Volumetrics

Section 8 – IGNITION OVEN
AASHTO T 308

AASHTO T 308

- **Standard Method of Test for Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method**

SCOPE

- **This test method covers the determination of asphalt binder content of asphalt mixtures by ignition at temperatures that reach the flashpoint of the binder in a furnace. The means of specimen heating may be the convection method or the direct infrared (IR) irradiation method. The aggregate remaining after burning can be used for sieve analysis using AASHTO T 30.**

SIGNIFICANCE AND USE

- **This method can be used for quantitative determinations of asphalt binder content and gradation in asphalt mixture and pavement specimens for quality control, specification acceptance, and mixture evaluation studies. This method does not require the use of solvents. Aggregate obtained by this test method may be used for gradation analysis according to T 30.**

AASHTO T308: Asphalt Content by Ignition Oven Method

Make sure that the scale is centered after moving the field lab

Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method

- AC mix is heated up above flash point so it will burn leaving aggregate
- The remaining aggregates may be used for sieve analysis
- Two types of oven can be used: convection and infrared
- Two methods depending on whether the scale is inside or outside the oven (WYDOT USES METHOD A)
- This procedure can be used for quality control, specification acceptance, and mixture evaluation studies

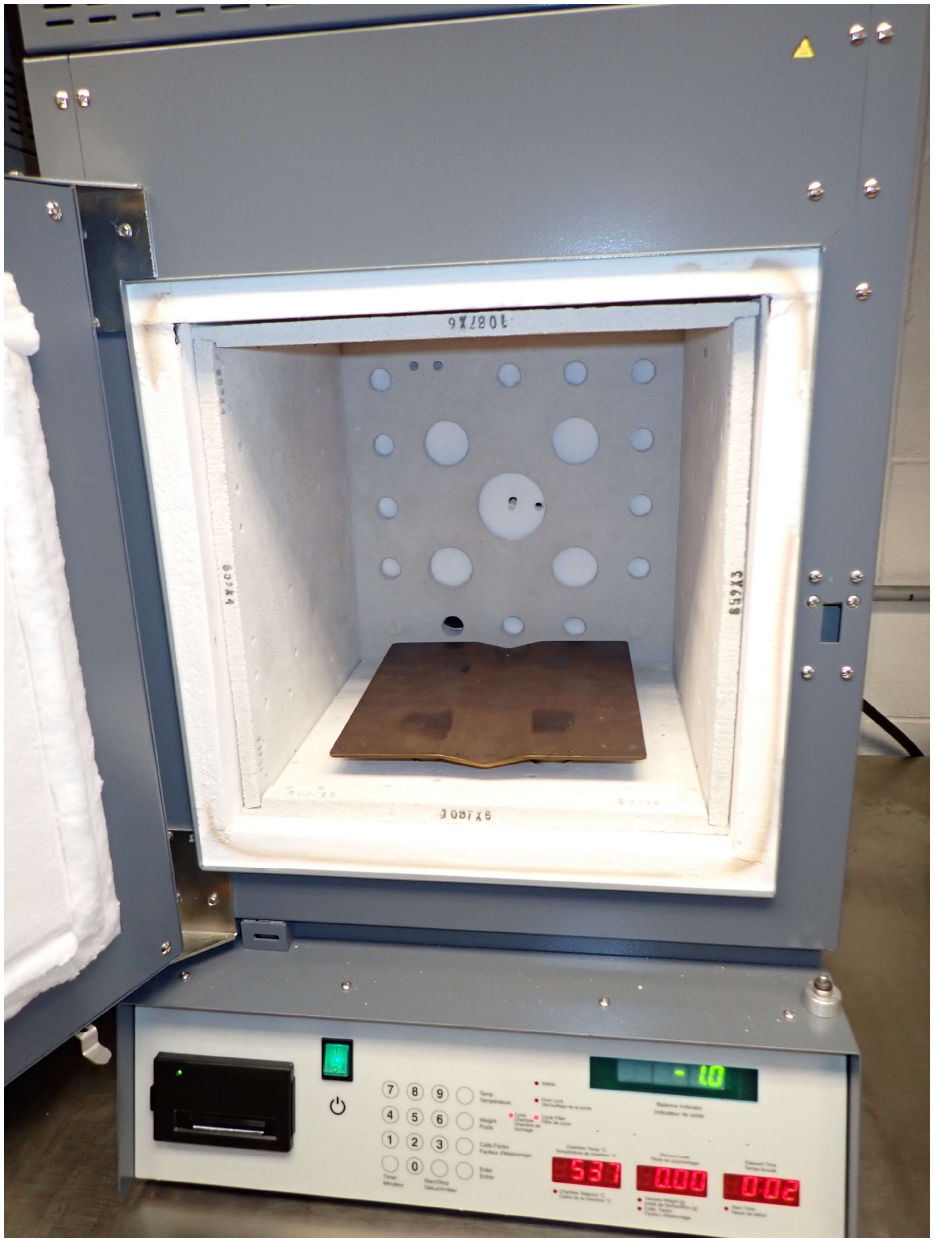
Method

- The asphalt binder is calculated by subtracting the residual weight from the mix weight before burning
- Correction factor is used to address for binder and moisture
- Correction factor must be established by series of tests with known asphalt content for each type of mix

Apparatus

- Ignition Furnace capable of maintaining a temperature of 538 ±5°C (1000 ± 9°F) and able to hold 3,500 gm of mix
- Internal balance with accuracy of 0.1 gm
- The furnace shall provide a printed ticket with the initial specimen mass, specimen mass loss, temperature compensation, correction factor, corrected asphalt binder content (percent), test time, and test temperature

