

Aggregate – A mixture of crushed rock or gravel separable by mechanical means. Focus on road applications.



Aggregate from sedimentary rock in SW PA

Source (Geologic Origin) – Most PA aggregates are mined from sedimentary rock such as limestone and sandstone. In the glaciated regions of NW and NE PA, aggregate is often mined glacial till, or pit-run gravel. In general, limestone is the hardest of the rocks, with shale being the softest, while pit-run varies widely in its usefulness as a road aggregate.

Gradation – The distribution by percent of weight of different sized stones comprising an aggregate. Determined by sieve separation and the loss by washing of material finer than the No. 200 sieve (~0.003 inches).



Aggregate sieves

| AASHTO Number | Total Percent Passing | | | | | | | | | | | | | |
|---------------|-----------------------|----------------|----------------|------------|------------------|--------------|----------------|----------------|---------------|-----------------|-----------------|------------------|------------------|---------------------|
| | 100 mm (4") | 90 mm (3 1/2") | 63 mm (2 1/2") | 50 mm (2") | 37.5 mm (1 1/2") | 25.0 mm (1") | 19.0 mm (3/4") | 12.5 mm (1/2") | 9.5 mm (3/8") | 4.75 mm (No. 4) | 2.36 mm (No. 8) | 1.18 mm (No. 16) | 150 μm (No. 100) | 75 μm (No. 200) *** |
| 1 | 100 | 90-100 | 25-60 | | 0-15 | | 0-5 | | | | | | | |

Aggregate specifications have an allowable range of different stone sizes, expressed as a percentage of the total weight of sample. This **gradation specification** is reported on a table or chart (see example above). The *nominal* maximum size of an aggregate specification is defined as the smallest sieve opening through which 100% of the aggregate can pass.



Open-graded

Open graded aggregates are “porous” with notable air voids between individual stones, and little to no “fines”. These mixtures drain effectively, but do not compact well to form a dense conglomerate. Road applications include use as base material and for subsurface drainage.



Well-graded

Well graded aggregates are “dense” with few air voids between individual stones. These mixtures are not suitable for drainage, but are preferred for use as surface aggregates as they tend to compact well to maintain desired road shape, lengthening grading cycles. This is also a key component in extending the road life cycle for traffic support.

Aggregate Quality or Type is primarily based on the resistance to weathering (soundness), the resistance to traffic (abrasion) and the absence of extraneous undesirable material. For both soundness and abrasion the maximum allowable amount is expressed as a percentage (by weight) of material changed by specific tests. For undesirable material the maximum allowable amount is expressed as a percentage (by weight) of the total weight of the mixture. For these parameters a maximum allowable percentage is set for each aggregate Type (A,B & C). Lower numbers represent higher quality. Lower quality aggregates should be reserved for fill and sub-base applications only.

| PennDOT | Type A | Type B | Type C |
|--------------------|--------|--------|--------|
| Soundness, Max % | 10 | 12 | 20 |
| Abrasion, Max % | 40 | 45 | 55 |
| Undesirable, Max % | 2 | 2 | 15 |



PI, or Plasticity Index is a measure of the plasticity of a soil. *Soils with a high PI tend to be clay.* Ideally, surface aggregates should be non-plastic to slightly plastic with a PI of 6 or lower.

