

## Qualified Aggregate Technician

Kentucky Specifications



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## Aggregate Specifications

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- State, FHWA, FAA, Contractor
- Kentucky Transportation Cabinet

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## Aggregate Size Designations

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- **Nominal Maximum Size**
  - The largest sieve on the gradation table for an aggregate size on which any material may be retained
- **Maximum Size**
  - The largest sieve size through which all material must pass

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## Aggregate Source Approval

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- Provide fine aggregates from the Aggregate Source List
- For approval provide:
  - 1) A Quality Control Plan
  - 2) A satisfactory laboratory facility
  - 3) A Qualified Aggregate Technician
- To supply sand **only** for asphalt mixtures--1,2 and 3 will be waived.

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## Non-Approved Sources

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- Coarse aggregates are subject to preliminary source approval
  - Obtain the Department's approval before furnishing aggregates from sources not on the Aggregate Source List
  - The Department will sample during stockpiling, and test according to KY Manual of Field Testing and Sampling Practices
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## Material May Be Rejected By Department When:

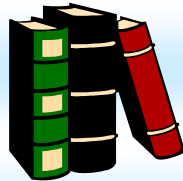
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- Excessive gradation variations exist
  - Aggregate physical properties cause:
    - unworkable mixtures
    - mixture control problems
    - nonconformance to finished product or mixture requirements
  - Contaminated
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## Kentucky Standard Specifications

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- Section 804--Fine Aggregates
- Section 805--Coarse Aggregates



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## Fine Aggregates Section 804

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- Conglomerate sand– Natural material, processed without crushing. May include some crushed natural material
- Mortar Sand– Natural, crushed, or conglomerate sand—cement mortar
- Natural Sand--natural disintegration
- Crushed Sand--Fine granular material--from crushing stone or gravel. Includes slag where permitted
- Mineral filler– crusher fines, cement, fly ash

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## **Fine Aggregate Definition ASTM C-125**

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- FINE AGGREGATE - passing the 3/8-in. sieve, almost entirely passing the No. 4 sieve, and predominately retained on the No. 200 sieve
  
  - COARSE AGGREGATE - The portion of aggregate predominately retained on the No. 4 sieve
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## **Coarse Aggregate Section 805**

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- Crushed stone and crushed or uncrushed gravel
  
  - Includes lightweight aggregates or slag where permitted
  
  - Department's List of Approved Materials
  
  - Aggregate Source List
  
  - Class A and Class B Polish Resistant Aggregate Sources
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## Coarse Aggregate Definition ASTM C-125

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- AGGREGATE - predominately retained on the No. 4 sieve
- ASPHALT - The portion of aggregate retained on the No. 4 sieve

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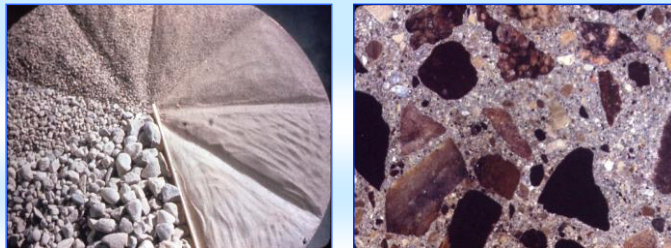
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## Aggregate Applications in Concrete



## **Aggregate Applications in Concrete**

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Section 804.03 - Fine Aggregate  
Concrete Applications

Section 805.04 - Coarse Aggregate  
Concrete Applications

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## **Fine Aggregate for Concrete 804.03**

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- Department will allow any combination of natural, crushed, or conglomerate sand when the combination is achieved in the concrete plant weigh hopper
  - Combined sand must meet the minimum requirements for use in concrete
- Wearing surfaces for vehicular traffic:
  - Use natural or conglomerate sand
- Engineer may allow other sands

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**Fine Aggregate for Concrete  
804.03**

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• Conform to:

- 1) Sand Equivalent – 80 (min)
- 2) Soundness --10% loss (max)
- 3) Friable Particles --3.0% (max)
- 4) Coal plus Lignite -- 0.50% (max)
- 5) Uncompacted Voids (FAA) -- 47% (max)
- 6) Organic Impurities -- Not darker than standard

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**Fine Aggregate for Concrete  
804.03**

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• Conform to (cont.):

- 7) Mortar Strength--95% at 7 days (min)
- 8) Gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
No. 4	90-100
No. 16	45-85
No. 50	5-25
No. 100	0-8

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## WHY?

