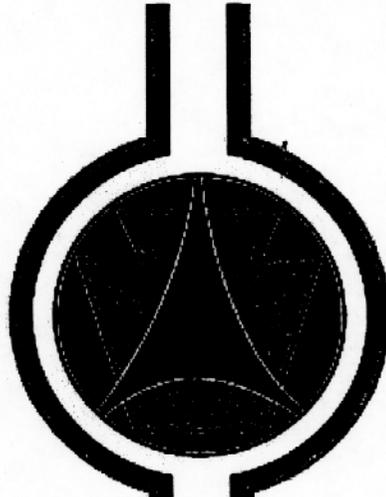


Appendix F
PennDOT Specifications Manual
Section 703—Aggregates



**Commonwealth of Pennsylvania
DEPARTMENT OF TRANSPORTATION**



SPECIFICATIONS

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SECTION 703—AGGREGATE

703.1 FINE AGGREGATE—

(a) **General.** Fine aggregate is natural or manufactured sand consisting of hard, durable, uncoated inert particles, reasonably free from clay, silt, vegetation, or other substances determined to be deleterious. Substances which are present in amounts to cause inconsistent performance in the properties of the plastic or hardened concrete are considered deleterious. Such substances as reactive chert, gypsum, iron sulfide, amorphous silica, and hydrated iron oxide are considered deleterious. Only fine aggregate reasonably uniform in the physical properties specified in Table A will be acceptable. Obtain material from a source listed in Bulletin 14 and/or approved by the MTD.

1. **Natural Sand.** Fine aggregate resulting from glacial or water action. Fine aggregate produced simultaneously with gravel coarse aggregate may contain crushed particles.

2. **Manufactured Sand.** Fine aggregate from controlled mechanical breakdown of rock or air-cooled blast furnace slag or steel slag into sound, approximately cubical particles.

Manufactured sand will be acceptable only when it is the primary product of the crushing operation and sized by a sand classifier. However, for aggregate used in bituminous concrete mixtures, a sand classifier is not required.

Fine aggregate manufactured from limestone may not be used in concrete wearing surfaces. Fine aggregate manufactured from steel slag may not be used in cement concrete or mortar mixture.

Provide steel slag fine aggregate reasonably uniform in density and quality. After gradation preparation, place steel slag fine aggregate, whether reclaimed from an old stockpile or processed directly from the steel-making process, in a controlled stockpile and completely soak with water before or during stockpiling. Submit for review method of constructing and controlling stockpile. Keep stockpiled slag in a reasonably uniform moist condition for a period of not less than 6 months. After minimum cure period, stockpile will be sampled and tested by MTD for expansive characteristics in accordance with PTM No. 130. The steel slag fine aggregate stockpile will only be approved for use if the average total volumetric expansion by PTM No. 130 is less than 0.50%. If the stockpile fails expansion criterion, cure an additional minimum 2 months elapsed time from last sampling before resampling and retesting will be performed. Steel slag fine aggregate may only be approved for use in bituminous wearing courses; however, do not use in conjunction with steel slag coarse aggregate.

The MTD will evaluate the quality of the aggregates by petrographic analysis using ASTM C 295 and by other tests necessary to demonstrate that required construction of acceptable durability can be achieved.

(b) **Production Testing.** Provide, and assign to the work, an aggregate technician properly instructed and trained to perform all required tests on the fine aggregate. Provide the following equipment for acceptance testing and for developing and maintaining a quality control program to assure compliance with specification requirements during production. Document the results of tests made during production, and make them available when requested. Provide a separate set of sieves for exclusive use by the Department for acceptance testing. Arrange for sharing of the remaining equipment between the producer and the Department. The amount of equipment listed is the minimum required. If time or space conflicts arise, or if the Department is not able to have consistent access to shared equipment when acceptance testing is to be performed, have the producer provide a separate set of equipment for the Department, as needed.

No.	Equipment
1	F.A. Mechanical Sieve Shaker with Timer
1	Sample splitter having an even number of equal width chutes, which discharge alternately to each side of the splitter. A minimum of 12 total chutes is required. The minimum width of the individual chutes is to be at least 50 percent larger than the largest particles in the sample and the maximum width is to be 20 mm (3/4-inch). Include two (2) receptacles to hold the samples following splitting. Splitter design should ensure that the sample flows smoothly, without restriction or loss of material.
2	Set Standard Sieves for F.A.
1	Balance conforming to requirements of AASHTO M 231 for class of general purpose scale required, for principal sample mass (weight) of the sample being tested, PTM No. 616.
1	Oven capable of maintaining a uniform temperature of 110 °C ± 5 °C (230F ± 9F).
1	Thermometer, ASTM E1.