Ignition Oven



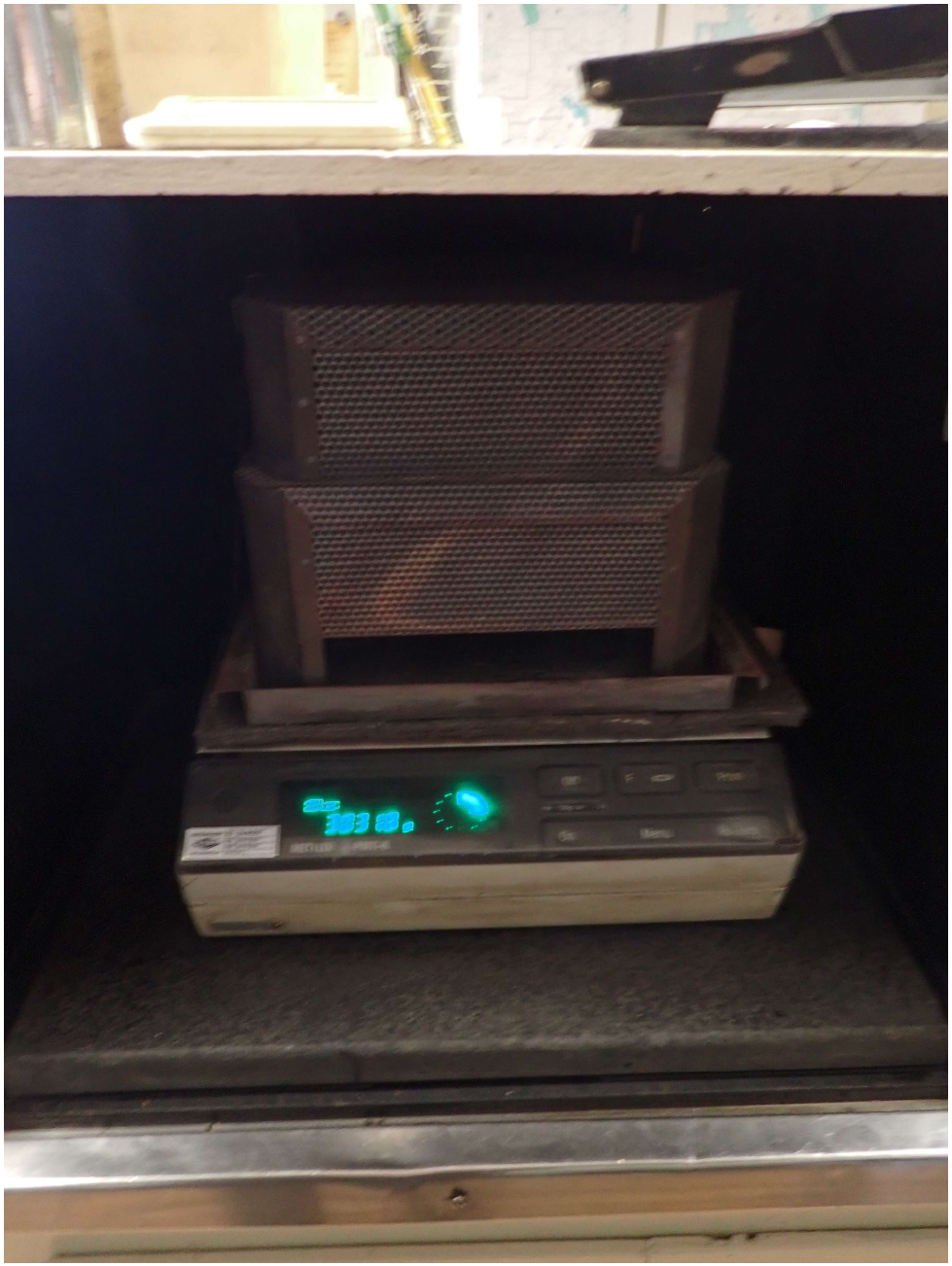
Apparatus (Continued)

- Specimen basket assembly consisting the basket, catch pan, and an assembly guard to secure the specimen basket(s) to the catch pan
- Oven—Capable of maintaining 110 ± 5°C (230 ± 9°F)
- Balance, safety equipment and
- Miscellaneous Equipment like spatula, bowl, brush, etc.

