

Benefits of Testing Aggregate

Aggregates are used in construction to give asphalt and concrete mass and strength. Aggregates are found naturally in the Earth as sand, gravel, or clay.

All aggregates are different. Gravel is coarse (larger) aggregate and clay and silt are fine (small) aggregates. Test aggregate to determine the quality of material. Doing a simple visual test is inadequate. Aggregate quality is based on gradation, fines content, and plasticity. Select good quality aggregates to improve construction materials and reduce maintenance.

This article includes information on:

- the benefits of testing aggregates,
- which material to accept and reject, and
- tips when working with contractors.

Sampling

Work with an experienced sampler to ensure material brought to the lab is representative of the entire batch. Poor sampling techniques can lead to inaccurate test results.

Gradation

Test aggregates for gradation. A gradation test measures the size distribution, or amount of coarse and fine aggregates in a sample. Use a sieve analysis to test gradation. Stack mesh screens, or sieves, in order by size. Place the largest mesh sieve at the top and the smallest mesh sieve at the bottom. Then, pass the aggregate through the sieves from top to bottom so that large (coarse) aggregates will be retained on the top sieves and small (fine) aggregates will be retained on the bottom sieves.

The correct gradation depends on the intended use of the aggregates. *Table 1* (p.6) provides two examples of requirements for specific purposes.



Top: A USA Standard Testing Sieve No. 200.



On Left: A USA Standard Testing Sieve. The opening in millimeters and in inches is listed on each sieve.

Fines

Fines are the small particles in an aggregate that bind larger particles together. Fines shrink and swell as their water content changes. Fines are hard when dry and soft when wet. In wet weather, the surface may rut but it will quickly dry and harden in sunny and windy weather.

Test to determine the fines content. Lab tests will show the percent of fines and if they are clays or silts. Clays are preferred because they provide a better binding action than silt.

Use fine aggregate (i.e. silt) for the surface to provide a smooth driving surface and ensure ability to bind with gravel. A good surfacing gradation requires more materials passing through a #200 sieve than the base course.

Use aggregate with only 1-10% fines in the base. Too many fines will cause the base to lose strength and stability during wet weather. The result is rutting (grooves in the gravel) or pavement failure.

Plasticity

Plasticity is the likelihood that a particular aggregate will deform, or permanently change shape. The plasticity index (PI) is a measure of the plasticity of an aggregate. Clays have high plasticity and

silts have low plasticity. This is why clays provide a better binding action. Soils lacking silts and clays will have a PI of 0.

It is impossible to determine plasticity without testing. Use a laboratory test to determine whether the fines are clays or silts. As with gradation, the required PI depends on the intended use. *Table 1 (below)* shows required PIs for a typical aggregate base course and a typical gravel surface.

Table 1: Examples of Gradation and Plasticity requirements for Two Gradations

Specification Requirements	Typical Aggregate Base Course	Typical Gravel Surface
1 inch	100	
3/4 inch	80-100	100
1/2 inch	68-91	
No. 4	46-70	50-78
No. 8	34-54	37-67
No. 40	13-35	13-35
No. 200	3-12	4-15
PI	0-6	4-12

Specification Differences

Use larger aggregate to increase the strength in asphalt paving mixes. Use smaller aggregates when chip sealing. Larger stones are difficult to retain in liquid asphalt and cause windshield damage, excess tire noise and are often dislodged by snow plows.

Quality Control

Approximately 94 percent (by weight) of hot mix is aggregate. The remaining 6 percent is asphalt cement. Ensure the asphalt is the right type and mixed correctly. Use good quality aggregate for the base course to prevent pavement failures. Use good quality gravel for the road surface to avoid problems with washboarding, rutting, or loosening in dry weather.

Cost Benefit

Testing may seem expensive, but it is necessary to minimize future expenses. Always test when large batches of aggregates are necessary to reduce future maintenance and to produce a quality finished product.

Working with Contractors

Look up specifications for gradation, fine content, and plasticity index before getting the needed material. Inform the crushing contractor of the specifications. Test the aggregate, and if it fails, work with the crushing contractor to solve the issue. Do not accept material that does not pass specifications. It is up to the crushing contractor to provide exactly what is specified. However, it is up to you to ensure you get exactly what you need.

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www.t2.unh.edu/StreetWise/streetwise_0601.pdf, accessed May 11, 2008

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