Have the producer perform routine maintenance and repair of all equipment whether shared or for exclusive Department use. Have balances calibrated annually by an independent agency acceptable to the Department. Oven temperatures will be verified every 120 days using the thermometer supplied as required equipment. Have the producer keep accurate records of calibration and temperature checks. Ensure that the producer has back-up equipment available so that no acceptance tests are missed.

Also, during production, sufficient necessary incidental equipment to conduct and document the specified tests, except for the strength ratio and soundness test. The strength ratio and soundness tests are performed by the producer, or a laboratory accredited by the AASHTO Materials Reference Laboratory (AMRL) or other inspection agency approved by MTD at intervals sufficient to ensure the quality of the material. The equipment and test result documentation will be a condition for source acceptance, source requalification, and listing in Bulletin 14.

Provide the following equipment for exclusive Department use:

No.	Equipment
1	Desk and chair
1	Electronic calculator with tape
1	Work table 760 mm x 2100 mm x 760 mm high (2 1/2 feet x 7 feet x 2 1/2 feet high)
1	4 drawer, fire resistant (D-label) metal file cabinet
1	Closet or locker for storage

If testing equipment is to be shared, provide a minimum of 14 m² (150 square feet) of office and work space. If a separate set of testing equipment is provided for the Department, provide a minimum of 22 m² (240 square feet) of office and work space to accommodate both the office and the testing equipment. Provide office and work space area, as specified, which is heated/air-conditioned; with on-site access to a water cooler, telephone, fire extinguisher, and sanitary toilet facilities.

(c) Grading and Quality Requirements.

1. **Gradation.** The requirements of Table A represent the extreme limits for determining the suitability of supply sources. Control the grading of Type A Fine Aggregate so the fineness modulus, of at least nine out of ten consecutive test samples from a single source delivered to a project or plant varies less than ± 0.20 from the average fineness modulus of the consecutive test samples. Determine the fineness modulus, in accordance with PTM No. 501.

For bituminous mixtures:

- If directed, vary the gradations within the limits shown in Table A.
- A blend of fine aggregates may be used, provided the gradation limits proposed for blending have been accepted in writing by the District Engineer.
- If filler is required, meet the gradation of Table A and use cement, cement dust, fly ash, or fines that are reasonably free of clay resulting from the crushing of stone, gravel, or slag.

2. **Material Finer than the 75 μ m (No. 200) Sieve.** Determine the loss by washing in accordance with PTM No.100.

3. **Minimum Strength Ratio.** AASHTO T 21. If color No. 5 or darker results, the minimum strength ratio will be determined in accordance with PTM No. 502.

4. **Soundness Test.** The percentage of weight loss after five cycles of immersion and drying will be determined using a sodium sulfate solution, in accordance with PTM No. 510.

TABLE A
FINE AGGREGATE
Grading and Quality Requirements

Sieve Size	Cement Concrete Sand	Bituminous Concrete Sand Type B				Mortar Sand
	Type A	#1	#2	#3	Filler	Type C
9.5 mm (3/8-inch)	100	100	—	100	—	—
4.75 mm (No. 4)	95-100	95-100	100	80-100	—	100
2.36 mm (No. 8)	70-100	70-100	95-100	65-100	—	95-100
1.18 mm (No. 16)	45-85	40-80	85-100	40-80	—	—
600 µm (No. 30)	25-65	20-65	65-90	20-65	100	—
300 µm (No. 50)	10-30	7-40	30-60	7-40	95-100	—
150 µm (No. 100)	0-10	2-20	5-25	2-20	90-100	0-25
75 µm (No. 200)	—	0-10	0-5	0-10	70-100	0-10
Material Finer Than 75 µm (No. 200) Sieve Max. Percent Passing	3	—	—	—	—	—
Strength Ratio Min. Percent	95	—	—	—	—	95
Soundness Test Max. Loss Percent	10	15	15	15	—	10
Fineness Modulus	2.30 to 3.15	—	—	—	—	1.6 to 2.5

703.2 COARSE AGGREGATE—

(a) **General.** Coarse aggregate consists of hard, tough, durable, uncoated, inert particles, reasonably free from clay, silt, vegetation, or other substances determined to be deleterious. Substances which are present in amounts to cause inconsistent performance in the properties of the plastic or hardened concrete are considered deleterious. Such substances as chert, gypsum, iron sulfide, amorphous silica and hydrated iron oxide are considered deleterious. Only coarse aggregate reasonably uniform in the physical properties specified in Tables B, C, and D will be acceptable.

