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Volumetrics in Asphalt Mixtures

- Asphalt is a paving material that consists of asphalt binder and mineral aggregate.



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Binder

- Acts as a lubricant when at mixing temperature
- Provides a waterproofing around the aggregates
- Acts as a flexible solid cement or glue when cool
- Different binder grades based on climate and traffic

+ ESALS

2

Binder

The 3 main factors that determine the performance of a binder are:

- Temperatures (During construction and the lifecycle)
- Loading (Traffic)
- Age (Time and Oxidation)

These 4 binders are commonly used in Colorado

3

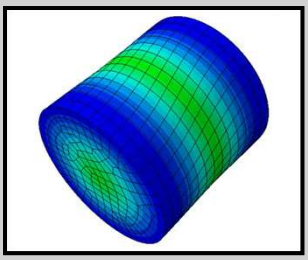
Binder

Viscosity, Viscoelasticity, and Temperature Susceptibility

- Binders behave differently at different temperatures (temperature susceptibility)
- The viscosity of the binder decreases significantly as temperature increases
- "Viscosity" is a fluid's resistance to flow
- "Viscoelasticity" is the measurement of a substance's ability to temporarily deform under stress and return to the pre-stressed form (flexible pavement)
- It is critical to utilize the correct temperatures for the binder material you are working with to properly represent the true characteristics of the material in the field

Superpave Binder Grade	Lab Mixing Temp.	Lab Compaction Temp.
PG 58-28	310°F (154°C)	280°F (138°C)
PG 58-34	310°F (154°C)	280°F (138°C)
PG 64-22	325°F (163°C)	300°F (149°C)
PG 64-28	325°F (163°C)	300°F (149°C)
PG 70-28	325°F (163°C)	300°F (149°C)
PG 76-28	325°F (163°C)	300°F (149°C)

Viscoelasticity



Low Viscosity

High Viscosity

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Binder

Loading (Traffic) ESALS

- Traffic load is measured for roadway construction and pavement design using "ESALS" or "Equivalent Single-Axle Loads"
- One ESAL is typically represented as one pass from an 18,000lb load spread over a single, standard axle
- "Stiffer" binders (higher PG grading) are typically chosen for pavements with higher traffic loads

Likely 76-28 on the interstate, and standard, softer binder (64-22 or 58-28) for residential streets and under

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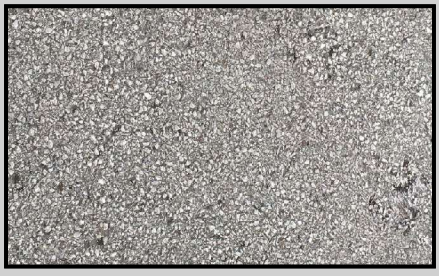
Binder

Aging and Oxidation

- "Oxidation" is a chemical reaction in which a material gives up electrons, as when the material combines with oxygen. Burning is an example of rapid oxidation; rusting is an example of slow oxidation.
- The effect of oxidation over a long period of time (years) on asphalt binder is an increase in stiffness and a decrease in viscoelasticity
- Producing asphalt at temperatures higher than specified will prematurely age the binder, and thus reduce or alter the designed performance and lifecycle of the pavement

EXAMPLE: Fresh motor oil on the left and used, dark-colored motor oil on the right.

Old pavement surface



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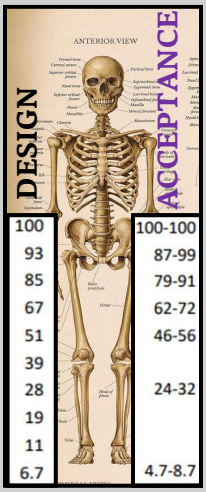
Mineral Aggregate

- The framework or skeleton of the mix is created with a designed grading of mineral aggregate particles
- Significant deviations from the mix design or JMF gradation will change the volumetric properties of the mix, which can reduce or alter the designed performance and lifecycle of the pavement

Combined aggregate "cold-feed" conveyor

Sieve Size	
mm	in.
50	2
37.5	1.5
25	1
19	3/4
12.5	1/2
9.5	3/8
4.75	No. 4
2.36	No. 8
1.18	No. 16
0.6	No. 30
0.3	No. 50
0.15	No. 100
0.075	No. 200



