

PA State Conservation Commission

Driving Surface Aggregate Standard and Specification

- I. **Definition** - This document is for the purchase and placement of Driving Surface Aggregate (DSA) for the Pennsylvania State Conservation Commission's Dirt, Gravel, and Low Volume Road Maintenance Program (DGLVRMP). DSA is an aggregate mixture of crushed stone designed specifically as a surface-wearing course for unpaved roads. DSA provides a durable road surface with longer maintenance cycles than conventional road surface aggregates.
- II. **Use** - For the purposes of funding under the DGLVRMP, DSA must be used in areas where it will have an environmental benefit (reduced erosion, reduced runoff). DSA shall only be placed after drainage and subgrade issues have been addressed by utilizing practices that promote Environmentally Sensitive Maintenance. DSA was originally designed to reduce erosion and runoff on road segments close to streams where drainage improvements were limited. Surface aggregate is not required on every project.
- III. **Material** - DSA to be used on DGLVRMP projects shall be tested prior to delivery by an independent lab that has no affiliation with the source quarry. Samples tested using DGLVR funds must be performed by a lab that is certified by AASHTO, USACE, or PennDOT. Samples shall be obtained by Conservation District (CD) staff, Center for Dirt and Gravel Road Studies (CDGRS) staff, or otherwise approved by the SCC. Material must meet the following requirements:

Gradation: The required sieve sizes and allowed ranges, determined by weight, for DSA components are shown in Table 1. Submit actual sieve passing values to one decimal. Values will not be rounded to whole numbers.

Sieve Size	Percent Passing
1.5"	100
0.75"	65 – 97
#4	30 – 65
#16	15 – 32
#200*	11 – 15

*If the Plasticity Index for the material is 2 or below, then the #200 sieve is permitted to be 11-17% passing.

Table 1 – DSA Gradations

- A. **Abrasion Resistance:** The loss of mass (LA Abrasion) shall be less than 45%. Determine the resistance to abrasion using the Los Angeles Abrasion test, ASTM C131.
- B. **pH:** Aggregate shall be in the range of pH 6 to pH 12.45 as measured by ASTM D4972.
- C. **Moisture:** Upon delivery to the site, material shall be well mixed and placed at optimum moisture content or up to 2% below that value as determined for that particular source. The optimum percentage moisture is to be determined using Proctor Test ASTM D698, Procedure C, Standard. Aggregate provider is encouraged to perform moisture testing prior to loading

material for delivery.

- D. **Plasticity:** Material shall not exceed a Plasticity Index (PI) of 4. The laboratory test required for these results is ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. If Plasticity Index for material is 2 or below, the #200 sieve is permitted to be 11-17% passing.
- E. **Soundness:** Determine the percentage of mass (weight) loss of each fraction of the coarse aggregate after five cycles of immersion and drying using a sodium sulfate solution according to PTM No. 510. The maximum weighted percent loss allowed is 20%.
- F. **Aggregate:** All DSA shall be derived from natural rock formations that meet program specification for abrasion resistance, pH and freedom from contaminants.
- G. **Fines:** If fines need to be added to the aggregate to meet DSA gradation requirements, the added material passing the #200 sieve must be derived from rock material that conforms to program specifications. No mineral clay or silt soil may be added. The amount of particles passing the #200 sieve shall be determined using the washing procedures specified in PTM No. 100.
- H. **Mixing:** DSA shall be properly mixed and at the proper moisture content before it is loaded onto the transport vehicles.

