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DIVISION 1100
AGGREGATES

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SECTION 1101

GENERAL REQUIREMENTS FOR AGGREGATES

1101.1 DESCRIPTION

This specification covers the basis of approval, certification and acceptance of aggregates specified in **DIVISION 1100**.

1101.2 REQUIREMENTS

a. General. Provide aggregates that comply with all composition, quality, product control, and handling (stockpile) requirements of the applicable specifications.

b. Process Control.

(1) Perform or cause to be performed all inspections and tests necessary to provide and maintain an adequate process control system that will provide reasonable assurance that all aggregates or aggregate combinations submitted for acceptance will comply to Contract Document.

Before beginning aggregate production for quality control/quality assurance (QC/QA) projects, submit a proposed Process Control Plan in writing for review by the Engineer or the QC/QA Contractor. Include the sampling and testing frequencies, the sampling locations, the sampling and testing methods and other inspections expected to establish and maintain process control in the plan. If requested, the KDOT will make a chart of recommended sampling and testing frequencies for process control available to the Producer.

A process control plan should include procedures for all aggregates produced to determine grading, plasticity index, deleterious substance content, and other properties that may be required by the specification, and to inspect stockpiles for separation, contamination and segregation. These guidelines are considered normal activities necessary to control the production of aggregates or aggregate combinations at an acceptable quality level. It is recognized that, depending on the type of process or materials, some of the activities listed may not be necessary, or other activities may be required. The frequency of these activities is not listed in these guidelines, as they will vary with the process and the materials.

(2) Sampling and Testing. Use the same sampling and testing methods and procedures in process control as those used by the KDOT. These Kansas Test (KT) Methods are included in Part V, which is made available to the producer. Part V also includes a Sampling and Testing Frequency Chart for acceptance of materials that producers may wish to use as a guide to develop their process control plan. Producers supplying material for quality control/quality assurance projects have required minimum sampling and testing frequencies that can also be found in Part V.

(3) Test Reports. Maintain a file of all process control tests. Provide copies to the Engineer upon request.

(4) Acceptance Inspection. Acceptance of aggregate will be based on KDOT and/or Contractor tests at the point of usage unless designated otherwise by the Engineer. Aggregate production will also be inspected to determine if aggregates are being produced from deposits, ledges, and beds which meet the specific quality requirements. Aggregates produced from deposits, ledges, or beds that have not been previously approved for quality will be rejected. Remove rejected material from the project stockpile area immediately. Any work incorporating aggregates from sources not approved for quality for that work must be removed and replaced, or otherwise corrected, by and at the expense of the Contractor.

The KDOT reserves the right to run any test at any time to determine specification compliance. When test results on aggregates or mineral filler supplements indicate non-compliance with specifications, the Engineer may cause those materials to be rejected and removed from the work site at the expense of the Contractor.

c. Certification of Aggregates. Provide the Engineer a certification for each classification of aggregate utilized in a project.

(1). Aggregates Delivered to the Site: Certify each classification of aggregate delivered to a project or product preparation site. Prepare these certifications under the signature of the aggregate producer or their designated representative.

(a) Certify aggregates that are tested at their destination to determine final disposition as to the locations of the deposits from which they were produced.

(b) Certify aggregates that are tested at their production site to determine final disposition. These certifications state that the aggregates were removed from a KDOT tested and approved stockpile at the production site, or that they were removed from a plant while it was producing aggregate that was in compliance with the applicable specifications.

(2) Aggregates Incorporated into the Project: At locations where aggregates and products that incorporate aggregates are produced for KDOT and non-KDOT use, provide certifications stating that only KDOT tested and approved aggregate were provided for the KDOT projects.

(3) Frequency of Certification:

(a) Before the initial delivery of aggregates to a project or product preparation site, provide the Engineer a certification. This certification is to be under the signature of the aggregate producer or their designated representative and states that all aggregates to be provided for the project are in compliance with all the applicable KDOT specifications.

(b) Upon completion of the project, provide certifications as specified in **1101.2c.(1),(2)** to the Engineer. These certifications apply to all aggregates that were delivered to the project or product preparation site and ultimately used in the project.

These certifications are to indicate the approximate quantities in tons or cubic yards of each aggregate delivered to the project and the approximate quantities in tons or cubic yards of each aggregate delivered to the product preparation site and incorporated into a product that was utilized in the project.

1101.3 TEST METHODS

Test all aggregates in accordance with the applicable methods cited in **SECTION 1115**.

1101.4 PREQUALIFICATION

Aggregates from each source require "Official Quality" testing on samples obtained by an authorized representative of the KDOT before use on KDOT projects. These samples are taken from actual production, which may be "pit-run", "crusher-run" or may involve some processing. Approved sources remain approved only if there are no major changes in the production methods or deposit characteristics.

1101.5 BASIS OF ACCEPTANCE

Aggregates from sources approved for the intended use are accepted based on the following:

a. Current official quality test results complying with the requirements of the applicable subsection are on file with the KDOT.

b. Results of tests conducted on samples taken at a point or points designated by the Engineer. The KDOT reserves the right to re-sample, test and reject any previously accepted aggregate if the Engineer has reason to believe it no longer complies with the Contract Documents.

c. Certifications as specified in **subsection 1101.2 c**.

SECTION 1102

AGGREGATES FOR CONCRETE

1102.1 DESCRIPTION

This specification is for coarse aggregates, intermediate aggregates, fine aggregates, mixed aggregates (both coarse and fine material) and miscellaneous aggregates for use in all types of concrete construction.

1102.2 REQUIREMENTS

a. Coarse Aggregates for Concrete.

(1) Composition. Provide coarse aggregate that is crushed or uncrushed gravel, chat, or crushed stone. (Consider limestone, calcite cemented sandstone, rhyolite, quartzite, basalt and granite as crushed stone). When using quartzite, include supplementary cementitious materials to prevent ASR. Mixtures utilizing quartzite must comply with **Subsection 401.3 j or k.**

(2) Quality.

(a) Provide coarse aggregates for structures (SCA) and coarse aggregates for applications "not placed on-grade" that comply with **TABLE 1102-1**:

TABLE 1102-1: QUALITY REQUIREMENTS FOR COARSE AGGREGATES FOR STRUCTURAL CONCRETE AND COARSE AGGREGATES FOR APPLICATIONS NOT PLACED ON-GRADE

Concrete Classification	Soundness (min.)	Wear (max.)	Absorption (max.)	Acid Insol. (min.)
Grade xx (AE)(SW)[1]	0.90	40	-	-
Grade xx (AE)(SA)[2]	0.90	40	2.0	-
Grade xx (AE)(AI)[3]	0.90	40	-	55
Grade xx (AE)(PB)[4]	0.90	40	3.0	-
BDWS[5]	0.95	40	-	55
All Other Grades	0.90	50	-	-

[1]Grade xx (AE)(SW) - Structural concrete with select coarse aggregate for wear.
[2]Grade xx (AE)(SA) - Structural concrete with select coarse aggregate for wear and absorption.
[3]Grade xx (AE)(AI) - Structural concrete with select coarse aggregate for wear and acid insolubility.
[4]Grade xx (AE)(PB) - Structural concrete with select aggregate for use in prestressed concrete beams.
[5]BDWS - Bridge Deck Wearing Surface.

(b) The quality requirements for coarse aggregates for applications "placed on-grade" (CPA) are:

- All Aggregates:
  - Soundness, minimum (KTMR-21) 0.90*
  - Wear, maximum (KTMR-25) 50%

  *Soundness will be waived for limestone and dolomite complying with all requirements for Class I aggregate.

(3) Additional Requirements for Limestone or Dolomite for Concrete on-grade.

- Class I Aggregate
  - Modified Soundness, minimum (KTMR-21) 0.85
  - Durability Factor, minimum (KTMR-22) 95
  - Expansion, maximum (KTMR-22) 0.025%

- Limestone or dolomite used in CPA-4 with >5 percent retained on ¾ inch sieve (Class 2 aggregate):
  - Modified Soundness, minimum (KTMR-21) 0.85
  - Durability Factor, minimum (KTMR-22) 97
  - Expansion, maximum (KTMR-22) 0.015%

(4) Product Control.

(a) Provide Structural Coarse Aggregates that comply with **TABLE 1102-2.**

TABLE 1102-2: GRADING REQUIREMENTS FOR COARSE AGGREGATES FOR STRUCTURAL CONCRETE

Type	Composition	Percent Retained - Square Mesh Sieves							
		1½"	1"	¾"	½"	⅜"	No. 4	No. 8	No. 30
SCA-1	Chat	0	0-5				55-75	87-97	95-100
SCA-2	Siliceous Gravel or Crushed Stone			0	0-35	30-70	75-100	95-100	
SCA-3	Siliceous Gravel or Crushed Stone		0	0-20		40-70		95-100	
SCA-4*	Siliceous Gravel, Chat or Crushed Stone		0	0-20				95-100	
SCA-5	Crushed Siliceous Gravel, Chat and Crushed Stone			0	0-10	15-50	85-100		

*Use with Basic Aggregate to produce Mixed Aggregate

(b) Provide Coarse Paving Aggregates that comply with **TABLE 1102-3**.