The MTD will evaluate the quality of the aggregates by petrographic analysis, using ASTM C 295 and other tests necessary to demonstrate that required construction of acceptable durability can be achieved.

Furnish aggregate crushed and prepared from one of the materials described below, obtained from a source listed in Bulletin 14, or otherwise accepted by the MTD prior to use.

1. **Stone.** Durable stone, free from slaty texture or cleavage planes.

2. **Gravel.** Durable gravel particles. For use in cement concrete, wash thoroughly during production. For use in heavy duty bituminous base courses, heavy duty binder courses, and all bituminous wearing courses, a minimum of 85% crushed particles is required, with at least two faces resulting from fracture. For use as No. OGS, a minimum of 75% crushed particles is required, with at least three faces resulting from fracture. For all Type A use, the maximum allowable absorption as determined by PTM No. 506 is 3.0%; however, this restriction does not apply to dredged river gravel to be used in portland cement concrete. For all Type B use, the maximum allowable absorption as determined by PTM No. 506 is 3.5%.

3. **Blast Furnace Slag.** By-product of a pig-iron making process. Tough, hard, durable pieces of air-cooled blast furnace slag.

4. **Steel Slag.** By-product of a steel making process. Tough, hard, durable pieces of steel slag, reasonably uniform in density and quality. After crushing, grading and forming a stockpile, take a sample from the stockpile and submit it to the MTD for testing to determine expansive characteristics, in accordance with PTM No. 130. The stockpile will be accepted for use if the total expansion, as determined by PTM No. 130, is less than

0.50%. Once a stockpile is accepted, do not add to it if it is for Department use. If the stockpile does not meet expansion requirements, cure the aggregate stockpile as follows:

- Rework the stockpile, soaking the aggregate completely with water.
- Keep aggregate in a uniformly moist condition in the stockpile for a period of at least 6 months. Take a sample after this curing period and submit it to the MTD for testing in accordance with PTM No. 130.
- Submit to the engineer, for review and acceptance, the proposed method of constructing and controlling the stockpile during the cure period.
- The stockpile will be accepted for use if the total expansion is less than 0.50%. If the stockpile does not meet this requirement, use an additional curing period of 2 months from the time of the last sampling, before resampling and testing.

Aggregate manufactured from steel slag is not acceptable for pipe or structure backfill or in cement concrete. Steel slag may be used for subbase, selected granular material, shoulders, selected material surfacing, and in bituminous surface courses, if accepted.

5. Granulated Slag. By-product of an iron-making process. Granulated blast furnace slag is the granular glassy material formed when molten slag from iron-making is rapidly quenched by immersion in water and contains not more than 3% total iron reported as Fe_2O_3 . Provide material containing not more than 20% by mass (weight) of substances that are not granulated slag. Use material with a density of not more than 1300 kg/m^3 (80 pounds per cubic foot) (dry rodded density (unit weight), PTM No. 609). Provide reasonably uniform material having a maximum size of 50 mm (2 inches) and not more than 20% passing the 150 μm (No. 100) sieve. This material is only permitted for use for subbase material (Section 350).

6. Lightweight Aggregate. Acceptable types of lightweight aggregate are as follows:

- Aggregate prepared by expanding or sintering products, such as clay, shale, or slate.
- Aggregate prepared by processing natural materials, such as pumice, scoria, or tuff.

Furnish lightweight aggregate meeting the requirements of AASHTO M 195 plus the soundness and abrasion limits for Type A Aggregate as indicated in Table B. In addition, have the aggregate meet the following durability requirements.

