ASPHALT PLANT

LEVEL 1

Module 8: Mechanical Analysis of Extracted Aggregate
FM 1-T 030

Specification Year: January 2015
This is the last test that is covered in Asphalt Plant 1. Often called a gradation test, there are a series of steps to follow to properly determine the gradation (particle size distribution) of the aggregate.
CTQP Training Videos
The test method starts with an oven-dried sample like the one we obtained with the ignition oven test in the last module. We want to ensure that we do not lose any particles during this process. That includes the smallest dust size particles. So, we have to handle this material carefully. The mesh basket from the ignition test is emptied into a pan and the remaining material is brushed into the pan.
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- Always wash gradation
- Cover with water
- Add wetting agent (soap)
- Agitate aggregate

Dust and fines tend to cling to the larger aggregate particles and these need to be removed so that we can obtain an accurate gradation and is required on all mixes. The next step is to wet the aggregate and cover it with water. Add a few drops (not enough to cause it to foam) of a wetting agent or soap to the water to help remove the dust from the aggregate. The aggregate should be agitated (stirred) and the rinse water decanted through a set of sieves. Add more water to the pan or bowl and continue to agitate and decant several more times until the rinse water is clear.
Shown here is the water being poured out of the bowl. Depending on the gradation, it may take several repetitions of adding water, stirring, and decanting. Note the water is clear indicating that the dust is removed and we are ready to move to the next step.

Decant over a 2-sieve nest (No. 10 or 8 and a No. 200). Repeat wash / decant until wash water is clear.
Return any material on sieves to pan.

With as little rinse water as possible, clean off the sieves used to catch the oversized material.

Return any material on sieves to pan.
The sample now is dried again to a constant weight.

From FM 1-T030:
All material retained on the nested sieves shall be returned to the container. The washed aggregate in the container shall be dried to constant weight at a temperature not to exceed the mixture laboratory compaction temperature ± 9°F (± 5°C) and not less than 221°F (105°C) and weighed to the nearest 0.1 g.

Dry to a constant weight in a 300 ± 9°F oven.
A set of sieves are assembled. The typical stack (nest) of sieves will have a 3/4”, 1/2”, 3/8”, #4, #8, #16, #30, #50, #100, #200, and pan.

A #4 sieve has four openings per inch of width (or 16 openings in a square inch of cloth space).
Weigh the dry aggregate then place on the top sieve.

The dried aggregate is poured over the top sieve. Use a soft brush to clean out the pan into the nest of sieves being careful not to lose any particles.

Weigh the dry aggregate then place on the top sieve.
If the sieve shaker will not handle a full set of sieves, hand shake the top sieve(s) and weigh.
The nest of sieves is placed in a shaker.

Make sure not to overload the sieves.
The timer is set. The shaker is started.

After the shaking is completed, the hand shaking procedure is the ultimate check to determine if the sample was shaken for a sufficient time:

Verification that sieves were shaken for a sufficient time:
Hold the sieve slightly inclined.
Strike it with heel of the hand, **150 strikes/minute**.
Rotate the sieve 1/6th revolution every 25 taps.
< 0.5% of total sample weight after 1 minute.
Once the sieving is complete, the material caught on the sieve is removed and the sieve is cleaned to remove the remaining particles.

Typically, a brass brush is used. Do not use a screwdriver or pick, as this can damage the screen.

Clean the sieve, then weigh.
Record the cumulative aggregate weights retained on each sieve on the form. The percent retained on a specific sieve is equal to the weight retained divided by the total weight. The percent passing a sieve is equal to the (total weight minus the weight retained on that sieve) divided by total weight.

Record the cumulative aggregate weights retained on each sieve.
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Weight passing the No. 200 sieve:

Total weight passing the No. 200 sieve

= weight of mineral matter lost during washing + aggregate in the pan

To determine the weight of the material passing the No. 200 sieve, add the material left in the bottom of the pan to the weight of the material lost during washing.
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Final weight must be within 0.2% of the total weight of the aggregate.

Example:

Total weight of aggregate = 1,000
Max. change = (1,000) x 0.002 = 2 g

Range = 998 to 1,002 grams

A check to make sure the test is valid is: that the final weight must be within 0.2% of the total weight of the aggregate.
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• Report:
  • Total % passing each sieve or
  • Total % retained on each sieve or
  • % retained on each sieve

Report to the nearest 0.01%.
What % is reported depends on specification.

Complete the paperwork.
The precision for gradation is more complicated than using just an accepted difference. Graphs in the test method are used to accomplish this and are shown next.
The precision for gradation is more complicated than using just an accepted difference.

Graphs in the test method are used to accomplish this. One graph is used for within lab variability.

This chart shows what the within lab variability would be for an average of two tests. The between lab variability in shown next. An example follows.
The other graph is used for **between lab** (tests from different labs) variability.

This chart shows what the between lab variability would be for an average of two tests from different labs.
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• Example: (dense graded)
  • Lab A: 49% passing No. 4
  • Lab B: 51% passing No. 4

Average = (49% + 51%) / 2 = 50%
Enter between-lab chart at 50% (bottom axis)
Draw line upward until it crosses the curve
Read max allowable difference on vertical axis (4.7%)

Difference is 51% - 49% = 2%
This is less than 4.7 %

Results Acceptable

An example is shown here. Go back to the previous graphs to determine the results.
QUESTIONS?