day)	One per 5,000 cubic metres	-	Use same sample
	Thickness	-	One core per 1,000 square metres of completed course	-	-	Roadway
	Field Density	-	One core per 1,000 square metres of each layer	-	-	Use roadway sample

Table 2-11: Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
Coarse Aggregate for Concrete	Sieve Analysis	One per source	One per 1,000 cubic metres of concrete	One per 10, 000 cubic metres of concrete	Fifty (50) kilogram sample from source	Twenty-five(25) kilogram sample from stockpile
	Loss by Abrasion	"	-	"	Use same sample	Use same sample
	Soundness	"	-	"	"	"
	Friable Particles	"	-	"	"	"
	Specific Gravity and Absorption	"	-	"	"	"
	Soft Fragments and Shale	"	-	"	"	"
	Thin and Elongated Pieces	"	-	"	"	"
	Soluble Sulphates and Chlorides	"	-	"	"	"
	Moisture	-	One per production day	"	"	"

Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
(cont.) Fine Aggregate for Concrete	Sieve Analysis (including Fineness Modulus)	One per source	One per 1,000 cubic metres of concrete	One per 10,000 cubic metres of concrete	Twenty-five (25) kilogram sample from stockpile	Five (5) kilogram sample From stockpile
Water for Portland Cement Concrete	Soundness	One per source	-	One per 10,000 cubic metres of concrete	Use same sample	Use same sample
	Friable Particles	"	-	"	"	"
	Organic Impurities	"	-	"	"	"
	Sand Equivalent Moisture	"	-	"	"	"
Portland Cement	Soluble Sulphates	"	One per production day	-	-	-
	Quality	"	-	One per 10,000 cubic metres of concrete	One(1) litre sample from source	One (1) litre sample from source
Portland Cement	Quality	One per source	Certificates of Guarantee	"	Five (5) kilogram sample from several bags or silo	Five(5) kilogram sample from several bags or silo
	Time of Set (Vicat)	-	One test per shipment	-	Use same sample	-

Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/Source	Project Control	Check	Quality/Source	Project Control/Check
(cont.) Portland Cement Concrete	Mix Design	One per mix design	—	—	Two Hundred (200) kilogram sample of aggregate	-
	Compressive Strength	One set of cylinders per mix design	One set of cylinders per 50 cubic metres. Not less than one per production day	One set of cylinders per 500 cubic metres	Three (3) cylinders from mixer or truck	Three (3) cylinders from mixer or truck
	Air Content	See mix design	“	—	0.1 cubic metre from mixer or truck	—
	Unit Weight/Cement Factor	“	“		“	-
	Slump	“	One test per 20 cubic metres		0.05 cubic metre from mixer or truck	-
Mortar Same requirements a cement, fine aggregate, and water for concrete.						
Reinforcing Steel	Quality	—	Certificates of Guarantee	One sample for each size bar for each 50 tons or fraction of that size	—	One 1.5 metre bar each size

Table 2-12: Minimum Sampling and Test schedule

Test Frequencies				Sample Size and Location		
General Specification	Test	Quality/source	Project Control	Check	Quality/Source	Project Control/Check
Section 5.04 Prestressing Steel	Quality	–	Certificates of Guarantee	One sample from each spool	–	One 2-metre strand each spool
Section 6.09 Paint	Quality	–	Certificates of Guarantee	One sample from each lot	–	Ten (10) litre sample from project storage
Section 6.10 Thermoplastic Traffic Markings	Quality	–	Certificates of Guarantee	One sample from each lot	–	Ten (10) litre sample from project storage
All other Manufactured Items	Manufacturer's certifications and/or test reports covering all material. Additional tests or samples may be ordered by The Engineer.					
All other Contractor produced materials	Sampling and testing as ordered by the Engineer and required by the specifications.					

- Notes:**
- 1) Not required unless the test is specifically included in the specifications.
 - 2) If the Contractor is not required to furnish facilities to perform test, they may be performed in an independent laboratory approved by the AACRA.
 - 3) If lime is added, acceptance samples shall be taken after the addition of the slurry but before the drier. In this case, minimum acceptance sampling frequency shall be one per production day.
 - 4) Physical tests required on all samples. Chemical tests required on occasional samples selected by the Engineer.
 - 5) If used for roadway structural improvement, additional design testing will be required.