- | | |
|--|------------|
| • Aggregate Absorption Factor (PTM No. 526) | Max. % 2.5 |
| • Freeze-Thaw Resistance of Concrete, Decrease of Dynamic Modulus at 300 Cycles (AASHTO T 161, Procedure B, except that after 14 days of moist cure, dry the beams 76 mm x 102 mm x 406 mm at $22 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ (3 inches x 4 inches x 16 inches at $72\text{F} \pm 3\text{F}$) and approximately 50% relative humidity for 14 days. Then soak the beams in water for three days prior to starting the freezing and thawing test.) | Max. % 60 |
| • Freeze-Thaw Resistance of Aggregate (PTM No. 525) | Max. % 25 |

**TABLE B
COARSE AGGREGATE
Quality Requirements**

	Type A	Type B	Type C
Soundness, Max. %	10	12	20
Abrasion, Max. %	45	45	55
Thin and Elongated Pieces, Max. %	15	20	—
Material Finer Than 75 μm (No. 200) Sieve, Max. %	*	*	10
Crushed Fragments Min. %	55**	55**	50
Compact Density (Unit Weight), Min. kg/m^3 (lbs./cu. ft.)	1100 (70)	1100 (70)	1100 (70)
Deleterious Shale, Max. %	2	2	10
Clay Lumps, Max. %	0.25	0.25	3
Friable Particles, Max. % (excluding shale)	1.0	1.0	—
Coal or Coke, Max. %	1	1	5
Glassy Particles, Max. %	4 or 10***	4 or 10***	—
Iron, Max. %	3****	3****	3****
Absorption, Max. %	3.0****	3.5****	—
Total of Deleterious Shale, Clay Lumps, Friable Particles, Coal, or Coke Allowed, Max. %	2	2	15

- * See Section 703.2(c)4.
- ** See Section 703.2(a)2.
- *** See Section 703.2(c)10.
- **** Gravel only. See Section 703.2(a)2.
- ***** See Section 703.2(c)11.

7. Recycled Concrete. Salvaged and crushed concrete pavements and concrete highway structures from municipal, or county projects, for-use as aggregate in subbase only. Other recycled concrete may be used in subbase if it can be shown that the concrete was made using materials approved by the Department. Provide concrete meeting the requirements of Table B and Table C.

) Production Testing. Provide, and assign to the work, an aggregate technician properly instructed and to perform all necessary tests on the coarse aggregate. Provide the following equipment for acceptance and for developing and maintaining a quality control program to assure compliance with specifications during production. Document the results of tests made during production and make them available as requested. Provide a separate set of sieves for exclusive use by the Department for acceptance testing. Arrange for the remaining equipment between the producer and the Department. The amount of equipment listed is minimum required. If time or space conflicts arise, or if the Department is not able to have consistent access to equipment when acceptance testing is to be performed, have the producer provide a separate set of equipment for the Department, as needed.

No.	Equipment
1	C. A. Mechanical Sieve Shaker with Timer
1	Sample splitter having an even number of equal width chutes, which discharge alternately to each side of the splitter. A minimum of 8 total chutes is required. The minimum width of the individual chutes is to be at least 50 percent larger than the largest particles in the sample. Include two (2) receptacles to hold the samples following splitting. Splitter design should ensure that the sample flows smoothly, without restriction or loss of material.
2	Set of Standard Sieves for C. A.
1	Cylindrical Metal Measure (25 L (1 cu. Ft.)) PTM No. 609
1	Balance conforming to the requirements of AASHTO M 231 for the class of general purpose scale required for the principle sample mass (weight) of the sample being tested — PTM No. 506.
1	Platform scale conforming to the requirements of AASHTO M 231 for the class of general purpose scale required for the principle sample mass (weight) of the sample being tested — PTM No. 616.
1	Oven capable of maintaining a uniform temperature of 110 °C ± 5 °C (230F ± 9F).
1	Thermometer, ASTM E 1.

Have the producer perform routine maintenance and repair of all equipment whether shared or for exclusive Department use. Have balances calibrated annually by an independent agency acceptable to the Department. Oven temperatures will be verified every 120 days using the thermometer supplied as required equipment. Have the producer keep accurate records of calibration and temperature checks. Ensure that the producer has back-up equipment available so that no acceptance tests are missed.

Also, during production, sufficient necessary incidental equipment to conduct and document the specified test except for the soundness test and abrasion test. The soundness test and abrasion test are performed by the producer or a laboratory inspected by the AASHTO Materials Reference Laboratory, (AMRL) or other inspection agency approved by the MTD at intervals sufficient to ensure the quality of the material. The equipment and test documentation will be a condition for source acceptance, source requalification, and listing in Bulletin 14.

Provide the following equipment for exclusive Department use:

No.	Equipment
1	Desk and chair
1	Electronic calculator with tape
1	Work table 760 mm x 2100 mm x 760 mm high (2 1/2 feet x 7 feet x 2 1/2 feet high)
1	4 drawer, fire resistant (D-label) metal file cabinet
1	Closet or locker for storage

If testing equipment is to be shared, provide a minimum of 14 m² (150 square feet) of office and work space. If a separate set of testing equipment is provided for the Department, provide a minimum of 22 m² (240 square feet) of office and work space to accommodate both the office and the testing equipment. Provide office and work space area, as specified, which is heated/air-conditioned; with on-site access to a water cooler, telephone, fire extinguisher and sanitary toilet facilities.