TABLE 1102-3: GRADING REQUIREMENTS FOR COARSE AGGREGATES FOR CONCRETE PAVEMENT AND ON-GRADE CONCRETE

Type	Composition	Percent Retained - Square Mesh Sieves							
		1½"	1"	¾"	½"	⅜"	No. 4	No. 8	No. 30
CPA-1	Siliceous Gravel or Crushed stone except limestone or dolomite	0	0-10	14-35		50-75		95-100	
CPA-2	Chat	0	0-5				55-75	87-97	95-100
CPA-3	Siliceous Gravel or Crushed Stone			0	0-35	30-70	75-100	95-100	
CPA-4*	Siliceous Gravel, Chat or Crushed Stone		0	0-10**				95-100	

* Use with Basic Aggregate to produce Mixed Aggregate

If limestone or dolomite aggregates do not comply with Class 2 in **subsection 1102.2a.(3), the maximum percent retained is 5.

(c) Deleterious Substances. Maximum allowed deleterious substances by weight are:

- Material passing the No. 200 sieve (KT-2) 2.5%
- Shale or Shale-like material (KT-8) 0.5%
- Clay lumps and friable particles (KT-7) 1.0%
- Sticks (wet) (KT-35) 0.1%
- Coal (AASHTO T 113) 0.5%

(d) Uniformity of Supply. Designate or determine the fineness modulus (grading factor) according to the procedure listed in the Construction Manual Part V, Section 17 before delivery, or from the first 10 samples tested and accepted. Provide aggregate that is within ±0.20 of the average fineness modulus.

(e) Proportioning of Coarse and Fine Aggregate. Combine fine and coarse aggregates in a 50%-50% ratio by weight. Adjustments to improve workability may be made when approved by the Engineer. Use of a proven optimization method such as the ACI 302.1 method can provide adequate justification.

(5) Do not combine siliceous fine aggregate with siliceous coarse aggregate if neither comply with **subsection 1102.2c.(2)(a)**. Consider such material, regardless of proportioning, as a Mixed Aggregate that must comply with **subsection 1102.2d**.

(6) Handling Coarse Aggregates.

(a) Segregation. Before acceptance testing, remix all aggregate segregated by transportation or stockpiling operations.

(b) Stockpiling.

- Stockpile accepted aggregates in layers 3 to 5 feet thick. Berm each layer so that aggregates do not "cone" down into lower layers.
- Keep aggregates from different sources, with different grading, or with a significantly different specific gravity separated.
- Transport aggregate in a manner that insures uniform gradation.
- Do not use aggregates that have become mixed with earth or foreign material.
- Stockpile or bin all washed aggregate produced or handled by hydraulic methods for 12 hours (minimum) before batching. Rail shipment exceeding 12 hours is acceptable for binning provided the car bodies permit free drainage.
- Provide additional stockpiling or binning in cases of high or non-uniform moisture.

b. Intermediate Aggregate for Mixed Aggregate.

(1) Composition. Provide intermediate aggregate for mixed aggregates (IMA) that is crushed or uncrushed gravel, chat, crushed stone, natural occurring sand, or manufactured sand.

(2) Quality. Provide IMA complying with **subsection 1102.2a.(2), 1102.2c.(2) or 1102.2d.(2)**.

(3) Product Control. Provide IMA grading as necessary to obtain specified MA grading and any coarseness factor and workability requirements.

c. Fine Aggregates for Concrete.

(1) Composition.

(a) Type FA-A. Provide either singly or in combination natural occurring sand resulting from the disintegration of siliceous or calcareous rock, or manufactured sand produced by crushing predominately siliceous materials.

(b) Type FA-B. Provide fine granular particles resulting from the crushing of zinc and lead ores (Chat).

(c) Type FA-C. Provide a singly crushed siliceous gravel or chat that is free of dirt, clay, and foreign or organic material.

(2) Quality.

(a) Mortar strength and Organic Impurities. If the DME determines it is necessary, because of unknown characteristics of new sources or changes in existing sources, provide fine aggregates that comply with the following:

- Mortar Strength (Mortar Strength Test, KTMR-26). Compressive strength when combined with Type III (high early strength) cement:
  - At age 24 hours, minimum 100%*
  - At age 72 hours, minimum 100%*

  *Compared to strengths of specimens of the same proportions, consistency, cement and standard 20-30 Ottawa sand.

- Organic Impurities (Organic Impurities in Fine Aggregate for Concrete Test, AASHTO T 21). The color of the supernatant liquid is equal to or lighter than the reference standard solution.

(b) Hardening characteristics. Specimens made of a mixture of 3 parts FA-B and 1 part cement with sufficient water for molding will harden within 24 hours. There is no hardening requirement for FA-A or FA-C.

(c) Provide FA-C for Multi-Layer Polymer Concrete Overlay complying with **TABLE 1102-4.**

TABLE 1102-4: QUALITY REQUIREMENTS FOR MULTI-LAYER POLYMER CONCRETE OVERLAY		
Property	**Requirement**	**Test Method**
Soundness, minimum	0.92	KTMR-21
Wear, maximum	30%	KTMR-25
Acid Insoluble Residue, minimum	55%	KTMR-28
Fine Aggregate Angularity, minimum	45	KT-50
Moisture Content, maximum	0.2%	KT-11

(3) Product Control.

(a) Size Requirements. Provide fine aggregates that comply with **TABLE 1102-5**.

TABLE 1102-5: GRADING REQUIREMENTS FOR FINE AGGREGATES FOR CONCRETE							
Type	**Percent Retained-Square Mesh Sieves**						
	⅜"	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**
FA-A	0	0-10	0-27	15-55	40-77	70-93	90-100
FA-B	0	0-5	0-24	15-50	40-75	70-90	90-100
FA-C	0	0	25-70	95-100	100	100	100

(b) Deleterious Substances.

- Type FA-A: Maximum allowed deleterious substances by weight are:
  - Material passing the No. 200 sieve (KT-2).....2.0%
  - Clay lumps and friable particles (KT-7).....1.0%
  - Sticks (wet) (KT-35).....0.1%

- Type FA-B: Provide materials that are free of organic impurities, sulfates, carbonates, or alkali. Maximum allowed deleterious substances by weight are:
  - Material passing the No. 200 sieve (KT-2).....2.0%
  - Clay lumps & friable particles (KT-7).....0.25%

(c) Uniformity of Supply. Designate or determine the fineness modulus (grading factor) according to the procedure listed in Part V, Section 17 before delivery, or from the first 10 samples tested and accepted. Provide aggregate that is within ±0.20 of the average fineness modulus.

(4) Proportioning of Coarse and Fine Aggregate. Combine Fine and Coarse aggregates in a 50%-50% ratio by weight. Adjustments to improve workability may be made when approved by the Engineer. Use of a proven optimization method such as the ACI 302.1 method can provide adequate justification.

Do not combine siliceous fine aggregate with siliceous coarse aggregate if neither comply with **subsection 1102.2c.(2)(a)**. Consider such fine material, regardless of proportioning, as a Basic Aggregate and must comply to **subsection 1102.2d.**

(5) Handling and Stockpiling Fine Aggregates.

- Maintain separation between aggregates from different sources, with different gradings or with a significantly different specific gravity.
- Transport aggregate in a manner that promotes uniform grading.
- Do not use aggregates that have become mixed with earth or foreign material.
- Stockpile or bin all washed aggregate produced or handled by hydraulic methods for 12 hours (minimum) before batching. Rail shipment exceeding 12 hours is acceptable for binning provided the car bodies permit free drainage.
- Provide additional stockpiling or binning in cases of high or non-uniform moisture.

d. Mixed Aggregates for Concrete.

(1) Composition.

(a) Total Mixed Aggregate (TMA). A natural occurring, predominately siliceous aggregate from a single source that complies with the Wetting & Drying Test and grading requirements.

(b) Mixed Aggregate.

- Basic Aggregate (BA). Singly or in combination, a natural occurring, predominately siliceous aggregate that does not comply with either the Wetting & Drying Test or grading requirements of the Total Mixed Aggregate. For MA-1 or MA-2 mixes, sweetened basic aggregate must contain at least 50% basic aggregate. For Contractor optimized mixes (MA-3), sweetened basic aggregate must contain at least 30% basic aggregate.
- Coarse Aggregate Sweetener. Types and proportions of aggregate sweeteners to be used with BA are listed in **TABLE 1102-6.**

TABLE 1102-6: COARSE AGGREGATE SWEETENER FOR BASIC AGGREGATE

Type of Coarse Aggregate Sweetener	Proportion Required by Percent Weight
Crushed Sandstone*	30 (minimum)
Chat*	25 (minimum)
Crushed Limestone or Dolomite*	30 (minimum)
Gravel Approved under **1102.2d.(2)** *	30 (minimum)
Gravel not Approved under **1102.2d.(2)** **	30 (maximum)

*Waive the minimum portion of Coarse Aggregate Sweetener for all BA that comply with the wetting and drying requirements for TMA. In this case, combine the BA and coarse aggregate sweetener in proportions required complying with the grading listed in **TABLE 1102-6**.

