

Black Text SCC approved 3/13/2018 – Red Text proposed changes 7/22/2020

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 done 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:

- o **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 – 95-97
#4	30 – 65
#16	15 – 30
#200*	10 – 15*

Table 1 – DSA Gradations

* If Plasticity Index for material is 2 or below, the #200 sieve is permitted to be 10-17% passing

- A. **Abrasion Resistance:** The loss of mass (LA Abrasion) shall be less than 40%. 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

Commented [SB21]: •Reasons:
 •Without a certification, anyone could call themselves a lab and perform tests. CDGRS uses only certified labs currently. This change ensures any testing funded by the Program is done by a properly certified lab.
•Impacts to production: none, just a clarification
•Impacts to quality: none, just a clarification

Commented [SB22]: •Reasons:
 •There is currently no guidance on the rounding of percent passing measurements. Some entities round, for example a 9.5% passing would round to a 10 and meet the spec for fines. This provides clarification that we want numbers including the decimal point, and we will not round up or down to a whole number (have always done it this way, just was not specified in spec).
•Impacts to production: none, just a clarification
•Impacts to quality: none, just a clarification

Commented [SB23]: •Reasons:
 •Many producers bump up against the higher limit on this sieve. This change makes it easier for producers to hit spec without changing screens from those used in 2A production. This makes it less of a specialty product and easier to produce.
 •Note: can't increase this to 100% passing, or it could make aggregate too small (with ¾" top size), and it may also cause smaller sieves to go out of spec.
•Impacts to production: makes DSA easier to produce
•Impacts to quality: negligible

Commented [SB24]: •Reasons:
 •DSA specification originally allowed 10-18% fines, but with no plasticity limit. This caused many problems with aggregate being full of clay and soft. The #200 spec was reduced to 10-15% due to these issues. Since that time, a maximum plasticity has been added to the DSA specification. Since the plasticity specification now limits the clay content, aggregates with 15-17% passing the #200 sieve are no longer an issue.
•Impacts to production: makes DSA easier to produce
•Impacts to quality: negligible since clay is limited by plasticity spec

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 6-4. 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 10-17% 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.

Commented [SB25]: •Reasons:

- A PennDOT study conducted in 2013 concluded that the PI of DSA should be 4 or less to control rutting seen with higher plasticity.
- Over the past 6 years since a plasticity limit was introduced, producers are consistently paying more attention to PI and making more non-plastic aggregate. Of the 285 DSA samples testing by the CDGRS from 2017 through 2019, only two returned with a PI higher than 4.
- Impacts to production:** negligible since most producers are now producing aggregate with low PI as illustrated by test results above.
- Impacts to quality:** will improve overall quality by further limiting clay content for new sources

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 sidesloped to ½ to ¾ 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 1,000 tons of DSA, a motorized paver is required. A track mounted paver is preferred. DSA placements ~~should~~ **shall** be placed in a single pass across the width of the road. The crown or cross slope must range from ½ to ¾ 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

Commented [SB26]: Previously proposed in March and already went out to CDs for comment

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.**

Commented [SB27]: Previously proposed in March and already went out to CDs for comment

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>