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- **Coal plus Lignite**
  - Air Entraining Agent
  - Surface Staining and Popouts
- **Mortar Strength**
  - Verifies fine aggregate and cement combination
- **Organic Impurities**
  - Strength gain
  - Air Entraining agent
- **Gradation**
  - Workability of concrete mixture
  - #16, #30, and #50 screens affect air entraining agents effectiveness

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## Acceptable Coarse Aggregates for Concrete Applications

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- Crushed Stone
- Crushed or Uncrushed Gravel
- Includes Lightweight Aggregates and Slag (where permitted)

**Coarse Aggregate  
Requirements for Concrete  
805.04**

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- General (section 805.03)
- Physical properties (Section 805.03.02)
- Specifications (Section 805.04)

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**General Requirements  
Section 805.03**

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- Provide coarse aggregates that are free of objectionable amounts of clay lumps, dirt coatings, and foreign material
- Soundness and Shale
  - Portland Cement Concrete Mixtures
  - Asphalt Mixtures
  - Other Uses



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## Physical Properties Section 805.03.02

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- Wear (except slag and sandstone) 40% max
- Wear (sandstone) 50% max
- Wear (slag) 60% max
  - Note "Wear" refers to L.A. Abrasion
- Friable particles 1.0% max
- Unit weight (slag) 70 lbs/ft<sup>3</sup> min

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## Blending Section 805.03.03

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- Must be done with precise procedures, e.g. cold feeds, belts, weigh hopper or equivalent

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**Coarse Aggregate for Concrete**  
**Section 805.04**

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- Provide aggregates from the Aggregate Source List
- Sources not on the Aggregate Source List must be sampled and tested by the Department prior to use
- Must use material from approved ledges and benches as listed on the Concrete Restriction List maintained by the Department.

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**Minus #200 is Critical**

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- Indicates workability
- High -#200 more water demand
- High -#200 more air entrainment required

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## Coarse Aggregate for Concrete Section 805.04

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<u>Conform:</u>	<u>Max % By Wt.</u>
– Friable Particles	1.0
– Finer than No. 200	2.0
– Coal and Lignite	0.5
– Lightweight particles (Gravel)	4.0
• (Sp. Gr. Less than 2.40)	
– Lightweight particles (Limestone)	1.0
• (Sp. Gr. Less than 2.40)	

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## General Concrete Use Section 805.04

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- Must pass the Carbonate Alkali Expansion Test (KM 64-629) - Test takes a minimum of 6 months to complete
- OK if less than 20% of total lift footage (bench) is potentially alkali-carbonate reactive as determined from Petrographic Investigation

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**JPC Base, JPC Pavement, JPC Shoulders  
and Concrete for Bridge Decks**  
Section 805.04

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- Must pass the Carbonate Alkali Expansion Test -(KM 64-629)
  - 20% maximum of lift footage as determined by Petrographic examination (see previous slide)
- Must pass Freeze Thaw Testing - (KM 64-626).
  - Up to 3 months to complete test
  - Contractor to provide Certification of Compliance-
    - \* See page 221 of this manual with Section 805.04.01

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**JPC Base, JPC Pavement, JPC Shoulders,  
and Concrete for Bridge Decks**  
Section 805.04

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- Must pass Petrographic Examination
- OR
- Must pass Carbonate-Alkali Beam test (KM 64-629)
  - Must pass Freeze/Thaw testing (KM64-626)
  - Expansion **0.06%** max.

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## Potential Alkali Reactivity

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- ASTM C-33 Appendix indicates some methods for evaluating potentially reactive coarse and fine aggregates
- A petrographic examination of hand samples is very helpful in determining if materials are present which are known to be reactive with cements

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## Alkali Reactivity Example

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- The problem with a reactive aggregate is that sometimes it may take several years for the problem to become visible.