**To be used only with BA that complies with the wetting and drying requirements of TMA.

(2) Quality.

(a) Total Mixed Aggregate.

- Soundness, minimum (KTMR-21) 0.90
- Wear, maximum (KTMR-25) 50%
- Wetting & Drying Test of Sand-Gravel Aggregate for Concrete (KTMR-23)

Concrete Modulus of Rupture:

- At 60 days, minimum..... 550 psi
- At 365 days, minimum..... 550 psi

Expansion:

- At 180 days, maximum..... 0.050%
- At 365 days, maximum..... 0.070%

Aggregates produced from the following general areas are exempt from the Wetting and Drying Test:

- Blue River Drainage Area.
- The Arkansas River from Sterling, west to the Colorado state line.
- The Neosho River from Emporia to the Oklahoma state line.

(b) Basic Aggregate.

- Retain 10% or more of the BA on the No. 8 sieve before adding the Coarse Aggregate Sweetener. Aggregate with less than 10% retained on the No. 8 sieve is to be considered a Fine Aggregate described in **subsection 1102.2c.** Provide material with less than 5% calcareous material retained on the ⅜ inch sieve.
- Soundness, minimum (KTMR-21) 0.90
- Wear, maximum (KTMR-25) 50%
- Mortar strength and Organic Impurities. If the DME determines it is necessary, because of unknown characteristics of new sources or changes in existing sources, provide mixed aggregates that comply with the following:
  - Mortar Strength (Mortar Strength Test, KTMR-26). Compressive strength when combined with Type III (high early strength) cement:
  - At age 24 hours, minimum 100%*

- At age 72 hours, minimum 100%*

*Compared to strengths of specimens of the same proportions, consistency, cement and standard 20-30 Ottawa sand.

- Organic Impurities (Organic Impurities in Fine Aggregate for Concrete Test, AASHTO T 21). The color of the supernatant liquid is equal to or lighter than the reference standard solution.

(c) Coarse Aggregate Sweetener. Comply with SCA-3 or CPA-4 in **subsection 1102.2a**.

(3) Product Control.

(a) Size Requirement. Provide mixed aggregates that comply with **TABLE 1102-7**.

TABLE 1102-7: GRADING REQUIREMENTS FOR MIXED AGGREGATES FOR CONCRETE

Type	Usage	Percent Retained - Square Mesh Sieves									
		1"	¾"	½"	⅜"	No. 4	No. 8	No.16	No. 30	No. 50	No. 100
MA-1	All concrete except mainline pavement [1]	0	0-5			20-60			76-84	90-96	
MA-2	All Concrete		0	3-15	15-30	33-50	45-66	64-80	78-90	87-96	95-100
MA-3	Optimized for PCCP concrete	0	0-6[2]	Note[3,4]	Note[3,4]	Note[3,4]	Note[3,4]	Note[5]	Note[5]	Note[5]	95-100
MA-5	Drilled Shafts[6]	0	0-12	8 min	22-34		55-65		75 min		95-100

[1]MA-1 can be used in concrete for mainline patching.
[2]If aggregate qualities fail to comply with Class 2 aggregate requirements, **subsection 1102.2a.**, the maximum retained gradation is restricted to 3%.
[3]Retain a maximum of 24% and a minimum of 6% of the material on each individual sieve.
[4]When Class 2 aggregate is used, retain a maximum of 20% on each individual sieve.
[5]Retain a maximum of 15% and a minimum of 6% of the material on each individual sieve.
[6]It is recommended that the aggregate gradation combine a SCA-3 or CPA-4 and an FA-A or Basic Aggregate for MA.

(b) Deleterious Substances. Maximum allowed deleterious substances by weight are:

- Material passing the No. 200 sieve (KT-2) 2.5%
- Shale or Shale-like material (KT-8) 0.5%
- Clay lumps and friable particles (KT-7) 1.0%
- Sticks (wet) (KT-35) 0.1%
- Coal (AASHTO T 113) 0.5%

(c) Uniformity of Supply. Designate or determine the fineness modulus (grading factor) according to the procedure listed in Part V, Section 17 before delivery, or from the first 10 samples tested and accepted. Provide aggregate that is within ±0.20 of the average fineness modulus.

(4) Handling Mixed Aggregates.

(a) Segregation. Before acceptance testing, remix all aggregate segregated by transit or stockpiling.

(b) Stockpiling.

- Maintain separation between aggregates from different sources, with different gradings or with a significantly different specific gravity.
- Transport aggregate in a manner that promotes uniform grading.
- Do not use aggregates that have become mixed with earth or foreign material.
- Stockpile or bin all washed aggregate produced or handled by hydraulic methods for 12 hours (minimum) before batching. Rail shipment exceeding 12 hours is acceptable for binning provided the car bodies permit free drainage.
- Provide additional stockpiling or binning in cases of high or non-uniform moisture.

e. Miscellaneous Aggregates for Concrete.

(1) Aggregates for Mortar Sand, Type FA-M.

(a) Composition. Provide aggregates for mortar sand, Type FA-M that is natural occurring sand.

(b) Quality.

- Mortar strength and Organic Impurities. If the DME determines it is necessary, because of unknown characteristics of new sources or changes in existing sources, provide aggregates for mortar sand, Type FA-M that comply with the following:
  - Mortar Strength (Mortar Strength Test, KTMR-26). Compressive strength when combined with Type III (high early strength) cement:
    - At age 24 hours, minimum 100%*
    - At age 72 hours, minimum 100%*

    * Compared to strengths of specimens of the same proportions, consistency, cement and standard 20-30 Ottawa sand.
  - Organic Impurities (Organic Impurities in Fine Aggregate for Concrete Test, AASHTO T 21). The color of the supernatant liquid is equal to or lighter than the reference standard solution.

(c) Product Control.

- Size Requirements. Provide aggregates for mortar sand, Type FA-M that comply with **TABLE 1102-8.**

TABLE 1102-8: GRADING REQUIREMENTS FOR MORTAR SAND							
Type	**Percent Retained - Square Mesh Sieves**						
	No. 4	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**	**Gradation Factor**
FA-M	0	0-2	0-30	20-50	50-75	90-100	1.70-2.50

- Deleterious Substances. Maximum allowed deleterious substances by weight are:
  - Material passing the No. 200 sieve (KT-2) 2.0%
  - Clay lumps and friable material (KT-7) 0.5%
  - Sticks (wet) (KT-35) 0.1%
  - Coal (AASHTO T 113) 0.5%

(2) Modified Lightweight Aggregates.

(a) Composition. Provide an expanded shale lightweight aggregate produced from a uniform deposit of raw material combined with FA-A **subsection 1102.2c.**

(b) Quality.

- Soundness, minimum (KTMR-21) 0.90
- Loss on Ignition 5%

(c) Product Control.

- Size Requirements. Provide modified lightweight aggregates that comply with **TABLE 1102-9**.

TABLE 1102-9: GRADING REQUIREMENTS FOR MODIFIED LIGHTWEIGHT AGGREGATES						
Type	**Percent Retained - Square Mesh Sieves**					
	¾"	**½"**	**⅜"**	**No. 4**	**No. 8**	**No. 16**
Grade 1	0	0-10	30-60	85-100	95-100	
Grade 2		0-2	0-30	20-50	50-75	90-100

- Deleterious Substances.
  - Organic Impurities (Organic Impurities in Fine Aggregate for Concrete Test, AASHTO T 21). The color of the supernatant liquid is equal to or lighter than the reference standard solution.

- Expanded Shale Unit Weight (dry, loose weight) (max.) ..... 1890 lbs/cu yd

(d) Concrete Making Properties. Drying shrinkage of concrete specimens prepared with expanded shale and FA-A proportioned as shown in the Contract Documents can not exceed 0.07%.
(e) Uniformity of Supply. Designate or determine the fineness modulus (grading factor) according to procedure listed in Part V, Section 17 before delivery, or from the first 10 samples tested and accepted. Provide aggregate that is within ±0.20 of the average fineness modulus.
(f) Proportioning Materials. Combine separately batched FA-A and expanded shale aggregate in proportions as shown in the Contract Documents.
(g) Stockpiling

- Stockpile accepted aggregates in layers 3 to 5 feet thick. Berm each layer so that aggregates do not "cone" down into lower layers.
- Keep aggregates from different sources, with different gradings or with a significantly different specific gravity separated.
- Transport aggregate in a manner that promotes uniform gradation.
- Do not use aggregates that have become mixed with earth or foreign material.
- Stockpile or bin all washed aggregate produced or handled by hydraulic methods for 12 hours (minimum) before batching. Rail shipment exceeding 12 hours is acceptable for binning provided the car bodies permit free drainage.
- Provide additional stockpiling or binning in cases of high or non-uniform moisture.

1102.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1102.4 PREQUALIFICATION

Aggregates for concrete must be prequalified according to **subsection 1101.02.**

1102.5 BASIS OF ACCEPTANCE

The Engineer will accept aggregates for concrete base on the prequalification required by this specification and **subsection 1101.03.**

SECTION 1103

AGGREGATES FOR HOT MIX ASPHALT (HMA)

1103.1 DESCRIPTION

This specification covers the quality, composition and gradation requirements of aggregates for hot mix asphalt (HMA) on QC/QA projects.