(c) **Quality Requirements.** The following notes are applicable to Table B.

1. **Soundness.** The percentage of mass (weight) loss after five cycles of immersion and drying will be determined using a sodium sulfate solution, in accordance with PTM No. 510.

Aggregate failing the test may be accepted if the MTD confirms in writing that the aggregate has been demonstrated to have a satisfactory service record, in both pavements and structures.

Acceptable aggregate produced from recycled concrete need not meet soundness requirements since cementitious material cannot be evaluated with this test.

2. **Abrasion.** The percentage of mass (weight) loss will be determined in accordance with PTM No. 622

TABLE C
SIZE AND GRADING REQUIREMENTS FOR COARSE AGGREGATES
 (Based on Laboratory Sieve Tests, Square Openings)

AASHTO NUMBER	TOTAL PERCENT PASSING													75 µm (No. 200) ***		
	100 mm (4")	90 mm (3 1/2")	63 mm (2 1/2")	50 mm (2")	37.5 mm (1 1/2")	25.0 mm (1")	19.0 mm (3/4")	12.5 mm (1/2")	9.5 mm (3/8")	4.75 mm (No. 4)	2.36 mm (No. 8)	1.18 mm (No. 16)	150 µm (No. 100)			
1	100	90-100	25-60		0-15		0-5									
3			100	90-100	35-70	0-15		0-5								
467				100	95-100		35-70		10-30	0-5						
5					100	90-100	20-55	0-10	0-5							
57					100	95-100		25-60		0-10	0-5					
67					100		90-100		20-55	0-10	0-5					
7							100	90-100	40-70	0-15	0-5					
8								100	85-100	10-30	0-10	0-5				
10									100	85-100			10-30			
2A**				100			52-100		36-70	24-50	16-38*	10-30				0-10
OGS**				100			52-100		36-65	8-40		0-12				0-5

* Applies only for bituminous mixtures.

** PaDOT Number

*** For 75 µm (No. 200), see Table "D".

Note A: A combination of No. 7 and No. 5 may be substituted for No. 57, provided that not more than 50% nor less than 30% of the combination is No. 7 size.

Note B: Provide No. OGS material that has a minimum average coefficient of uniformity of 4.0. The average coefficient of uniformity is defined as the average of the sublots within each lot. Determine the coefficient of uniformity in accordance with PTM No. 149 each time the gradation is determined. Individual samples may not have a coefficient of uniformity less than 3.5. If the coefficient of uniformity of any sample falls below 3.5, reject the lot. The coefficient of uniformity is not to be used in the multiple deficiency formula.

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3. Thin and Elongated Particles. Aggregate, tested when directed for the percent on the 9.5 mm (3/8-inch) sieve, having a ratio greater than 5:1 between the maximum and minimum dimensions of an imaginary enclosing rectangular prism. When the material retained on the 9.5 mm (3/8-inch) sieve is less than 5.0% of the total mass (weight) of the test sample, do not determine thin and elongated particles.

4. Material Finer Than the 75 µm (No. 200) Sieve. Determine the loss by washing with water, as shown on Table D.

This test is not required for aggregate processed through a mechanical dryer for concrete; however, the aggregate is to be clean and free of any fines which would adversely affect the concrete with bituminous material.

TABLE D
MATERIAL PASSING THE 75 µm (No. 200) SIEVE —
(Based on Laboratory Sieve Tests, Square Openings)

SECTION	SPECIFICATION	% MAXIMUM
350	Subbase (No. 2A)	10
350	Subbase (No. OGS)	5
430	Bit. Wear. Crse. FB-2	2
431	Bit. Bind. Crse. FB-2	2
439	Bit. Wear. Crse. FB-1	2
440	Bit. Bind. Crse. FB-1	2
441	Bit. Bind. Crse. CP-2	2.0
450	Bit. Bind. Crse. DP-1	2.0
470	Bit. Seal Coat	1.0
471	Bit. Seal Coat w/Precoat. Aggr.	2.0
480	Bit. Surf. Treatment	1.0
704	Cement Concrete	1
—	All other uses	2

5. Crushed Fragments. PTM No. 621

6. Compact Density. PTM No. 609, for slag.

7. Deleterious Shale. The percentage of mass (weight) by four cycles of wetting and drying determined in accordance with PTM No. 519. Confirmation will be made by the MTD, using petrographic analysis.