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## Concrete Mix Design

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- Aggregate Grading
- Aggregate Specific Gravity
- Water content
- Cementitious content
- Curing
- Admixtures
- Aggregate shape
- Air content



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### Mix Design Data: Specific Gravity (SSD) and Absorption

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- While all testing is important, these two tests have the most dramatic impact on the manufacturing, placement and acceptance of concrete products
- As such, the testing methods **must** be strictly adhered to for uniformity and consistency of results

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## Absorption

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- Free moisture = Total Moisture - Absorption
- Critical for accurate water / cement ratio which will affect various concrete properties, including strength and durability

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## Summary Concrete Aggregate

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- Section 804.03 - Fine Aggregate Concrete Applications
- Section 805.04 - Coarse Aggregate Concrete Applications

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## Aggregate Applications in Asphalt Mixtures



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## Aggregate Applications in Asphalt

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Division 400 - Asphalt Pavements

Section 804.04 - Fine Aggregate for  
Asphalt Mixtures

Section 805.05 - Coarse Aggregate for  
Asphalt Mixtures

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## Mixture Designations 403.03.03

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- Polish-Resistant Aggregate Requirements

**Type A**

- 100% Class A Coarse / 20% Class A Fine (total combined)

**Type B**

- 100% Class B Coarse or 50% Class A Coarse / 20 % Class A Fine or 30% Class B Fine or 30% Class A & B Fine (total combined)

**Type D**

- No Restrictions – but must be on the List of Approved Materials

Note: Type C has been eliminated

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## Polish-Resistant Fine Aggregate 804.04.03

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- Provide fine aggregate from a Class A Polish-Resistant Aggregate Source
- Natural sand, conglomerate sand, and crushed gravel sand are always considered Polish-Resistant
- Contractor to provide Certificate of Compliance- see page 212 of this manual with 804.04.03

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**Polish Resistant  
Coarse Aggregate  
805.05.05**

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- Provide coarse aggregate from a Class A or Class B Polish-Resistant Aggregate Source
- Requirements are based on the mixture designation of aggregate type
- Contractor to provide Certificate of Compliance- see page 222 of this manual with 805.05.05

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**Aggregates**

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- Five mixture types--nominal max. size
  - 9.5 mm (3/8")
  - 12.5 mm(1/2")
  - 19 mm (3/4")
  - 25 mm (1")
  - 37.5 mm (1.5")

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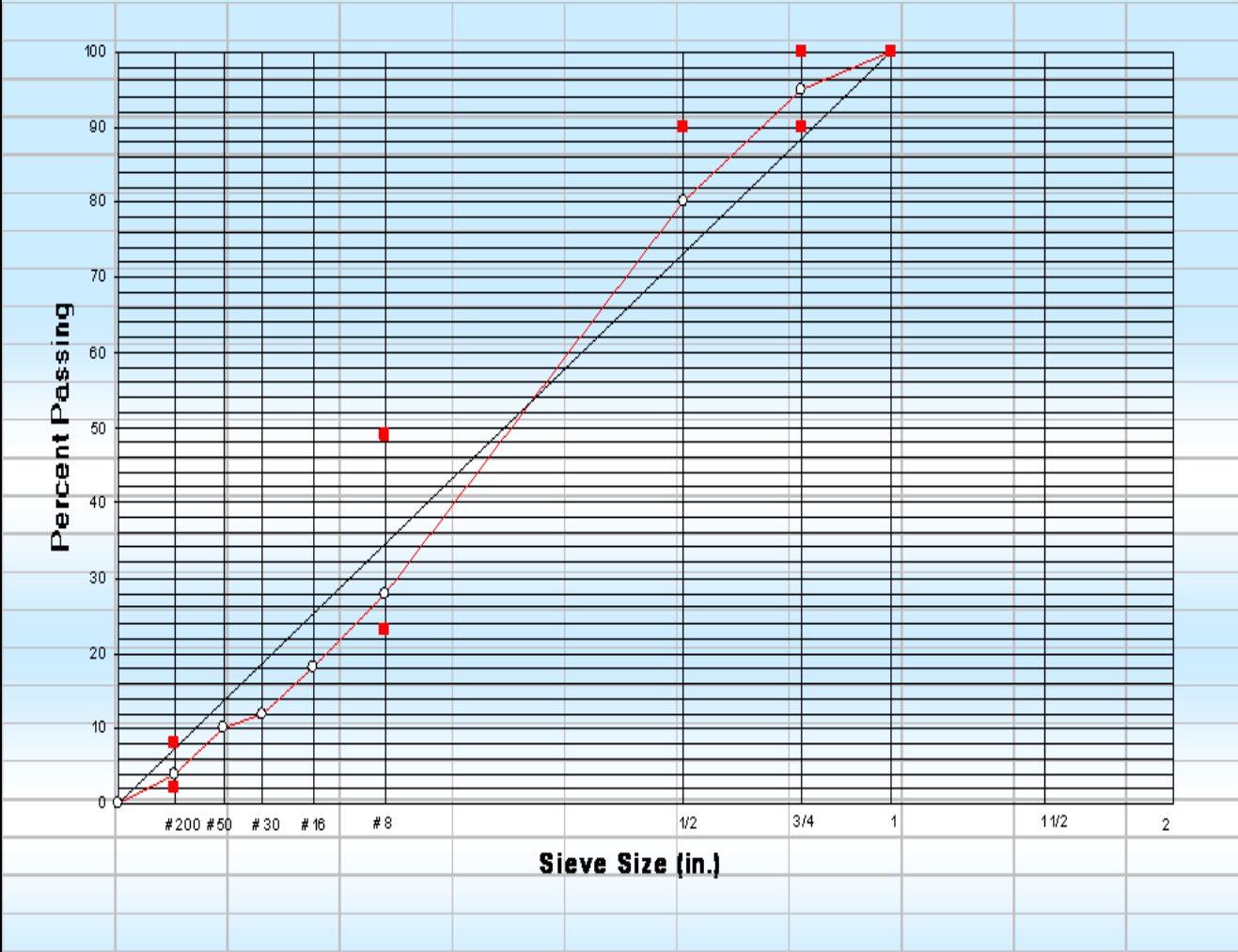
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# Superpave Gradations