1103.2 REQUIREMENTS

a. Composition Individual Aggregates. Use aggregate from each source that complies with the gradation requirements listed in **TABLE 1103-1**.

(1) Crushed Aggregates. Limit crushed aggregates to the following materials.

(a) Produce Crushed Stone (CS-1) and Crushed Stone Screenings (CS-2) by crushing limestone, sandstone, porphyry, (rhyolite, basalt, granite, and Iron Mountain Trap Rock are examples of porphyry) or other types of stone.

(b) Produce Crushed Gravel (CG) by crushing siliceous gravel containing not more that 15% non-siliceous material.

(c) Provide Chat (CH-1) obtained during the mining of lead and zinc ores in the tri-state mining district.

(d) Consider materials complying with Mineral Filler Supplements MFS-1, MFS-2, MFS-4, and MFS-7 as crushed aggregate.

(e) Produce Crushed Steel Slag (CSSL) by crushing electric furnace steel slag. Some sources of steel slag are angular when produced and may be treated the same as crushed gravel and manufactured sand. Use steel slag with an Uncompacted Void Content of the Fine Aggregate "U" Value, determined by test method KT-50, of more than 42.00 and the Coarse Aggregate Angularity greater than the minimum specified value. The maximum allowable quantity of crushed steel slag is 50% of the total aggregate weight.

(f) Produce Manufactured Sand or Buckshot by crushing siliceous sand and gravel, or washing crushed stone screenings.

(2) Uncrushed Aggregates. Limit uncrushed aggregates to the following materials.

(a) Produce Sand-Gravel (SSG) by mixing natural sand and gravel formed by the disintegration of siliceous and/or calcareous materials.

(b) Provide Natural Sand consisting of particles formed by the natural disintegration of siliceous and/or calcareous materials. Use natural sand with an Uncompacted Void Content "U" value of less than 42.00.

(c) Provide Grizzly (Grizzly Waste) consisting of the matrix or bedding material occurring in conjunction with calcitic or dolomitic cemented sandstone "Quartzite", generally separated from the sandstone prior to crushing.

(d) Provide Wet Bottom Boiler Slag (WBBS) consisting of a hard angular by-product of the combustion of coal in wet-bottom boilers. Quality requirements do not exist for this material. Obtain written approval by the Chief of Materials and Research for use in HMA. The use of WBBS does not modify the requirements for minimum contents of either crushed stone or natural sand.

(3) Mineral Filler Supplement. Provide a mineral filler supplement that is easily pulverized and free of cemented lumps, mudballs, and organic materials that complies with the following and the general requirements in **subsection 1103.02c**. Do not blend 2 or more materials to produce mineral filler supplement. Provide only 1 mineral filler supplement in each HMA design.

(a) Mineral Filler Supplement designation MFS-1 is Portland cement, blended hydraulic cements, or crushed stone.

(b) Mineral Filler Supplement designation MFS-2 is crushed limestone.

(c) Mineral Filler Supplement designation MFS-3 is water or wind deposited silty soil material.

(d) Mineral Filler Supplement designation MFS-4 is Hydrated lime. The minimum allowable quantity of MFS-4 or Hydrated Lime is 1% of the total aggregate weight when required as a supplement on the Contract Documents.

(e) Mineral Filler Supplement designation MFS-5 is volcanic ash containing a minimum of 70% glass shard. The maximum allowable quantity of MFS-5 is 5% of the total aggregate weight when specified as acceptable mineral filler supplement.

(f) Mineral Filler Supplement designation MFS-6 is fly ash. Fly ash is the finely divided residue resulting from the combustion of ground or powdered coal and is transported from the boiler by flue gasses. The maximum allowable quantity of MFS-6 is 3% of the total aggregate weight when specified as acceptable mineral filler supplement.

(g) Mineral Filler Supplement designation MFS-7 is processed chat sludge that has been dewatered at the source of supply, and does not exceed 15% moisture content by weight at the time of shipping.

(4) Reclaimed Asphaltic Pavement (RAP). Use RAP in HMA only when such an option is permitted by Contract Special Provision. The RAP will be subject to the limitations (i.e. source, max. percent allowed in mix, etc.) shown on the Contract Documents and contained in the appropriate Contract Special Provisions. Screen the RAP through a 2 ¼" screen or grizzly before it enters the HMA plant.

b. Quality of Individual Aggregates.

- Soundness, minimum (KTMR-21) 0.90%
  Soundness requirements do not apply to aggregates having less than 10% material retained on the No. 4 mesh sieve.
- Wear, maximum (KTMR-25) 40%
  Wear requirements do not apply to aggregates having less than 10% retained on the No. 8 sieve.
- Absorption, maximum (KT-6) 4.0%
  Test aggregates for absorption as follows:
  - Crushed Stone (CS-1) ..... Test Method KT-6, Procedure I
  - Screenings (CS-2) ..... Test Method KT-6, Procedure II
  - Sand Gravel (SSG)/Crushed Gravel (CG) ..... Test Method KT-6, Procedures I & II

  Apply the specified maximum absorption to both the fraction retained on the No. 4 sieve and the fraction passing the No. 4. Screenings produced concurrently with CS-1 will be accepted without tests for absorption.

  Crushed aggregates with less than 10% materials retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.
- Plasticity Index, the maximum P.I. for MFS-1, MFS-2, MFS-3, MFS-5, and MFS-7 is 6.

c. Product Control of Individual Aggregates

(1) Size Requirements. Produce each individual aggregate that complies with **TABLE 1103-1 and 1103-2**.

(2) Deleterious Substances. Provide combined aggregates free from alkali, acids, organic matter, or injurious quantities of other foreign substances that does not exceed the following maximum percentages by weight.

- Shale or Shale-like (KT-8) 1.0%
- Clay lumps and friable particles (KT-7) 1.0%
- Sticks (wet) (KT-35) 0.1%
- Coal (AASHTO T-113) 0.5%

TABLE 1103-1: REQUIREMENTS FOR INDIVIDUAL AGGREGATES

Designation	Material	Percent Retained – Square Mesh Sieves						
		1"	½"	3/8"	No. 4	No. 8	No. 30	No. 200
CS-1	Crushed Stone	0						96-100
CS-2	Crushed Stone Screenings		0	0 - 5				60-100
CG	Crushed Gravel	Blend gradation with other aggregates in the mix.						
CH-1	Chat	Blend gradation with other aggregates in the mix						
SSG	Sand & Sand Gravel	0						80-100
WBBS	Wet Bottom Boiler Slag		0	Blend gradation with other aggregates in the mix.				
CSSL	Crushed Steel Slag	Blend gradation with other aggregate in the mix.						

TABLE 1103-2: REQUIREMENTS FOR MINERAL FILLER SUPPLEMENTS								
Designation	**Material**	**Percent Retained – Square Mesh Sieves**						
		1”	**½”**	**3/8”**	**No. 4**	**No. 8**	**No. 30**	**No. 200**
MFS-1	Cement or Crushed Stone			0		0-5	0-8	0-40
MFS-2	Crushed Limestone			0		1-10		60-80
MFS-3	Silt			0	0-5			0-40
MFS-4	Hydrated Lime	Blend gradation with other aggregate in the mix						
MFS-5	Volcanic Ash			0		0-5	0-8	0-40
MFS-6	Fly Ash	Blend gradation with other aggregate in the mix						
MFS-7	Processed Chat Sludge			0		0-5	0-8	0-40

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1103.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTIONS 1115 and 2501**.

1103.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1103.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedure described in **subsection 1101.5.**

SECTION 1104

AGGREGATES FOR AGGREGATE BASE CONSTRUCTION

1104.1 DESCRIPTION

This specification covers aggregates for use in aggregate base construction.

1104.2 REQUIREMENTS

a. Composition.

(1) Type AB-1 or AB-2 may be singularly or any combination of crushed stone, crushed or uncrushed gravel, sand, sand-gravel, or limestone gravel mixed with soil or other qualified binder material.

(2) Type AB-3 is at least 85% limestone or dolomite produced by mechanical crushing.

b. Quality[1].

- Soundness[2], minimum (KTMR-21) 0.85
- Wear[3], maximum (KTMR-25) 50%
- Absorption, maximum (AB-1 only) (KT-6, Procedure I) 4.0%
- Specific Gravity (dry), minimum (KT-6, Procedure I) 2.20

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

c. Product Control.

(1) Gradation and Plasticity. Provide a uniformly mixed final product that complies with **TABLE 1104-1**.

(2) Deleterious Substances. Provide aggregates that are free from weeds, sticks, grass, roots and other undesirable foreign matter.