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Mineral Aggregate

Aggregate Sources

- Natural aggregate – straight from the ground
- Processed aggregate – altered from its natural state
  - Blasted
  - Crushed
  - Screened
  - Washed
- Synthetic aggregate - various substances created and crushed into aggregate material
- Blast-furnace slag (a byproduct in iron ore refinement)
- Clays and shales can be fired in a kiln to create durable ceramic materials

Sand washing operation

Blast furnace slag

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Mineral Aggregate

RAP

- RAP (Reclaimed Asphalt Pavement)
- Produced from millings and clean asphalt tear-out
- Crushed and screened (typically ¾")
- RAP is reintroduced into most asphalt mixes in Colorado at a 20% rate
- It is unique because it provides an aggregate contribution as well as a significant binder contribution
- Asphalt is 100% recyclable!

Top-down view into a RAP feeder bin

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Mineral Aggregate

Aggregate Properties

- "Shear strength" is the ability to resist forces that will cause the internal structure to slide against itself
- Shear strength created in asphalt pavements by specifying a certain percentage of cubical aggregate with crushed faces (processed aggregate)
- Interlocking crushed aggregate particles create internal friction and resistance to shearing and permanent deformation (rutting)

LABCAT Level E – Aggregates

Provides certification for 12 aggregate property tests that are used to qualify mineral aggregate for asphalt mix design in Colorado.

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Superpave

- Compacts volumetric specimens (pucks) at specified temperatures (based on binder PG grading) and specified design gyrations (based on expected traffic loads or ESALS)
- Provides specimen heights data every 2 seconds (every gyration)
- The volumetric properties of a compacted paving mixture provide some indication of the mixture's probable pavement service performance

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Volumetric Properties

- **Air Voids (Va)** - The volume of the small pockets of air between the coated aggregate particles throughout a compacted paving mixture, expressed as percent of the bulk volume of the compacted paving mixture
- **Voids in the Mineral Aggregate (VMA)** – The void spaces between the aggregate particles of the compacted mix. The void space includes the air voids (Va) and the effective asphalt content (Pbe)
- **Voids Filled with Asphalt (VFA)** - The volume of inter-granular void space between the aggregate particles of a compacted paving mixture that is occupied by the effective binder (asphalt). It is expressed as the ratio of (VMA-Va) to VMA.
- **Effective Asphalt Content (Pbe)** - The total binder content minus the quantity of binder lost by absorption into the aggregate. It is the binder that remains as a coating on the outside of the aggregate particles and is the binder content that governs the performance of an asphalt mixture.

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Determination of the Voids in the Mineral Aggregate (VMA)

CDOT CP 48

Gsb = 2.605
Gmb = 2.355
Ps = 94.5

EXAMPLE

$$VMA = 100 - \frac{G_{mb} P_s}{G_{sb}}$$

2.355 x 94.50 = 222.548

222.548 / 2.605 = 85.43

100 – 85.43 = **14.57**

Where:
VMA = Voids in mineral aggregate, in percent of bulk volume,
G_{sb} = Bulk specific gravity of the aggregate,
G_{mb} = Bulk specific gravity of compacted mix,
P_s = Aggregate, percent by total weight of the mix

REPORTING VMA
Each VMA to the neareast 0.01%
The average of three VMA to 0.1%

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Determination of the Voids in the Mineral Aggregate (VMA)

CDOT CP 48

- **Section 3.2** – When the total aggregate consists of separate fractions, the bulk specific gravity of the total aggregate is computed as follows:

$$G_{sb} = \frac{P_1 + P_2 + \ldots + P_n}{\frac{P_1}{G_1} + \frac{P_2}{G_2} + \ldots + \frac{P_n}{G_n}}$$

Where:
P_1 = Percent by weight of aggregate 1, etc.,
G_1 = Bulk specific gravity of aggregate 1, etc. 3.3 When the total mix contains 20 percent or less of reclaimed asphalt pavement (RAP), the bulk specific gravity of the aggregate contained in the RAP shall be assumed to be the same as the effective specific gravity of the aggregate contained in the RAP for the calculation in Subsection 3.2. The calculation for the effective specific gravity may be found in CP 56.