Specimen Basket Assembly

Basket Assembly

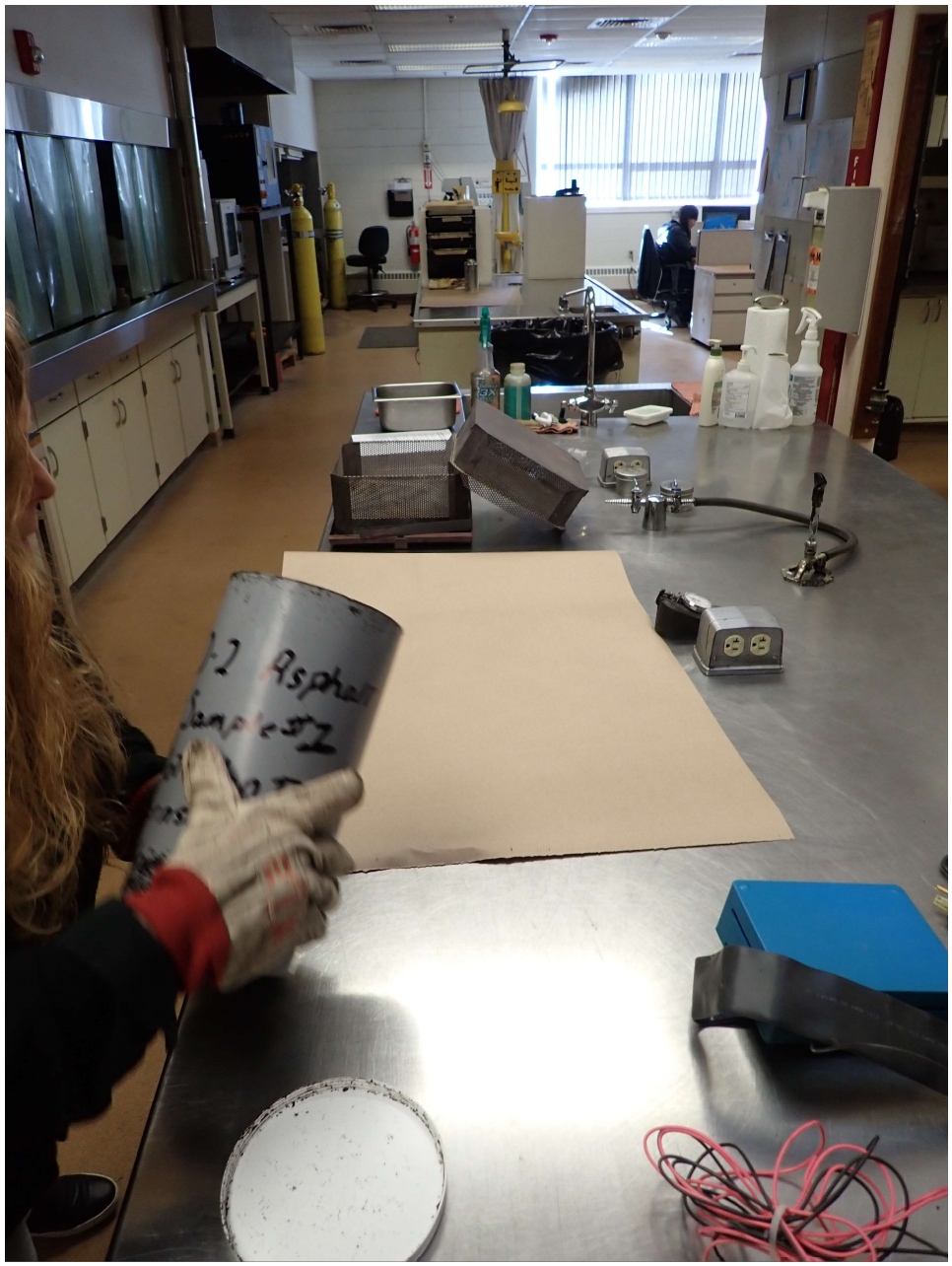
Get Weight of Empty Assembly Basket



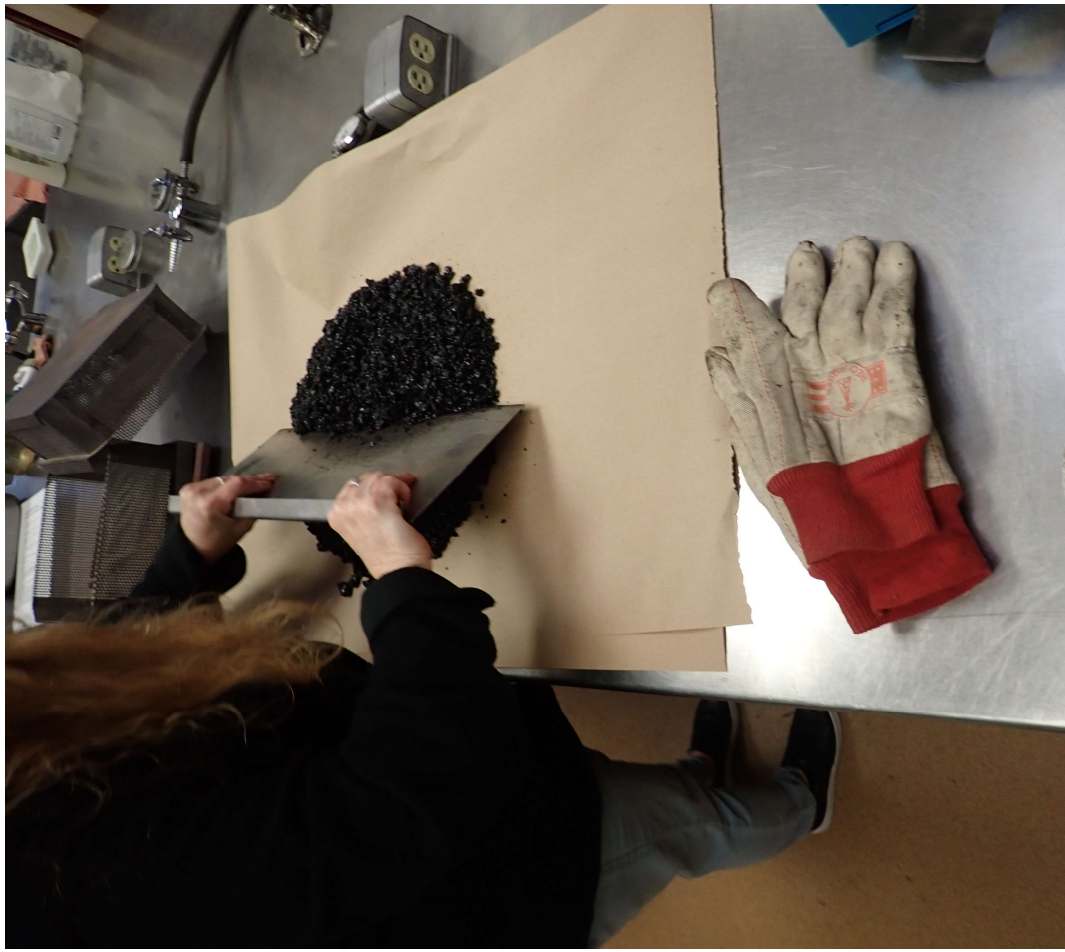
Procedure

- Determine moisture content in the mix using AASHTO T329
- Preheat the oven to a temperature of 538 ± 5°C (1000 ± 9°F)
- Find the correction factor for a specific mix from the oven
- Mass of the specimen basket assembly to the nearest 0.1 g
- Place the specimen basket(s) in the catch pan and distribute the specimen in the basket(s)
- Record the total mass of the specimen and specimen basket assembly to the nearest 0.1 g