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1104.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

TABLE 1104-1: GRADATION AND PLASTICITY OF AGGREGATES FOR AGGREGATE BASE CONSTRUCTION

Type	% Retained-Square Mesh Sieves									P.I.	Liquid Limit (Max.)
	2”	1 ½”	1”	¾”	3/8”	No. 4	No. 8	No. 40	No. 200		
AB-1	0	0-10		5-40		35-75	54-85	78-95	90-98	0-6	25
AB-2*			0		1-35		25-50	60-75	78-90	1-6	25
AB-3**	0	0-5		5-30		35-60	45-70	60-84	80-92	2-8	30

*The fraction passing the No. 200 sieve shall not exceed 2/3 of the fraction passing the No. 40 sieve.

**The fraction passing the No. 200 sieve shall not exceed 3/4 of the fraction passing the No. 40 sieve.

1104.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1104.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5.**

SECTION 1105

AGGREGATES FOR CEMENT TREATED BASES

1105.1 DESCRIPTION

This specification covers aggregate for the construction of fly ash and portland cement treated base.

1105.2 REQUIREMENTS

a. Composition. Provide singly or in combination, crushed limestone, crushed dolomite, crushed portland cement concrete pavement (PCCP) reclaimed from the project site and sand or sand-gravel produced from a naturally occurring alluvial deposit.

b. Quality [1]. Provide individual aggregates that comply with the following:

Crushed Limestone and Dolomite.

- Soundness [2], minimum (KTMR-21) 0.85
- Wear [3], maximum (KTMR-25) 45%

Reclaimed crushed PCCP.

- Soundness [2], minimum (KTMR-21) 0.85
- Wear [3], maximum (KTMR-25) 60%

Sand or Sand Gravel.

- Soundness [2], minimum (KTMR-21) 0.75
- Wear [3], maximum (KTMR-25)..... 50%
- Specific Gravity, minimum, (KT-6, Procedure I, Bulk S.S.D.) 2.45

[1] Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2] The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3] The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

c. Product Control.

(1) Size Requirements. Develop a single point aggregate gradation and establish a plus and minus tolerance for each sieve specified in **TABLE 1105-1**. The established tolerances will be applied to the designated single point gradation for the purposes of establishing a gradation band for field acceptance testing. Perform sieve analyses of the aggregates and chart the results. Suspend production of materials when any test result on any sieve falls outside the gradation band.

TABLE 1105-1: GRADATION OF AGGREGATES FOR CEMENT TREATED BASES (PERCENT RETAINED)

Sieve size	1 ½"	¾"	No. 4	No. 8	No. 40	No. 200
Single point	*	*	*	*	*	*
Tolerance	*	+/-*	+/-*	+/-*	+/-*	+/-*

* These values to be established by the Contractor

(2) Deleterious Substances. Provide aggregates that are free from grass, weeds, roots, sticks, and other undesirable foreign matter.

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1105- AGGREGATES FOR CEMENT TREATED BASES

1105.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115.**

1105.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1105.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5.**

SECTION 1106

AGGREGATES FOR GRANULAR BASE

1106.1 DESCRIPTION

This specification covers aggregate for granular base for concrete pavements.

1106.2 REQUIREMENTS

a. Composition. Mix sand, gravel, crushed stone, and/or a suitable binder soil, singly or in combination, to produce uniformity of grading and plasticity, and comply with the following.

b. Quality [1].

- Soundness [2], minimum (KTMR-21) 0.85
- Wear [3], maximum (KTMR-25) 50%
- Absorption, maximum (KT-6) 4.0%

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

Apply the specified maximum absorption to both the fraction retained on the No. 4 sieve and the fraction passing the No. 4 sieve. Screenings produced concurrently with products approved under KT-6, Procedure I, will be accepted without tests for absorption.

c. Product Control.

(1) Size and Plasticity Requirements:

TABLE 1106-1: GRADATION OF AGGREGATES FOR GRANULAR BASE (PERCENT RETAINED)

Sieve size	1 ½"	¾"	No. 4	No. 8	No. 40	No. 200
Single point	0	0-15	10-65	25-70	50-90	85-95

Plasticity Index.

- Mixes containing more than 50% Crushed Limestone 1-8
- Other Aggregate Combinations 3-8
- Liquid Limit, maximum 25

(2) Pulverization.

(a) Binder Soil. Pulverize binder soil that occurs in natural deposits and not naturally combined with coarse material that complies with **TABLE 1106-2**:

TABLE 1106-2: GRADATION OF BINDER SOIL

Sieve Size	¾"	No. 4	No. 8
Percent Retained	0	0-25	0-50

Determine pulverization of binder soil in moist or natural conditions at the latest possible point before incorporation into the total combined material.

(b) Natural Mixtures. When binder and coarse material occur naturally combined, pulverize the combination so that at least 25% of the total passing the No 40 sieve by washing passes the No. 40 sieve by dry screening.

(3) Deleterious Substances. Provide aggregates that are free from grass, weeds, roots, sticks, and other undesirable foreign matter.

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1106.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115.** Test for absorption as follows:

- Crushed Stone. ..... Test Method KT-6, Procedure. I
- Screenings ..... Test Method KT-6, Procedure. II
- Sand-Gravel ..... Test Method KT-6, Procedure. I & II

1106.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1106.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5.**

SECTION 1107

AGGREGATES FOR BACKFILL

1107.1 DESCRIPTION

This specification covers aggregate for backfill. Use this when structures, pipe, mechanically stabilized earth (MSE) walls (panel or modular), underdrain, permeable or crushed stone backfill requirements are specified in the Contract Documents.

1107.2 REQUIREMENTS

a. Structures or Pipe.

(1) Composition. Provide singly or in combination sand, gravel, or crushed stone. Consider limestone, calcite-cemented sandstone, rhyolite, basalt, and granite as crushed stone.

(2) Quality[1].

- Soundness[2], minimum (KTMR-21) 0.85
- Wear[3], maximum (KTMR-25) 45%

For Structures Backfill Only:

- Coarse Aggregate Angularity[4], minimum (KT-31) 75%
- Fine Aggregate Angularity[4], minimum (KT-50) 40%

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

[4]Required testing for sand and gravel.

(3) Product Control.

(a) Gradation and Plasticity.

TABLE 1107-1: AGGREGATES FOR STRUCTURES OR PIPE BACKFILL

Type	% Retained-Square Mesh Sieves									Plasticity Index (Max.)
	2"	1 ½"	1"	¾"	3/8"	No. 4	No. 8	No. 40	No. 200	
SB-1[1]	0	0-10		15-40	50-75		95-100			
SB-2[1]			0	0-20	40-70	75-100	95-100			
SB-3[2]	0	0-5		5-30		35-60	45-70	60-84	80-92	2-8
PB-1	0	0-10		15-40	50-75		95-100			
PB-2			0	0-20	40-70	75-100	95-100			
PB-3[3]			0	0-30		35-60	50-75	70-90	90-100	8

[1]Use SB designations for foundation stabilization material.

[2]Use SB-3 when the expected depth of foundation stabilization is less than 6 inches.

[3]Use PB-3 for flexible pipe backfill only.

(b) Deleterious Substances. Provide aggregates that are free from grass, weeds, roots, sticks, and other undesirable foreign matter.

b. MSE Walls: Precast Panel and Modular Block with Steel Soil Reinforcing Mesh.

(1) Composition. Use granular backfill material in the structure volume of sand, sand-gravel, or crushed stone, reasonably free from organics or other deleterious materials, and complies with the following:

(2) Quality. Submit representative material samples for the following tests to the Materials and Research Center, 2300 Van Buren, Topeka, KS 66611 (ATTENTION: Geotechnical Engineer) for acceptance prior to utilizing this material on the project.

(a) The Plasticity Index (P.I.) is 6 maximum, determined by KT-10.

(b) An angle of internal friction of 34 degrees or greater, as determined by the standard direct shear test – AASHTO T 236, utilizing a sample of the material compacted to 95 percent of AASHTO T 99 Methods C or D (with oversize correction, as outlined in Note 9 in AASHTO T 99) at optimum moisture content.
(c) Soundness. Use material substantially free of shale or other soft, poor durability particles as determined in accordance with **SECTION 1115**. "Freeze and Thaw", minimum 0.90 as determined in **DIVISION 1100**. Los Angeles Wear Abrasion, maximum 40%.
(d) Provide material that complies with **TABLE 1107-2**:

TABLE 1107-2: ELECTROCHEMICAL REQUIREMENTS (PANEL)	
Requirements	**Test Method**
Resistivity > 5000 ohm-cm	AASHTO T 288
pH > 5 < 10	AASHTO T 289

If the resistivity is less than 5000 ohm-cm, but greater than 3000 ohm-cm, the backfill material can be accepted if it complies with **TABLE 1107-3**:

TABLE 1107-3: ADDITIONAL ELECTROCHEMICAL REQUIREMENTS		
Property	**Requirements**	**Test Method**
Chlorides	< 100 parts per million	AASHTO T 291
Sulfates	< 200 parts per million	AASHTO T 290
Organic Content	< 1%	AASHTO T 267

(3) Product Control.
(a) Gradation.

TABLE 1107-4: AGGREGATES FOR PANEL MSE WALLS BACKFILL			
Sieve Size	**4"**	**No. 40**	**No. 200**
Percent Retained	0	40 - 100	95 - 100

(b) Coefficient of Uniformity. Provide material with a minimum coefficient of uniformity of 4 as defined by ASTM D 2487.