**Requirements for Superpave Fine Aggregates  
804.04.04**

ESAL Class	Design ESALs (millions)	Uncompacted Voids Minimum (Method A) (Depth from Surface)		Sand Equivalent Minimum
		≤ 100mm	> 100mm	
1	< 0.3	40	40	45
2	0.3 to < 3	40	40	45
3	3 to < 30	45	40	45
4	≥ 30	45	45	50

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**Asphalt Mixtures  
804.04**

- Provide natural, crushed, conglomerate, and slag sand to meet gradation requirements
- Department will allow any combination of these sands to achieve cold feeds at the plant

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## Seal Coats Section 805.05.04

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- No more than 3.0% passing No. 200 sieve



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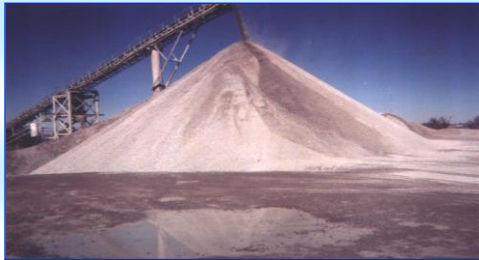
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## Other Specifications...



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**Dense Graded Aggregate  
and Crushed Stone Base  
Section 805.06**

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- Sand Equivalent 30 or greater
- Plasticity Index (PI) of 4 or less



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**Bedding, Backfill, Underdrains,  
Drainage, Granular Embankment, and Fill  
Material**

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- Listed in Section 805
- Gradations
- Shale
- Friable Particles
- Minus 200 content

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**Other Specifications  
Section 805.13**

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- Slope Protection
- Cyclopean Stone Riprap
- Channel Lining
  - Class IV - excavated material

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**Aggregate Surfacing, Traffic-Bound  
Base, and Maintenance  
Section 805.14**

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- Use #57's, #610's, #710's or DGA
- Meet Gradation requirements in table
- Minus 200 content -- 12% maximum,  
except for DGA

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## Size and Use Tables

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- **Aggregate size chart** Spec book pg. 805-15  
Manual pg 218
- **Aggregate size use table** S book pg. 805-16  
Manual pg 234
- **Test Methods used** Spec book pg. 805-16  
Manual pg 234

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## Summary

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- Specifications
- Kentucky Standard Specifications
- Section 804, Fine Aggregate
- Section 805, Coarse Aggregates
- Aggregates for Asphalt and Concrete