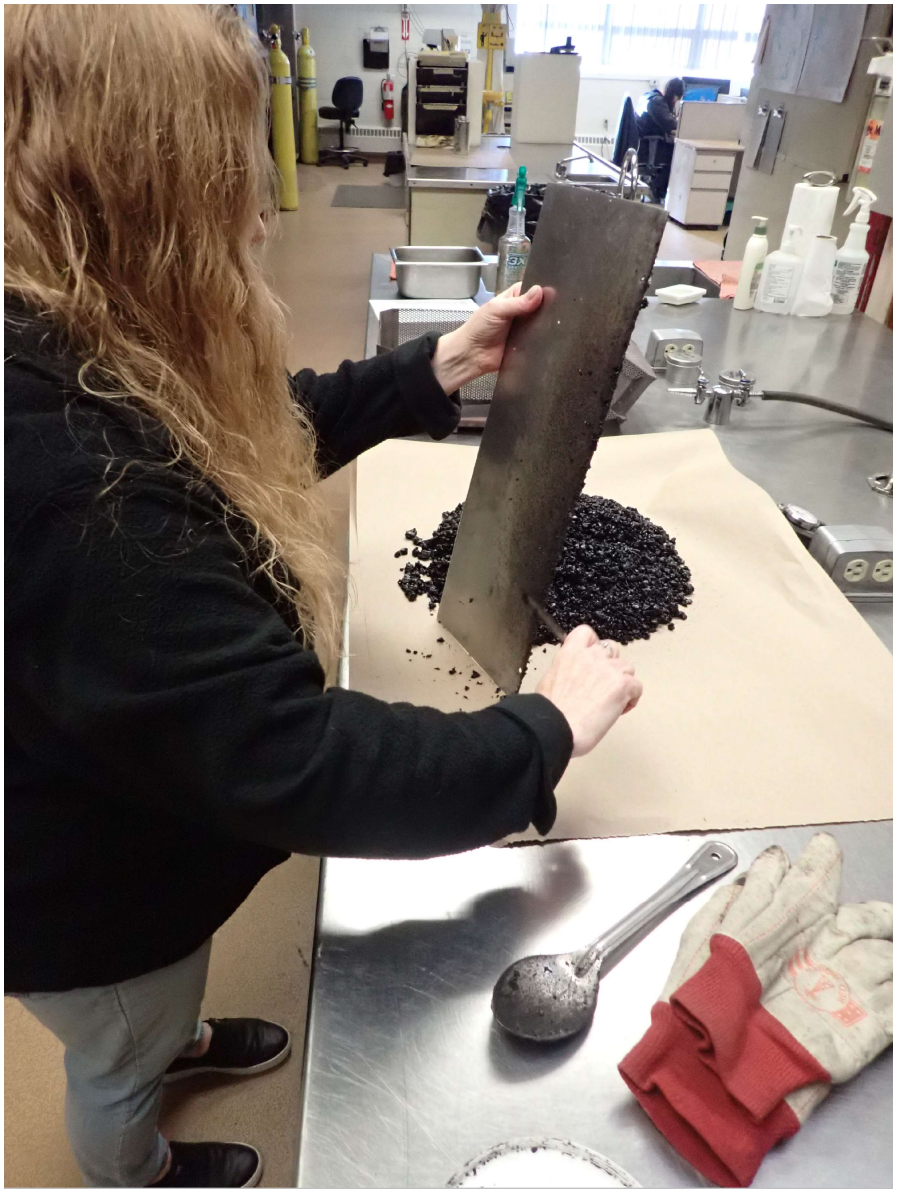
Sample preparation



Reduce Sample to Testing Size

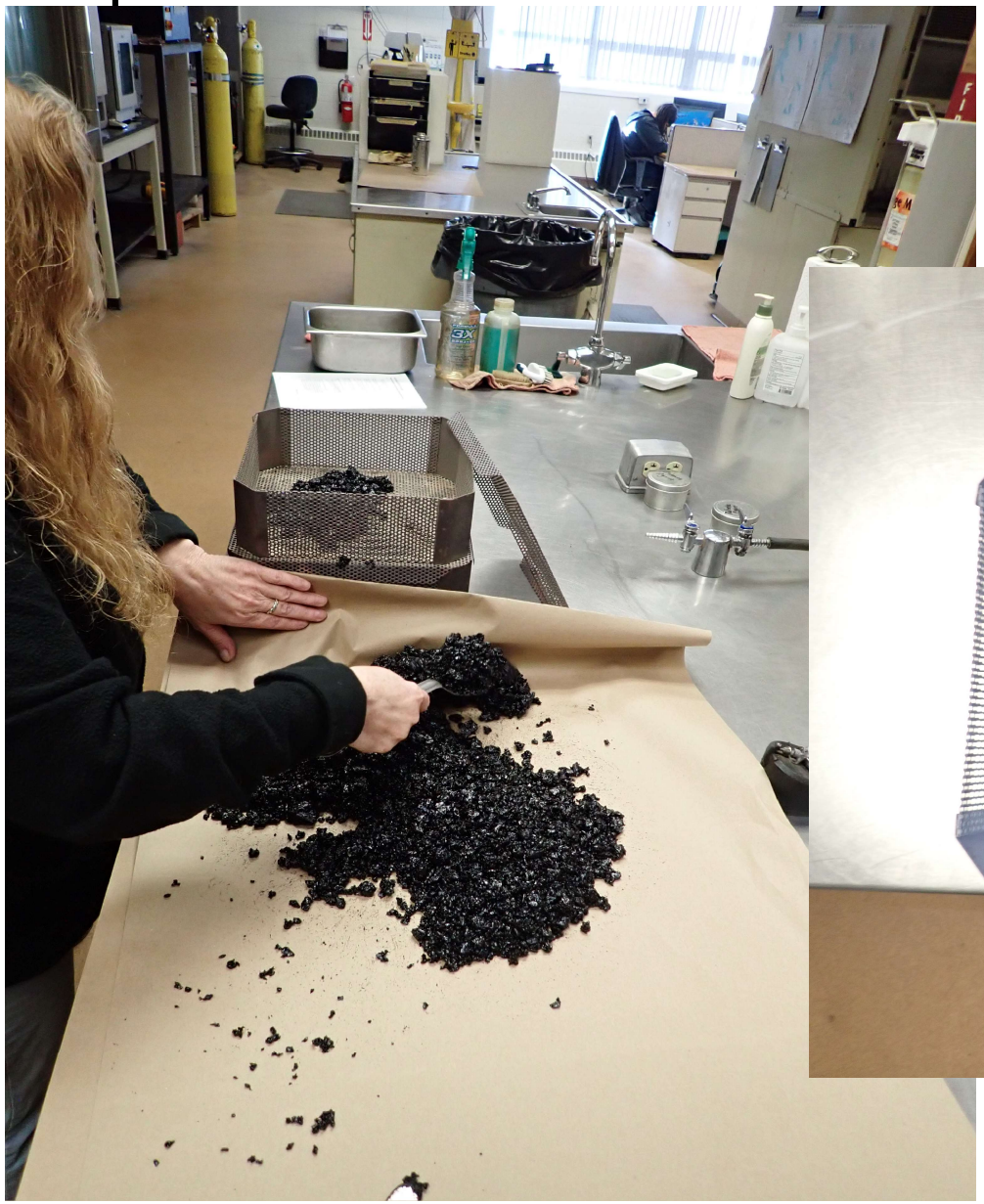


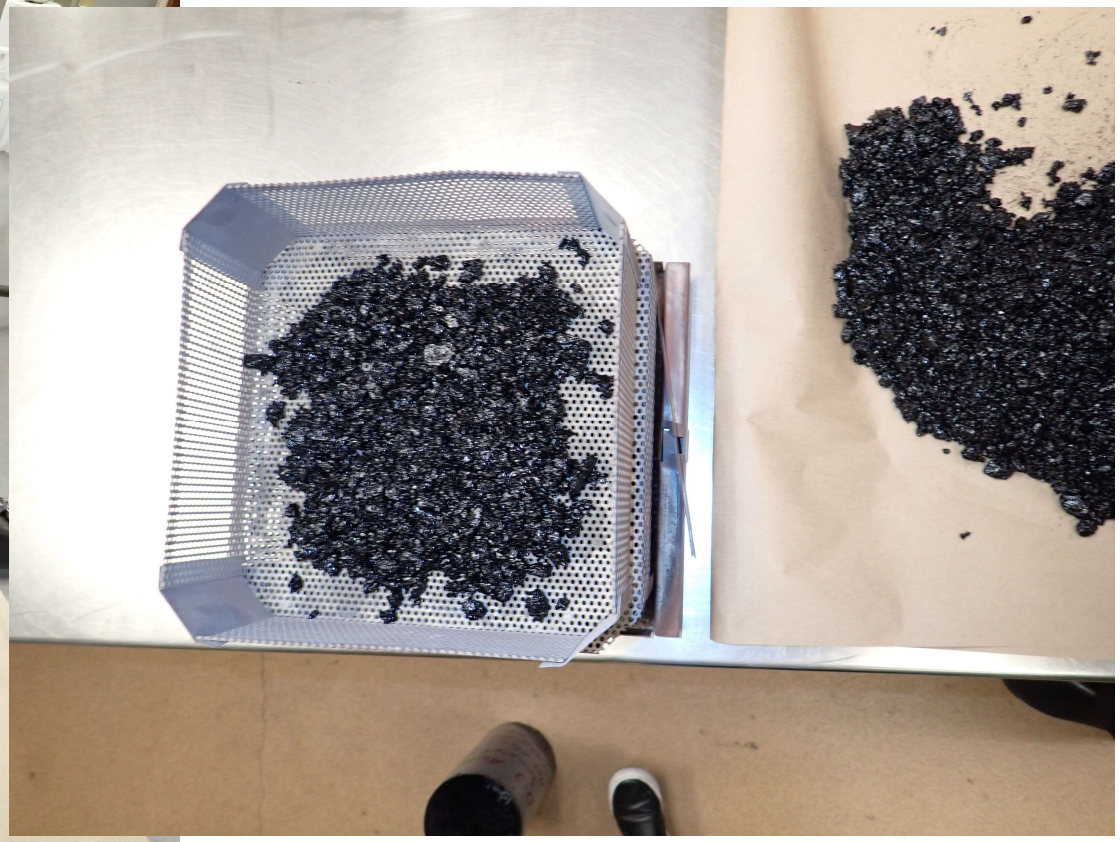
Make sure that you keep all materials during quartering



Load the lower part of the basket from the first quarter

Load the top part of the basket from the opposite quarter





Lock the basket

Procedure (Continued)

- Determine initial mass of the specimen and provide as input in the oven
- Reset the internal balance to zero
- Place the specimen basket assembly in the furnace and record the mass which should be within 5gm of previous mass
- Start the ignition oven. It will record the mass at different time interval. Oven usually makes a beep sound when test is complete
- Press stop button and open the oven door
- Calculate and record the final mass of the specimen, M_f
- Use the corrected asphalt binder content (percent) from the printed ticket