For select granular backfill material composed of crushed stone, submit a proposed project gradation with single-point gradations and tolerances for approval. For sand and sand-gravel combinations, a project gradation will be issued that will specify gradation tolerances after the proposed material is approved. Any quality assurance samples which fall outside the tolerances will necessitate re-approval to be in compliance with **subsection 1107.2 b.(2).**

c. MSE Walls: Modular Block with Soil Reinforcing Geogrid.

(1) Composition. Use granular backfill material in the structure volume of sand, sand-gravel, or crushed stone, reasonably free from organics or otherwise deleterious materials, and complies with the following:

(2) Quality. Submit representative material samples for the following tests to the Materials and Research Center, 2300 Van Buren, Topeka, KS 66611 (ATTENTION: Geotechnical Engineer) for acceptance prior to utilizing this material on the project.

(a) The Plasticity Index (P.I.) is 6 maximum, determined by KT-10.
(b) An angle of internal friction of 34 degrees or greater, as determined by the standard direct shear test – AASHTO T 236, utilizing a sample of the material compacted to 95% of AASHTO T 99 Methods C or D (with oversize correction, as outlined in Note 9 in AASHTO T 99) at optimum moisture content.
(c) Soundness. "Freeze and Thaw", minimum 0.90 as determined in **DIVISION 1100**. Los Angeles Wear Abrasion, maximum 40%.
(d) Provide material that complies with **TABLE 1107-5:**

TABLE 1107-5: ELECTROCHEMICAL REQUIREMENTS (Block)		
	Requirements	**Test Method**
(Mesa)	pH > 3 < 11	AASHTO T 289
(Anchor Landmark)	pH > 5 < 8	AASHTO T 289
	Organic Content < 1%	AASHTO T 267

(3) Product Control.

(a) Gradation.

TABLE 1107-6: AGGREGATES FOR MODULAR BLOCK MSE WALLS BACKFILL				
Type of Material	**% Retained – Square Mesh Sieves**			
	2”	**3/8”**	**No. 100**	**No. 200**
Sand	0-25		90-100	95-100
Crushed Stone	0-25	50-100		95-100

(b) Coefficient of Uniformity. Provide material with a minimum coefficient of uniformity of 4 as determined by ASTM D 2487.

For select granular backfill material composed of crushed stone, submit a proposed project gradation with single-point gradations and tolerances for approval. For sand and sand-gravel combinations, a project gradation will be issued that will specify gradation tolerances after the proposed material is approved. Any quality assurance samples which fall outside the tolerances will necessitate re-approval to be in compliance with **subsection 1107.2 c.(2)**.

d. Underdrain, Permeable or Granular Backfill.

(1) Composition. Provide washed crushed aggregate Type BD-1 and Type UD-1 composed of porphyry, sandstone, limestone or gravel.

(2) Quality.

- Soundness, minimum (KTMR-21) 0.90
- Wear, maximum (KTMR-24) 40%

(3) Product Control. Provide aggregate that complies with **TABLE 1107-7**

TABLE-1107-7: AGGREGATES FOR UNDERDRAIN AND OTHER PERMEABLE BACKFILL										
Type	**% Retained-Square Mesh Sieves***									
	1 ½”	**1”**	**¾”**	**3/8”**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**
BD-1**	0	0-10	10-40		80-100		90-100		93-100	98-100
UD-1			0	0-15		40-60		70-95		98-100

*The “washed screen” value is for the No. 100 sieve. (Follow KT-3, except use the No. 100 sieve instead of the No. 200 sieve.)

**BD-1 is intended for use with a filter fabric.

(2) Deleterious substances.

- Shale or shalelike material, maximum (KT-8) 3.0%
- Clay Lumps and friable particles, maximum (KT-7) 3.0%
- Sticks (wet), maximum (KT-35) 1.0%

e. Crushed Stone.

(1) Composition. Provide material produced by the crushing of any type of stone complying with the following.

(2) Quality.

- Soundness, minimum (KTMR-21) 0.70
- Wear, maximum (KTMR-25) 50%

(3) Product Control.

(a) Size Requirements. Provide uniformly graded crushed stone, from coarse to fine, for backfill that complies with **TABLE 1107-8**:

TABLE 1107-8: CRUSHED STONE BACKFILL			
Sieve Size	**2”**	**3/8”**	**No. 16**
Percent Retained	0	20 - 50	50 - 100

(b) Deleterious Substances.

- Clay lumps and friable particles, maximum (KT-7) 5.0%

1107.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1107.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1107.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5**.

SECTION 1108

AGGREGATES FOR COVER MATERIAL

1108.1 DESCRIPTION

This specification covers aggregates for cover material to be used for asphalt sealing of the type shown in the Contract Documents for each project.

1108.2 REQUIREMENTS

a. Composition. Provide sand-gravel, lightweight aggregate, crushed limestone, crushed sandstone, crushed or uncrushed gravel for cover material. Use expanded shale as lightweight aggregate.

b. Quality Requirements.

- Soundness, minimum (KTMR-21) 0.90
- Wear, Maximum (KTMR-25)
  - Sand-gravel, Gravel or Limestone 40%
  - Sandstone 45%
  - Lightweight aggregate 25%
- Absorption, maximum (KT-6, Procedure I) 4.0%

(All types except CM-L)

c. Product Control.

(1) Size Requirements. Use various size cover material that comply with **TABLE 1108-1**. Determine the gradation factor according to Part V, Section 17.07

(2) Deleterious Substances. Do not exceed the following deleterious substances by weight:

- Material Passing No.200 Sieve (KT-2)
  - Type CM-G 1.0%
  - Type CM-J 4.0%
  - All other types 2.0%
- Shale or Shale like material (KT-8) 1.5%
- Clay lumps and friable particles (KT-7) 1.5%
- Coal (AASHTO T-113) 0.5%
- Sticks (wet) (KT-35) 0.1%

TABLE 1108-1: GRADATION REQUIREMENTS FOR AGGREGATES FOR COVER MATERIAL

Type	Composition	Percent Retained-Square Mesh Sieves*						Minimum Gradation Factor
		¾"	½"	3/8"	No. 4	No. 8	No. 50	
CM-A	Sand-Gravel		0	0-20	30-100	85-100		
CM-B	Sand-Gravel		0	0-25		35-100	90-100	4.00
CM-C	Crushed Stone	0	0-12	40-100	95-100			
CM-D	Crushed Sandstone	0	0-5	15-35	70-100	95-100		
CM-G	Sand-Gravel, or Crushed Sandstone		0	0-15	45-100	95-100		
CM-H**	Crushed Stone	0	0-5		40-100	90-100		
CM-J**	Sand-Gravel	0	1-20			30-100	90-100	
CM-K	Crushed Limestone	0	0-5	15-35	70-100	95-100		
CM-L	Lightweight Aggregate	0	0-5	0-15	70-100	90-100		

*After removal of all deleterious substances.

**Do not specify Types CM-H and CM-J for Federal Aid projects.

Do not exceed any of the following combinations of deleterious substances as shown above:

- Type CM-G dustless 2.0%
- CM-J (SG) 6.0%
- All other 5.0%

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1108.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1108.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1108.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5.**

SECTION 1109

AGGREGATE FOR MICROSURFACING

1109.1 DESCRIPTION

This specification covers aggregates for use in microsurfacing operations.

1109.2 REQUIREMENTS

a. Composition. Provide aggregate for microsurfacing that is crushed gravel, crushed calcite cemented sandstone, or chat which is a material obtained from the mining of lead and zinc ores.

Produce crushed gravel by mechanical crushing of siliceous gravel and not containing more than 15% non-siliceous material.

b. Quality.

- Soundness, minimum (KTMR-21) 0.90
- Wear, maximum (KTMR-25) 40%

c. Product Control.

Provide material that complies with **TABLE 1109-1**:

TABLE 1109-1: GRADING REQUIREMENTS

Percent Retained - Square Mesh Sieves							
½"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 200
0	0-1	6-14	35-55	54-75	65-85	75-90	85-95

Additional Requirements for Crushed Gravel.

- Percent Crushed Particles (KT-31) (minimum) 98%*
- Uncompacted Void Content of Fine Aggregates (KT-50) (minimum) 46%
- Sand Equivalent (KT-55) (minimum) 65%

*Provide 98% of the crushed gravel with 2 or more fractured faces.

Deleterious Substances. Provide materials that are free from weeds, sticks, grass, roots and other undesirable foreign matter.

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1109.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1109.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1109.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5.**

SECTION 1110

AGGREGATES FOR SUBGRADE MODIFICATION OR RECONSTRUCTION

1110.1 DESCRIPTION

This specification covers the required types of aggregates for use in subgrade modification or reconstruction operations as shown in the Contract Documents.

1110.2 REQUIREMENTS

a. Composition. Provide one of the types of aggregate for subgrade modification or reconstruction as shown in **TABLE 1110-1.**

b. Quality[1].