8. Friable Particles. PTM No. 620, by percentage of mass (weight).

9. Coal or Coke. Determine the percentage of mass (weight) by visual identification and separation. Confirmation will be made by the MTD, using petrographic analysis, when required.

10. Glassy Particles. Determine the percentage of mass (weight) by visual identification and separation. Pieces of slag containing more than 50% glass will be considered glassy particles. Waste glass will be considered glassy particles. The maximum allowable amount for use is 4% in cement concrete and 1% in bituminous concrete; however, coarse aggregate containing glassy particles consisting of waste glass will not be considered glassy particles in cement concrete or bituminous wearing courses.

11. Metallic Iron. Content will be determined by the MTD, using petrographic analysis. Pieces of slag containing metallic iron will be considered metallic iron. When aggregate with iron is used in bituminous mixtures or subbase, this requirement is waived.

12. Clay Lumps. Determine the percentage of mass by visual identification and separation. Confirmation will be made by the MTD, using petrographic analysis, when required.

(d) Testing And Acceptance. Section 703.5(b)

703.3 SELECT GRANULAR MATERIAL (2RC)—

(a) **General.** Select granular material, consisting of durable bank or crushed gravel, stone, or slag, mixed or blended with suitable filler materials to provide a uniform mixture. Obtain or produce from accepted sources. Stockpile, sample, and test material before it is used, to ensure reasonable uniformity and acceptability. Use material free from vegetable or organic matter, lumps, or an excessive quantity of clay or other objectionable or foreign substances, and not more than 10% of deleterious shale by mass (weight).

(b) **Gradation.** Conforming to the following gradation, determined in accordance with PTM No. 619:

- Passing 50 mm (2-inch) sieve—100%
- Passing 4.75 mm (No. 4) sieve—15 to 60%
- Passing 150 μm (No. 100) sieve—0 to 30%

703.4 ANTI-SKID MATERIAL—

(a) **General.** Furnish material, from a supplier listed in Bulletin 14, meeting the gradation of Table E for use on ice or snow-covered pavement surfaces. Only material not containing substances such as metal or glass, substances which may be harmful to automotive equipment and vehicles, and material reasonably free of deleterious substances or foreign materials, will be acceptable. Deleterious substances or foreign materials include, but are not limited to, dirt, shale, slate, incinerated bituminous coal mine waste, and as listed in Section 703.2(a), Table B, Type C.

(b) **Description.**

1. **Types 1 and 1A.** Cinders, coke, crushed coal boiler bottom ash, or a combination of these. Bottom ash is residue of molten ash obtained from coal-burning boilers.

1.a Furnish bottom ash having no pyritic material or mill rejects commingled, mixed, or combined with it.

1.b Furnish Type 1 or 1A anti-skid material meeting following requirements:

- An air-dry loose density (weight) of not less than 560 kg/m^3 (35 pounds per cubic foot), as determined in accordance with PTM No. 609, Section 7;
- Type 1, having a density (unit weight) of 1220 kg/m^3 (76 pounds per cubic foot) or less, or Type 1A, having a density (unit weight) of more than 1220 kg/m^3 (76 pounds per cubic foot);
- Crushed brick, crushed stone, blast furnace slag, steel slag, or gravel may be present in amounts not exceeding a total of 3% by mass (weight), of total dry mass (weight) of the sample, as determined by the mass (weight) of this material retained on the 12.5 mm (1/2-inch) sieve;
- Unburned or partially burned coal or coke may be present in amounts not exceeding 7% by mass (weight), of total dry mass (weight) of the sample, as determined by the mass (weight) of this material retained on the 9.5 mm (3/8-inch) sieve, except unburned coal, partially burned coal, or coke may not be present in bottom ash.