Get weight of loaded basket

Use appropriate safety equipment

Load the specimen in the oven

Loading sample in oven

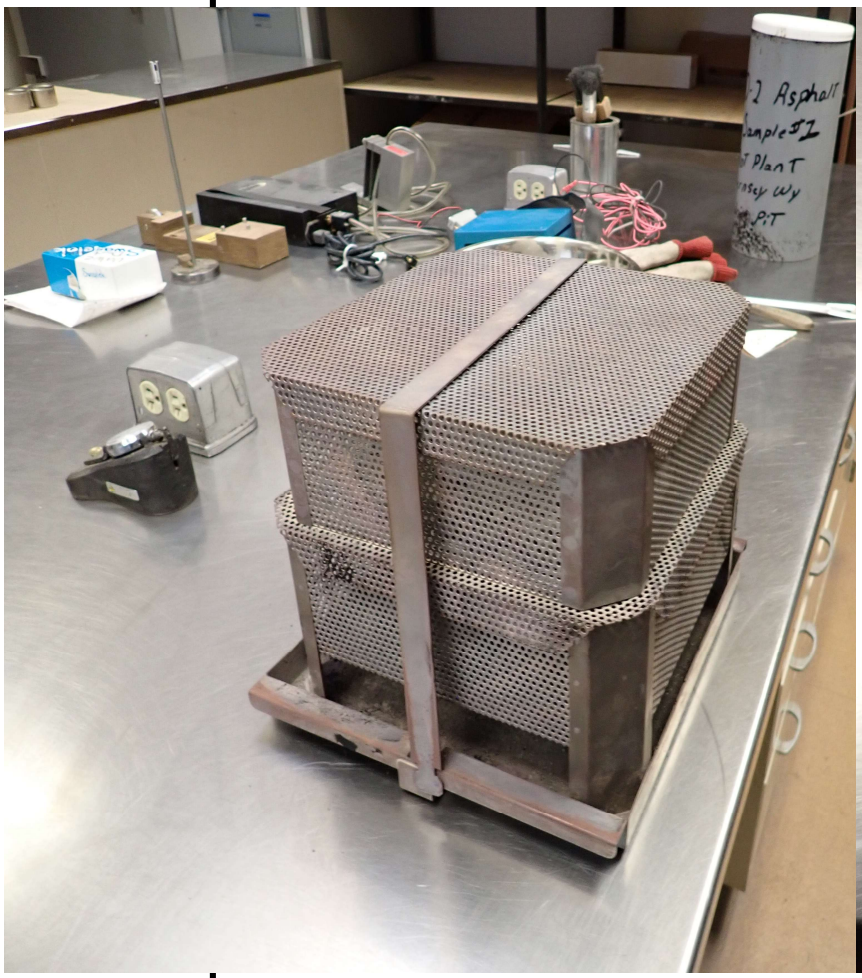

DANGER

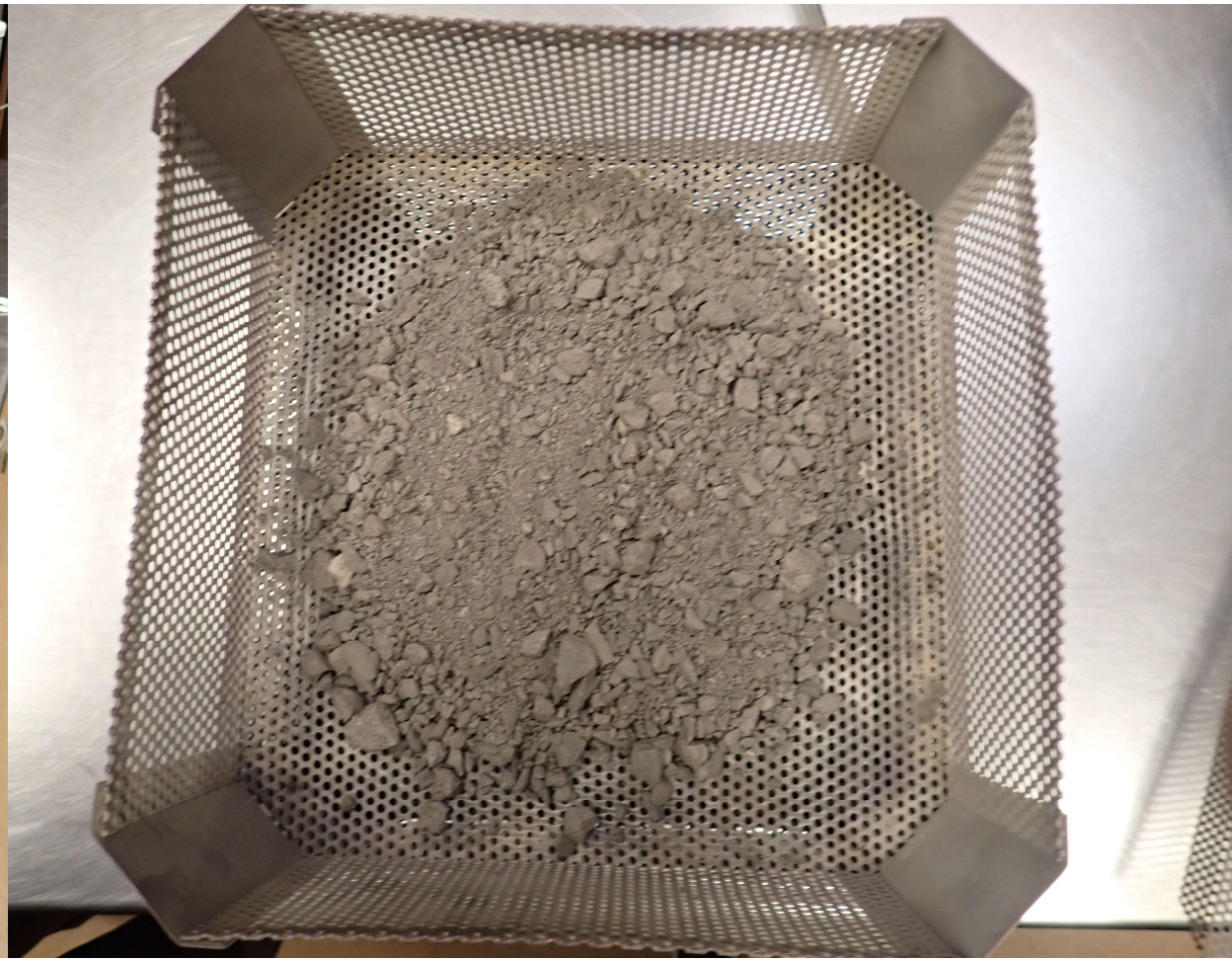

THERMOLYNE


THERMOLYNE
DANGER
HOT

Remove sample out of oven

Sample after testing





ANNEX A- CORRECTION FACTORS

- asphalt binder correction factor must be established by testing a set of correction specimens for each job mix formula (JMF) mix design.
- Correction factor must be determined prior to test strip construction.
- Historical data or scientific studies may be used to determine the correction factor(s) in lieu of using this testing procedure if the testing agency provides reference to the studies/data.

Asphalt Binder Correction Factor

- Certain aggregate types may result in unusually high correction factors (greater than 1.0 percent). Such mixes should be corrected and tested at a lower temperature.
- Each ignition furnace will have its own unique asphalt binder correction factor determined in the location where testing will be performed.

CORRECTION FACTOR PROCEDURE

- Obtain samples of aggregate in accordance with R 90. Reduce the samples to testing size as needed according to R 76.
- Obtain samples of asphalt binder in accordance with R 66.
- Prepare an initial, or “butter” mix at the design asphalt binder content. Mix and discard the butter mix prior to preparing any of the correction specimens to ensure an accurate asphalt binder content.