- Soundness[2], minimum (KTMR-21) 50%
- Wear[3], maximum (KTMR-25) 0.85

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

c. Product Control.

(1) Size and Plasticity. Provide aggregate that complies with **TABLE 1110-1**. Determine the grading factor in accordance with the procedures listed in Part V, Section 5.17.07.

TABLE 1110-1: GRADING AND PLASTICITY REQUIREMENTS

Type	Material	Percent Retained-Square Mesh Sieves[1]							Plasticity Index[2]
		1 ½"	1"	¾"	3/8"	No. 4	No. 16	No 50	
SR-1	Crushed Stone	0	0-15			35-100		90-100	0-6
SR-3	Crushed Stone Screenings[3]	0			0-5				0-5
SR-4	Sand-Gravel[4]		0	0-5	0-20				0-6
SR-7	Sand-Gravel	0					5-50	85-100	0-6

[1]After removal of all deleterious substances.

[2]This requirement does not apply if there is more than 70% retained on the No. 30 sieve.

[3]Do not exceed 7% of moisture contained in the aggregate when delivered to the road.

[4]Grading Factor is between 4.00-5.00.

(2) Deleterious Substances. Do not exceed the following percentages of deleterious substances by weight:

For crushed stone and sand-gravel:

- Material passing No. 200 sieve (KT-2) 15.0
- Shale or shalelike material (KT-8) 3.0
- Clay lumps & friable material (KT-7) 3.0
- Sticks (wet) (KT-35) 1.0

For limestone or sandstone screenings:

- Material passing No. 200 sieve (KT-2) 15.0

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1110.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1110.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1110.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5**.

SECTION 1111 AGGREGATES

AGGREGATES FOR SURFACING OR RESURFACING

1111.1 DESCRIPTION

This specification covers the type of aggregate used for surfacing or resurfacing operations as shown in the Contract Documents.

1111.2 REQUIREMENTS

a. Composition. Provide one of the following types of aggregates for surfacing or resurfacing as shown in **TABLE 1111-1**.

b. Quality[1].

- Soundness[2], minimum (KTMR-21) 0.85
- Wear[3], maximum (KTMR-25) 45%

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

c. Product Control.

(1) Size Requirements. Provide aggregate that complies with **TABLE 1111-1**. Determine the fineness modulus in accordance with the procedures listed in Part V, Section 17.07.

TABLE 1111-1: GRADING REQUIREMENTS FOR AGGREGATES FOR SURFACING OR RESURFACING

Type	Material	Percent retained-square mesh sieve (Gradings after removal of deleterious substances)							Fineness Modulus
		1 ½"	1"	¾"	3/8"	No. 8	No. 30	No. 200	
SA-1	Sand-gravel		0	0-5	0-20			**	4.00 min.*
SA-2	Sand-gravel	0	1-15					**	5.00 min.
SA-6	Crushed Stone	0	0-5	5-25	45-100		95-100	**	
SA-7	Crushed Stone	0		25-50		85-100		**	
SA-X	Crushed Stone		0	0-5	35-65		95-100	**	

*For fineness modulus less than 4.00 but greater than 3.75, provide additional materials as a penalty at a rate of 1.5% for each 0.05 less than 4.00 fineness modulus. Use a maximum lot size of 500 cubic yards or tons to determine penalty. Average all tests within the lot to determine penalty.

(2) Deleterious Substances. Do not exceed the following percentages of deleterious substances by weight:

- Material passing No. 200 sieve (KT-2) 3.0**
- Clay lumps and friable particles (KT-7) 2.0**
- Sticks (wet) (KT-38) 2.0

**The total combination of clay lumps and friable particles and material passing the No. 200 sieve can be 7% provided the contractor furnishes an additional 1.5% material for each 1% that the total combination of the two is over the 5% limit

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1111.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1111**.

1111.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1111.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5**.

SECTION 1112

AGGREGATES FOR SURFACING OR SUBGRADE MODIFICATION FOR COUNTY SECONDARY ROADS

1112.1 DESCRIPTION

This specification covers types of aggregates used for surfacing or subgrade modification for county secondary roads as shown in the Contract Documents.

1112.2 REQUIREMENTS

a. Composition. Provide one of the types of aggregate for surfacing or subgrade modification for secondary roads as shown in **TABLE 1112-1 and 1112-2**.

b. Quality[1].

- Soundness[2], minimum (KTMR-21) 0.85
- Wear[3], maximum (KTMR-25) 55%

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

c. Product Control.

(1) Size Requirements. Provide aggregate that complies with **TABLE 1112-1**. Determine the gradation factor in accordance with the procedures listed in Part V, Section 5.17.07.

TABLE 1112-1: GRADATION REQUIREMENTS

Type	Material	Percent retained On standard square mesh sieves*								Gradation Factor
		2”	1 ½”	1”	¾”	3/8”	No. 4	No. 8	No. 30	
SS-3	Crushed Stone		0	0-15		45-85			90-100	
SS-5	Crushed Stone	0	0-5	0-30		45-90			90-100	
SS-7	Sand-gravel			0	0-5	0-20				4.00 - 5.00**
SS-8	Sand-gravel			0	0-5	0-30				3.75+
SS-9	Sand-gravel			0		0-20				3.50+
SS-10	Sand-gravel	0	0-5			0-30				3.25+
SS-14	Limestone gravel		0							

*After removal of all deleterious substances

**For grading factors less than 4.00 but greater than 3.75, provide additional materials as a penalty at a rate of 1.5% for each 0.05 less than 4.00 grading factors. Use a maximum lot size of 500 cubic yards or tons to determine penalty. Average all tests within the lot to determine penalty.

(2) Deleterious Substances. Do not exceed the values for each respective type as shown in **TABLE 1112-2**.

TABLE 1112-2: DELETERIOUS SUBSTANCES

Type	Material	Passing No. 200 Mesh sieve		Sticks (wet)	Clay Lumps & Friable Particles	Combination[3]
		Note 1	Note 2			
SS-3	Crushed Stone	8.0	15.0	2.0	5.0	5.0
SS-5	Crushed Stone	8.0	15.0	2.0	5.0	5.0
SS-7	Sand-gravel	3.0	10.0	2.0	5.0	5.0
SS-8	Sand-gravel	8.0	15.0	2.0	4.0	
SS-9	Sand-gravel	10.0	15.0	2.0	3.0	
SS-10	Sand-gravel	10.0	15.0	2.0	3.0	
SS-14	Limestone gravel	7.0	30.0			

[1]Without penalty.
[2]Allowable wash penalty. The total combination of clay lumps and friable particles and material passing the No. 200 sieve can equal the value in this column (2) provided the contractor furnishes an additional 1.5% material for each 1% that the total combination of the two is over the sum of the two individual limits (1) + (3).
[3]Of any deleterious substances except material passing No. 200 (2).

d. Stockpiling.

Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1112.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115.**

1112.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1112.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5**.

SECTION 1113

AGGREGATES FOR SHOULDER CONSTRUCTION

1113.1 DESCRIPTION

This specification covers types of aggregates for shoulder construction.

1113.2 REQUIREMENTS

a. Composition.

(1) Type AS-1 is a mixture of aggregate and binder with at least 85% the material produced by the mechanical crushing of limestone, dolomite or sandstone.

b. Quality[1].

- Soundness[2], minimum (KTMR-21) 0.85
- Wear[3], maximum (KTMR-25) 50%
- Specific Gravity[4] (dry), minimum (KT-6 Procedure I) 2.20

[1]Crushed aggregates with less than 10% material retained on the No. 4 sieve (excluding mineral filler supplements) must be produced from a source complying with the official quality requirements of this Section prior to crushing.

[2]The above requirements for soundness do not apply for aggregates having less than 10% material retained on the No. 4 sieve.

[3]The above requirements for wear do not apply to aggregates having less than 10% material retained on the No. 8 sieve.

[4]Apply the specific gravity requirement to individual materials and to any combination of materials required to meet the grading and plasticity requirements.

c. Product Control.

(1) Gradation and Plasticity. Provide aggregate that complies with **TABLE 1113-1**.

TABLE 1113-1: GRADING AND PLASTICITY REQUIREMENTS FOR AGGREGATES FOR SHOULDER CONSTRUCTION

Type	Percent Retained - Square Mesh Sieves								P.I.	L.L.[3] (Max)	Ratio[4] (Max)
	2"	1½"	¾"	3/8"	No. 4	No. 8	No. 40	No. 200			
AS-1	0	0-5	5-30		35-60	45-70	60-84	80-92	2-8[1] 4-8[2]	30	3/4

[1]Crushed Limestone or Dolomite

[2]Crushed Sandstone

[3]Liquid Limit

[4]Ratio of percent passing the No. 200 sieve to the percent passing the No. 40 sieve.

(2) Deleterious Substances. Provide aggregates for shoulder construction that are free from grass, weeds, roots, sticks, and other undesirable foreign matter.

d. Stockpiling. Stockpile and handle aggregates in such a manner to prevent detrimental degradation and segregation, the incorporation of appreciable amounts of foreign material, and the intermingling of stockpiled materials.