2. **Type 2.** Crushed stone, crushed gravel, or crushed slag, meeting the following requirements:

- Not exceeding 1680 kg/m^3 (105 pounds per cubic foot);

- Los Angeles Abrasion loss, not exceeding 55% by mass (weight), as determined in accordance with AASHTO T 96, Gradation D; and
 - When crushed gravel is furnished, not less than 85% of the fragments retained on the 2.36 mm (No. 8) sieve are required to be crushed, one face, as determined in accordance with PTM No. 621.
 - Total of individual anti-skid particles containing metallic iron not to exceed 1.0% by mass (weight) of material, as determined by the mass (weight) of particles retained on the 4.75 mm (No. 4) sieve and by the total dry mass (weight) of the sample.
3. **Types 3, 3A, and 3B.** Total of individual anti-skid particles containing metallic iron not to exceed 1.0% by mass (weight) of material, as determined by the mass (weight) of particles retained on the 4.75 mm (No. 4) sieve and by the total dry mass (weight) of the sample.
4. **Type 4.** Burned anthracite coal mine refuse, with a Los Angeles Abrasion loss not exceeding 55% by mass (weight), as determined in accordance with AASHTO T 96.
5. **Type 6S.** Crushed stone, crushed gravel, or crushed slag meeting the following requirements:
- Not exceeding 1680 kg/m³ (105 pounds per cubic foot);
 - Los Angeles Abrasion loss not exceeding 55% by mass (weight) as determined in accordance with AASHTO T 96, Gradation D; and
 - When crushed gravel is furnished, not less than 60% of the fragments retained on the 4.75 mm (No. 4) sieve are required to be crushed, one face, as determined in accordance with PTM No. 621.
 - Total of individual anti-skid particles containing metallic iron not to exceed 1.0% by mass (weight) of material, as determined by the mass (weight) of particles retained on the 4.75 mm (No. 4) sieve and by the total dry mass (weight) of the sample.
- (c) **Gradations.** Conforming to the gradation of Table E, as determined in accordance with PTM No. 624.

**TABLE E
ANTI-SKID GRADATION**

Anti-Skid Type	Maximum Percent Passing Sieve								
	31.5 mm (1 1/4")	19.0 mm (3/4")	12.5 mm (1/2")	9.5 mm (3/8")	4.75 mm (No. 4)	2.36 mm (No. 8)	300 μm (No. 50)	150 μm (No. 100)	75 μm (No. 200)
Type 1	100					70	18		
Type 1A		100	90-100			55	18		
Type 2			100	95-100		30		8	
Type 3				100		85		8	
Type 3A				100		55		8	
Type 3B				100	85-100	55		5	4*
Type 4			100	95-100		30		8	
Type 6S				100	35-85	55		8	5*

*As determined by PTM No. 100.

(d) **Testing.** Test material for moisture content when shipping to Department stockpiles. Conduct tests, in accordance with PTM No. 513. Have the results verified by a Department representative. A minimum of two tests per day is required. When conditions exist which would cause a change in moisture content, additional tests are required. Document tests at the end of delivery quantity at the end of the day and determine the average moisture content. An adjustment of the delivery quantity will be required, based on the average moisture content. The percent

of moisture will be deducted from the aggregate quantity shipped, and payment will be based on the calculated oven dry mass (weight).

703.5 ACCEPTANCE OF CONSTRUCTION AGGREGATES—

(a) **General.** The following describes the certification acceptance of construction aggregates. Accept AASHTO No. 1 Coarse Aggregate in accordance with Section 850.2(a)1.

(b) **Testing And Acceptance.** Certify each day's shipment of aggregate in accordance with Section 106.03(b)3.

1. **Quality Control.** Section 106.03(b)2 and as follows:

- Submit for annual review a quality control plan meeting the minimum Department requirements for aggregate suppliers.
- Establish and positively identify aggregate stockpiles which have been tested in accordance with the approved quality control plan and meet Department Specifications. Material may be added to or shipped from stockpiles at the producer's discretion.

2. **Source Verification Samples.** Obtain a verification sample (n=3) under the direction and supervision of the Engineer, from each stockpile to be tested. Obtain the sample from the stockpile in accordance with PTM No. 607 or from a mini-stockpile. When the mini-stockpile method is chosen, obtain the sample in accordance with the following procedure:

- At the direction of the Engineer, have the loader operator place approximately 10 tonnes (10 tons) of aggregate into a mini-stockpile on a suitable surface, and use the loader to strike off the top of the mini-stockpile.
- At the direction of the Engineer, obtain sufficient material from random locations on the mini-stockpile using a square faced shovel to do the necessary sampling.

Immediately deliver the sample to the Engineer for testing using equipment provided as specified in Sections 703.1(b) and 703.2(b). All three increments will be tested for compliance with Section 703, Tables A, B, C, and D, as applicable. Use material under certification when test results verify the material meets specifications.