iv. **Delivery and Placement**

- A. **Preparation of Subgrade:** Unsatisfactory drainage and subgrade conditions shall be corrected prior to placement by scarifying, reshaping, and re-compacting, or by replacing or importing subgrade/sub-base. The subgrade/subbase shall be crowned or side-sloped to $\frac{1}{2}$ to $\frac{3}{4}$ inch per foot (4%-6% slope). Beginning and ending of DSA placements shall include a paving notch across the width of the subgrade. The paving notch shall have a minimum depth equal to the compacted DSA placement, and a sufficient length to facilitate transition into existing road surface, or a minimum of 4' in length.
- B. **Transport:** Tarps shall be used to cover 100% of the load's exposed surface from the time of loading until immediately before placement.
- C. **Certification:** A properly executed SCC DSA Certification Form shall be provided at the time of initial delivery and subsequent certification forms shall be provided if quarry conditions change. This Certification Form is to apply to the specific stockpile of DSA material being delivered from the source. The form certifies that the DSA material meets all of the specifications and requirements.
- D. **Placement:** The use of a motorized paver is highly recommended for all DSA placements. For projects and/or contracts including over 500 tons of DSA, a motorized paver is required. Paver must be in good working order and be of sufficient horsepower to be capable of pushing loaded trucks uphill while placing material in a full width pass at the required minimum depth stipulated in the contract. If the total tonnage is less than 500 tons, the DSA must be paver placed or placed by tailgating and groomed with a road grader equipped with a carbide-tipped grader blade. A track mounted paver is preferred. DSA shall be placed in a single pass across

the width of the road. The crown or cross slope must range from $\frac{1}{2}$ to $\frac{3}{4}$ inch per foot (4-6%). Material shall be placed in a single 6-8 inch loose lift or layer. This lift is to be compacted with a vibratory roller as specified in Section V - Compaction. If freezing temperatures or precipitation are forecast that may cause the material to freeze, or prevent the material from drying out, placement shall be postponed at the discretion of the road owner, Conservation District, or aggregate supplier. DSA shall not be placed before April 1st or after September 30th unless otherwise approved by the SCC.

v. **Compaction**

- A. **Vibratory Roller:** After placement, the material shall be compacted using a minimum ten-ton vibratory roller. DSA shall be compacted to a minimum of 95% of the dry-mass (dry-weight) density according to ASTM D698, Procedure C, Standard as determined by pre-sampling (refer to Materials, Section III.D). The road owner, or its designated representative, reserves the right to determine the in-place moisture and density according to ASTM D6938.

vi. **Maintenance** - Properly placed and compacted DSA provides a durable road surface with longer maintenance cycles than traditional aggregates, but it is not maintenance free. Refer to the Center for Dirt and Gravel Roads "Driving Surface Aggregate Handbook" for additional guidance on DSA maintenance.

vii. **References:**

- A. State Conservation Commission Driving Surface Aggregate Certification Form.
http://www.dirtandgravel.psu.edu/sites/default/files/General%20Resources/DSA/SCC_DSA_Spec_2014.pdf
- B. Penn State Center for Dirt and Gravel Road Studies "Driving Surface Aggregate Handbook"
<http://www.dirtandgravel.psu.edu/general-resources/driving-surface-aggregate-dsa>
- C. ASTM C131 [AASHTO T96] - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
<http://www.astm.org/Standards/C131>
- D. ASTM D4972 - Standard Test Method for pH of Soils. <http://www.astm.org/Standards/D4972>
- E. ASTM D698, Procedure C, Standard [AASHTO T99] – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
<http://www.astm.org/Standards/D698>
- F. ASTM D4318 [AASHTO T89/90] – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
<http://www.astm.org/Standards/D4318>
- G. Pennsylvania Test Method No. 100. - Method of Test for amount of material finer than 75 µm (no. 200) sieve in aggregate.
http://www.dot.state.pa.us/public/pdf/BOCM_MTD_LAB/PUBLICATIONS/PUB_19/PTM-100.pdf
- H. Pennsylvania Test Method No. 510 – Method of Test for soundness of aggregate by use of sodium sulfate.
http://www.dot.state.pa.us/public/pdf/BOCM_MTD_LAB/PUBLICATIONS/PUB_19/PTM-510.pdf
- I. ASTM D6938 [AASHTO T310] – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
<http://www.astm.org/Standards/D6938>