1113.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1113.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1113.5 BASIS OF ACCEPTANCE

Aggregates covered by this subsection are accepted based on the procedures described in **subsection 1101.5**.

SECTION 1114

STONE FOR RIPRAP, DITCH LINING AND OTHER MISCELLANEOUS USES

1114.1 DESCRIPTION

This specification covers stone for the following uses:

- Riprap
- Aggregate Ditch Lining (D_{50})
- Filter Course
- Flumes, Flume Drains and Slope Drains
- Tree Wells or Cribs
- Shot Rock
- Granular Drainage Blanket

1114.2 REQUIREMENTS

a. Stone for Riprap.

(1) Class. Provide the class for installation as specified in the Contract Documents.

(2) Quality.

- Specific Gravity (S.S.D.), min. (KT-6, Procedure I) 2.30
- Soundness, minimum (KTMR-21) 0.85
- Wear, maximum (KTMR-25) 45%

(3) Product Control.

- Deleterious Substances. Provide stone for riprap that is free from earth, soapstone, shale, shalelike or other easily disintegrated material that decrease the durability of the material after placement.
- Size. The class requirements are given in **TABLE 1114-1**.

TABLE 1114-1: STONE FOR RIPRAP*

Class	Percent Heavier Than										
	8 ton	4 ton	2 ton	1 ton	½ ton	¼ ton	250 lbs	200 lbs	100 lbs	75 lbs	5 lbs
Heavy Series											
8 Ton	50+	95+									
4 Ton	0	50+	95+								
2 Ton		0	50+	95+							
1 Ton			0	50+	95+						
½ Ton				0	50+	95+					
¼ Ton					0	50+				90+	
Light Series											
Facing								0		50+	90+
Light 24”						0		50+			90+
Light 18”							0		50+		90+

*Percent of total sample weight composed of pieces heavier than the indicated weight

b. Stone for Aggregate Ditch Lining (D_{50}).

(1) Type. Provide the size of ditch lining aggregate as specified in the Contract Documents.

(2) Quality.

- Specific Gravity (S.S.D.), min. (KT-6, Procedure I 2.40
- Soundness, minimum (KTMR-21) 0.85
- Wear, maximum (KTMR-25) 45%
- Absorption, maximum, (KT-6 Procedure I) 6.0%

(3) Product Control.

- Deleterious Substances. Provide stone for aggregate ditch lining that is free from earth, chert, cracks, seams, soapstone and shale or other easily disintegrated materials.
- Size. Provide D_{50} as listed in **TABLE 1114-2**.

TABLE 1114-2: STONE FOR AGGREGATE DITCH LINING (D_{50})

Size D_{50}	Max. Size	Percent Retained on Sieve Size (Minimum)										
Inch	Inch	8"	6 ½"	6"	5"	4"	3"	2 ½"	2"	1 ½"	1"	½"
1	2										50	85
2	4							15*	50		85	
3	6					15*	50			85		
4	8				15*	50			85			
5	10		15*		50			85				
6	12	15*		50			85					

*Suggested

c. Stone for Filter Course.

(1) Composition. Provide either singly or in combination, crushed stone or gravel for filter course material as specified in the Contract Documents.

(2) Quality.

- Specific Gravity (S.S.D.), min. (KT-6, Procedure I) 2.30
- Soundness, minimum (KTMR-21) 0.85
- Wear, maximum (KTMR-25) 45%

(3) Product Control.

- Size. Filter course material of Type I, Type II or Type III is listed in **TABLE 1114-3**.

TABLE 1114-3: STONE FOR FILTER COURSE

Material	Percent Retained on Sieve Size								
	6"	5"	4"	3"	2"	1"	½"	3/8"	No. 4
Type I		0	0-5		10-40	25-60		55-85	70-95
Type II			0	0-5			50-90		
Type III	0	5-25			40-60			75-95	

d. Stone for Flumes, Flume Drains and Slope Drains.

(1) Quality.

- Soundness, minimum (KTMR-21) 0.85

(2) Product Control.

- Deleterious Substances. Provide stone that is free from soapstone, shale, shalelike or other easily disintegrated material.
- Size Requirements. Provide stone for flumes, flume drains and slope drains as shown in the Contract Documents or as required by the Engineer.

e. Stone for Tree Wells or Cribs. Stone may be set aside during excavation on the project or obtained from nearby deposits. If stone is not available, use salvaged, durable concrete blocks from old structures or other materials approved by the Engineer.

f. Stone for Shot Rock.

(1) Quality.

- Soundness, minimum (KTMR-21) 0.85
- Wear, maximum (KTMR-25) 45%

(2) Product Control.

- Deleterious Substances. Provide stone for shot rock that is free from injurious quantities of clay and soapstone.
- Size. Shot rock shall be quarry run with no more than 10 percent larger than10 feet in circumference measured in any direction and not more than 10 percent passing the 1 inch sieve as determined by visual inspection. The maximum size of the shot rock will be limited by the thickness of the rock to be placed, as shown on the Contract Documents.

g. Granular Drainage Blanket

(1) Quality

- Soundness, minimum 0.85
- Wear, maximum 50%
- Absorption, maximum 4.0%
- Specific Gravity (dry), minimum (by KT-6 Proc. 1) 2.20

(2) Product Control.

- Deleterious Substances. Stone for these types of construction shall be free from soapstone, shale, shale-like or other easily disintegrated material.
- Size Requirements. Provide aggregate for granular drainage blankets that complies with **TABLE 1114-4**.

TABLE 1114-4: AGGREGATE FOR GRANULAR DRAINAGE BLANKETS		
Sieve Size	**4 in**	**No. 10**
Percent Retained	0	95-100

1114.3 TEST METHODS

Test aggregates according to the applicable provisions of **SECTION 1115**.

1114.4 PREQUALIFICATION

Prequalify aggregate sources according to **subsection 1101.4**.

1114.5 BASIS OF ACCEPTANCE

a. Aggregates covered by this subsection, except stone for tree wells and cribs, are accepted based on the procedures described in **subsection 1101.5**.

b. Stone for tree wells or cribs are acceptable based on visual inspection by the Engineer.

SECTION 1115

TEST METHODS FOR DIVISION 1100, AGGREGATES

1115.1 GENERAL TEST METHODS

KT tests are general procedures performed in the field and the central laboratory. They are included in Part V. Copies can be obtained by contacting the Plans and Proposals Section in the Bureau of Construction and Maintenance, the local DME, or the Quality Assurance Section at the Materials and Research Center. Check the special provision regarding test methods to ascertain the date of the latest revision.

TITLE	TEST METHOD
Sampling Aggregates	KT-1
Sieve Analysis of Aggregates	KT-2
Material Passing No. 200 Sieve by the Wash Method	KT-3
Percent Retained on the No. 200 Sieve by Dry Screening	KT-4
Unit Weight of Aggregate	KT-5
Specific Gravity and Absorption of Aggregate	KT-6
Clay Lumps and Friable Particles in Aggregate	KT-7
Shale or “Shalelike” Materials in Aggregate	KT-8
Plasticity Test	KT-10
Moisture Test	KT-11
Determination of Free Moisture or Absorption of Aggregate For Use in Concrete	KT-24
Determination of Percentage of Crushed Particles in Crushed Gravel	KT-31
Sieve Analysis of Extracted Aggregate	KT-34
Sticks in Aggregate	KT-35
Making, Curing and Testing Cement Treated and Unbound Bases In the Laboratory	KT-37
Moisture Contents of Asphalt Mixtures of Mineral Aggregates -Microwave Oven Method	KT-43
Uncompacted Void Content of Fine Aggregate	KT-50
Plastic Fines in Combined Aggregates by Use of the Sand Equivalent Test	KT-55
Flat and Elongated Particles in Coarse Material Test	KT-59

1115.2 MATERIALS AND RESEARCH CENTER TEST METHODS

KTMR tests are procedures found at the Materials and Research Center and are not expected to be performed in the field. Copies can be obtained by contacting the Quality Assurance Section in the Materials and Research Center.

TITLE	MR TEST METHOD
Permeability for Base Course Material	KTMR-5
Soundness and Modified Soundness of Aggregates by Freezing and Thawing	KTMR-21
Durable Aggregate Test	KTMR-22
Wetting and Drying Test of Sand-Gravel Aggregate for Concrete	KTMR-23
Procedures for Testing Lightweight Aggregates	KTMR-24
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	KTMR-25
Test Method for Compressive Strength of Hydraulic Cement Mortars Using 2 inch Cube Specimens	KTMR-26
Modified Specific Gravity and Absorption of Aggregate	KTMR-27
Determination of Total Acid Insoluble Residue	KTMR-28

1115.3 AASHTO TEST METHODS

In addition to the test methods referenced above, the following American Association of State Highway and Transportation Officials (AASHTO) test methods are used as written in the current edition of the AASHTO Materials Manual, Part II. Copies can be obtained from AASHTO, or can be viewed at the offices of the local DME, Materials and Research Headquarters, or the Quality Assurance Section in the Materials and Research Center.

TITLE	AASHTO TEST METHOD
Organic Impurities	AASHTO T 21
Coal and Lignite in Sand	AASHTO T 113