Test values not meeting specifications will be evaluated in accordance with Section 106.03(a)3 to determine the percent within limits (PWL). When results indicate a PWL for the material of less than 90, the stockpile will be rejected.

Increase quality control testing in accordance with the reviewed quality control plan. Construct another stockpile of the aggregate to be tested consisting of 300 tonnes (300 tons) to 500 tonnes (500 tons) of material or the remainder of the quantity identified for Department projects, whichever is less.

When the material from the new stockpile meets specifications, material will be accepted under certification as specified.

3. **Project Verification Samples.** Under the direction and supervision of the Inspector, obtain a verification sample(s) (n=3) at the point of placement (loose aggregate sample immediately prior to compaction), for each type of aggregate, in accordance with Table F:

TABLE F

AGGREGATE QUANTITIES	NUMBER OF SAMPLES (n=3)
500 tonnes (500 tons) or more, but less than 2000 tonnes (2,000 tons)	1
2000 tonnes (2,000 tons) or more, but less than 10 000 tonnes (10,000 tons)	2
10 000 tonnes (10,000 tons) or more, up to 25 000 tonnes (25,000 tons)	3
Each additional increment of 25 000 tonnes (25,000 tons)	1

Each sample (n=3) will represent one day's placement. The Inspector will select sample locations in accordance with PTM No. 1.

Immediately deliver the sample(s) to the test site under the direction and supervision of the Inspector. The sample(s) will be tested at the producers' location or the project site using equipment provided as specified in Sections 703.1(b) and 703.2(b). All three increments will be tested for compliance with Section 703, Tables C, and D, plus the Crushed Fragments Test of Table B when applicable. Material will continue to be accepted under certification when test results verify that the material meets specifications.

Test values not meeting specifications will be evaluated in accordance with Section 106.03(a)3 to determine the percent within limits PWL. The results will be averaged to determine the PWL of the material. When results indicate a PWL for the material of less than 90, immediately obtain an additional verification sample (n=3) at the project site under the direction and supervision of the Inspector, from the next 150 tonnes (150 tons).

Discontinue all operations using that type of aggregate until the results of the second verification sample are evaluated. When results indicate a PWL of 90 or more, resume operations using the aggregate which has been evaluated. When the results indicate a PWL of less than 90, acceptance testing will be performed at the point of placement in accordance with the following procedure:

- Provide a separate field laboratory, meeting the requirements of Section 609, at no additional expense to the Department. Do not resume operations using the material until the field laboratory is in place at the project site.
- Under the direction and supervision of the Inspector, obtain an acceptance sample (n=3) at the point of placement (loose aggregate sample immediately prior to compaction) for each day's placement. The Inspector will select sample locations in accordance with PTM No. 1. Immediately transport the sample from sampling point to testing site under the direction and supervision of the Inspector. All three sample increments will be tested for compliance with Section 703.2(c), Tables C, and D.
- Project acceptance testing will continue until 10 consecutive day's placements are accepted with no rejected material. The Contractor will be charged \$200 per day, for each day the material is placed, for project acceptance testing performed by the Department.
- Test values not meeting specifications will be evaluated in accordance with Section 106.03(a)3 to determine the PWL. When results indicate a PWL for the material of less than 90, the material will be removed and replaced at no additional cost to the Department.

4. Quality Assurance Samples. BOC&M quality assurance samples (n=3) may be taken at the source of supply or at the point of placement on the project. Submit samples to the MTD for testing. When results for any type of material indicate a percent within limits PWL of less than 90, the District will immediately obtain an additional verification sample (n=3) at the appropriate site (project or source). All three sample increments will be tested at either the producer's location or at the project site and PWL determined for the material. When results indicate a PWL for the material of less than 90, the actions prescribed in Section 703.5(b)2 and Section 703.5(b)3, will apply.

(c) **Weighing Responsibilities.** Be completely responsible for the preparation of accurate weight slips, certifications attesting to the accuracy of the weights recorded, and assuring conformance with Section 107.23(b), including the payment of liquidated damages as specified. Designate a licensed weigh person(s) to act as your agent. Have scales calibrated annually by an independent agency acceptable to the Department. A Department Inspector may provide random checking. Weigh empty trucks, used to haul material measured by weight, daily unless otherwise directed. When the invoice weight exceeds the net weight determined by a Department mobile weigh team by more than 3%, the deviation will be considered excessive. Take immediate corrective action upon notification of an excessive deviation. Within 30 days of notification, provide the District Engineer with a written description of corrective actions and safeguards, and the time at which they were implemented.