CORRECTION FACTOR PROCEDURE (CONTINUED)

- Prepare two correction specimens at the JMF design asphalt binder content and gradation. Aggregate used for correction specimens shall be sampled from the material designated for use in production. An additional “blank” (aggregate only) specimen shall be batched at the JMF gradation. Determine an aggregate gradation in accordance with T 30 on the “blank” specimen.
- Place the freshly mixed specimens directly into the specimen basket assembly. If specimens are allowed to cool prior to placement in the specimen basket assembly, the specimens must be dried to constant mass at a temperature of 110 ± 5°C (230 ± 9°F). Do not preheat the specimen basket assembly.
- Test the specimens in accordance with Method A.

CORRECTION FACTOR PROCEDURE (CONTINUED)

- Once both of the correction specimens have been burned, determine the asphalt binder content for each specimen by calculation or from the printed oven tickets, if available.
- If the difference between the asphalt binder contents of the two specimens exceeds 0.15 percent, repeat Section A2.3 through A2.7 with two more specimens and, from the four results, discard the high and low result. Determine the correction factor from the two original or remaining results as appropriate. Calculate the difference between the actual and measured asphalt binder contents for each specimen. The asphalt binder correction factor, CF, is the average of the differences expressed as a percentage by mass of the asphalt mixture.

CORRECTION FACTOR PROCEDURE (CONTINUED)

- If the asphalt binder correction factor exceeds 1.0 percent, the test temperature should be lowered to 482 ± 5°C (900 ± 9°F) for a convection-type furnace. If there is no improvement in the correction factor, it is permissible to use the higher temperature.
- The temperature for determining the asphalt binder content of asphalt mixture specimens by this procedure shall be the same temperature determined for the correction specimens.

Reducing Samples of Aggregate to Testing Size

- AASHTO R 76– Reducing Samples of Aggregate to Testing Size.
- Summary: the reduction of large samples of aggregate to the appropriate size for testing.
- Method A – Mechanical Splitter is used.
- Sample size is around 1,800 grams so a small splitter is normally used.

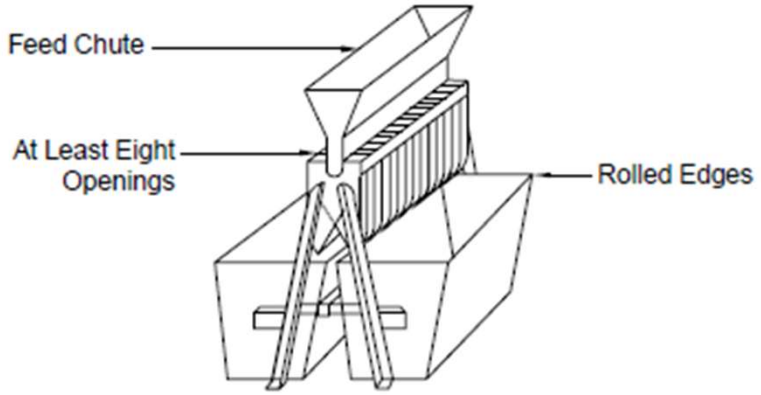
APPARATUS

- **Sample splitters shall have an even number of equal-width chutes, but not less than a total of eight for coarse aggregate, or twelve for fine aggregate, which discharge alternatively to each side of the splitter.**
- **For coarse aggregate and mixed aggregate, the minimum width of the individual chutes shall be approximately 50 percent larger than the largest particles in the sample to be split.**
- **For dry fine aggregate in which the entire sample will pass the 3/8-in sieve, the minimum width of the individual chutes shall be at least 50 percent larger than the largest particles in the sample and the maximum width shall be 3/4 in.**

APPARATUS (CONTINUED)

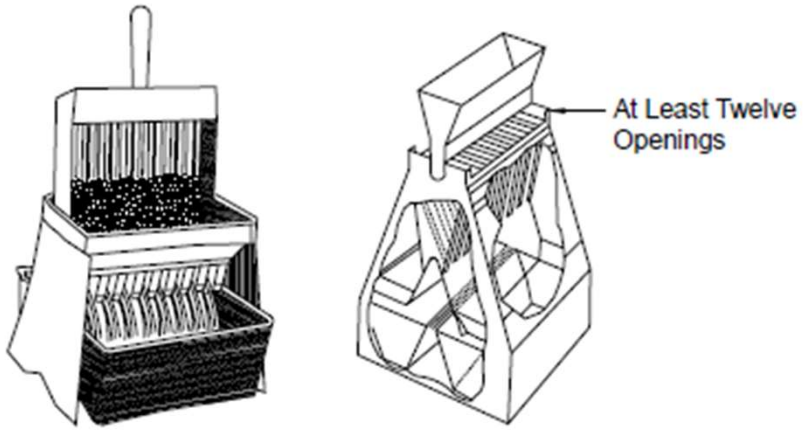
- The splitter shall be equipped with two receptacles to hold the two halves of the sample following splitting.
- It shall also be equipped with a hopper or straightedged pan, which has a width equal to or slightly less than the overall width of the assembly of chutes, by which the sample may be fed at a controlled rate to the chutes.
- The splitter and accessory equipment shall be so designed that the sample will flow smoothly without restriction or loss of material.

SAMPLES SPLITTERS



Riffle Sample Splitter

(a) Large Sample Splitter for Coarse Aggregate



(b) Small Sample Splitters for Fine Aggregate

SPLITTING PROCEDURE

- **Place the original sample in the hopper or pan and uniformly distribute it from edge to edge, so that when it is introduced into the chutes, approximately equal amounts will flow through each chute. Introduce the sample at a rate that allows the material to flow freely through the chutes into the receptacles below.**
- **Reintroduce the portion of the sample in one of the receptacles into the splitter as many times as necessary to reduce the sample to the size specified for the intended test. The portion of the material collected in the other receptacle may be reserved for reduction in size for other tests.**

MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE

- **AASHTO T 30-21**
- **For aggregate recovered from the ignition furnace used in AASHTO T 308.**
- **The results are used to determine compliance of the particle-size distribution with applicable requirements and to provide necessary data for control of the production of various aggregates to be used in asphalt mixtures.**

APPARATUS

- **Balance—A Class G2 balance meeting the accuracy requirements of M 231.**
- **Sieves—Conforming to the requirements of ASTM E11.**
- **Mechanical Sieve Shaker—A mechanical sieving device, if used, shall continually reorient the particles on the sieving surface.**
  - **Excessive time (more than 10 min) to achieve adequate sieving may result in degradation of the sample.**
  - **The same mechanical sieve shaker may not be practical for all sizes of samples, because a large sieving area is needed for practical sieving of a large nominal size coarse aggregate.**
  - **Use of the same device for a smaller size of coarse aggregate or fine aggregate will likely result in loss of a portion of the sample.**

APPARATUS (CONTINUED)

- **Oven—An oven of sufficient size, capable of maintaining a uniform temperature of 230 ± 9°F.**
- **Wetting Agent—Any dispersing agent, such as dishwashing detergent, that will promote separation of the fine materials.**
- **Container—A pan or vessel of a size sufficient to contain the sample covered with water and to permit vigorous agitation without loss of any part of the sample or water.**
- **Spoon or Mixing Utensil—Or similar device for agitating the sample during the washing procedure.**

PROCEDURE

- The sample shall consist of the entire lot or representative sample of aggregate obtained according to T 308 from which the binder material has been extracted.
- Dry the sample, if necessary, until further drying at 230 ± 9°F does not alter the mass by more than 0.1 percent (Note 3). Determine and record the mass of the sample to the nearest 0.1 g.
- the mass determined shall agree with the mass of aggregate remaining after ignition (Mf from T 308) within 0.1 percent. If the variation exceeds 0.1 percent, the results of this test should not be used for acceptance purposes. Record the mass as the initial specimen mass.

PROCEDURE (CONTINUED)

- Place the test sample in a container and cover it with water. Add a sufficient amount of wetting agent to assure a thorough separation of the material finer than the No. 200 sieve from the coarser particles. Add the wetting agent. Agitate the contents of the container vigorously and immediately decant the wash water over a nest of two sieves consisting of a No. 10 or No. 16 sieve superimposed on a No. 200 sieve. The use of a large spoon or similar device is recommended to aid the process of agitating the contents of the container. Limit agitation by mechanical washing equipment to a maximum of 10 min.

PROCEDURE (CONTINUED)

- Vigorously agitate the sample, bringing the particles finer than the No. 200 sieve into suspension. Decant the suspension over the sieve nest in order to completely separate the fine particles from the coarse particles. Use care to avoid, as much as possible, the decantation of the coarse particles of the sample onto the sieve nest. Repeat the operation until the wash water is clear. Do not overflow or overload the No. 200 sieve.
- Return all material retained on the nested sieves to the container. Dry the washed aggregate in the container to constant mass in accordance with T 255 and determine its mass to the nearest 0.1 percent.

PROCEDURE (CONTINUED)

- **Sieve the aggregate over various sieve sizes, including the No. 200 sieve as required by the specification covering the asphalt mixtures. Additional sieve sizes may be used to regulate the amount of material on a sieve to meet the requirements of Annex A2. Nest the sieves in order of decreasing size of opening from top to bottom and place the sample on the top sieve. Agitate the sieves by a mechanical apparatus for a sufficient period, established by trial or checked by measurement on the actual test sample, to meet the criterion for adequacy of sieving described in Annex A1.**

ANNEX A2(OVERLOAD DETERMINATION)

- Do not exceed a mass of 7 kg/m2 (4 g/in2) of sieving surface for sieves with openings smaller than No. 4 at the completion of the sieving operation.
- Do not exceed a mass in kg of the product of 2.5 × (sieve opening in millimeters) × (effective sieving area in square millimeters) for sieves with openings No. 4 and larger. This mass is shown in Table A2.1 for five sieve-frame dimensions in common use. Do not cause permanent deformation of the sieve cloth due to overloading.
- Note A1—The 7 kg/m2 (4 g/in.2) amounts to 200 g for the usual 8-in. diameter sieve [with effective or clear sieving surface diameter of 71/2 in.] or 450 g for a 12-in.diameter sieve [with effective or clear sieving surface diameter of 111/2 in.].

ANNEX A2(CONTINUED)

- As provided below, the amount of material retained on a sieve may be regulated by: (1) the introduction of a sieve with larger openings immediately above the given sieve, (2) testing the sample in a number of increments, or (3) testing the sample over a nest of sieves with a larger sieve-frame dimension.
- Insert an additional sieve with opening size intermediate between the sieve that may be overloaded and the sieve immediately above that sieve in the original set of sieves.

ANNEX A2(CONTINUED)

- Split the sample into two or more portions, sieving each portion individually. Combine the masses of the several portions retained on a specific sieve before calculating the percentage of the sample on the sieve.
- Use sieves having a larger frame size and providing greater sieving area.

ANNEX A2(CONTINUED)

Table A2.1—Maximum Allowable Mass of Material Retained on a Sieve, kg

Sieve Opening Size	Nominal Dimensions of Sieve[a]		
	203.2 mm (8 in.) dia[a]	254 mm (10 in.) dia[a]	304.8 mm (12 in.) dia[a]
	Sieving Area, m^2 ($in.^2$)		
	0.0285 (44.2)	0.0457 (70.8)	0.0670 (103.5)
50 mm (2 in.)	3.6	5.7	8.4
37.5 mm ($1^1/_2$ in.)	2.7	4.3	6.3
25.0 mm (1 in.)	1.8	2.9	4.2
19.0 mm ($^3/_4$ in.)	1.4	2.2	3.2
12.5 mm ($^1/_2$ in.)	0.89	1.4	2.1
9.5 mm ($^3/_8$ in.)	0.67	1.1	1.6
4.75 mm (No. 4)	0.33	0.54	0.80

[a] The sieve area for round sieves is based on an effective diameter of 12.7 mm ($^1/_2$ in.) less than the nominal frame diameter because ASTM E11 permits the sealer between the sieve cloth and the frame to extend 6.35 mm ($^1/_4$ in.) over the sieve cloth. Thus, the effective or clear sieving diameter for a 203.2-mm (8.0-in.) diameter sieve frame is 190.5 mm ($7^1/_2$ in.). Sieves produced by some manufacturers do not infringe on the sieve cloth by the full 6.35 mm ($^1/_4$ in.).