- **Section 3.3** – When hydrated lime is used in the mix, the Gsb for hydrated lime shall be 2.38

14

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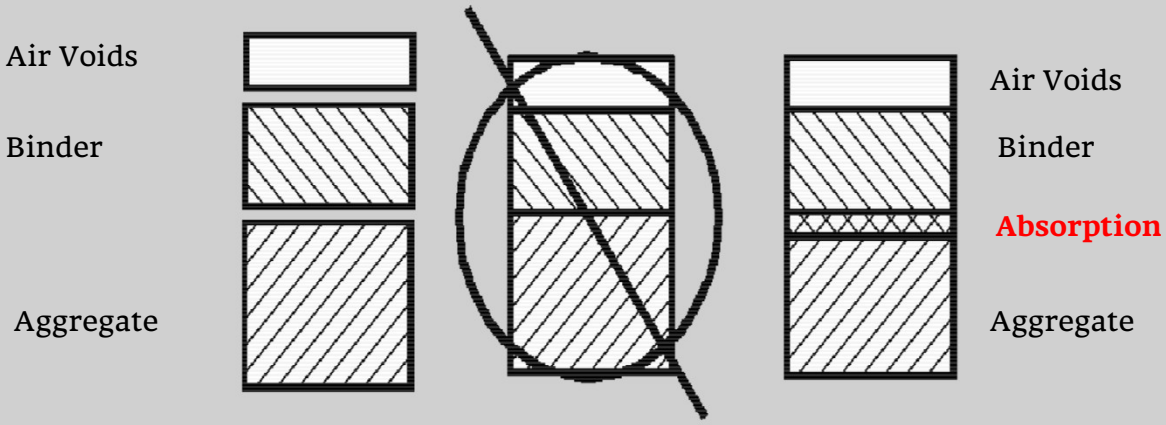
Binder Absorption



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VMA and VFA

- Minimum VMA can be a difficult mix design property to achieve
- Accurate aggregate specific gravities are critical to calculating accurate VMA
- The goal is to furnish enough space for the binder to provide adequate adhesion to bind the aggregate particles, without bleeding (flushing) when the temperatures rise and the binder expands

"Flushing" or "bleeding" is observable when the oil has nowhere else to go but up to the surface

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Designing for VMA

- The "restricted zone" is an area of the gradation to avoid due to tender mix behavior in the field
- Tender mix can be difficult to compact, as the mix remains plastic longer – especially at above-optimum binder contents

Not all aggregate is created equal. There are aggregate sources that can pass through this zone with satisfactory results!

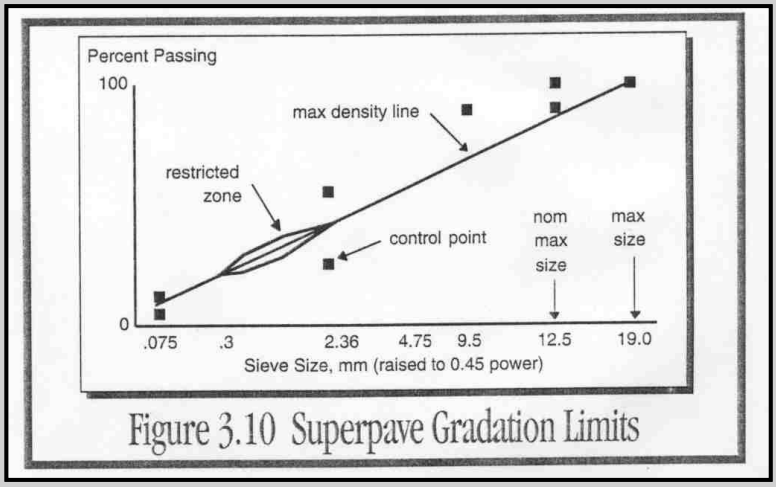

Figure 3.10 Superpave Gradation Limits

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18

Preparing Bituminous Test Specimens with the Superpave Gyratory Compactor

CDOT CP-L 5115

1

Scope

- This standard covers compaction of 150mm (6") and 100mm (4") specimens
- The specimens simulate density, aggregate orientation, and structural characteristics that are representative of proper asphalt pavement construction

100mm or 4"

150mm or 6"

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Safety

- ❑ Hot mix - long sleeves and hot gloves
- ❑ Heavy hot molds - appropriate footwear
- ❑ Moving parts in the compactor – hands clear

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Apparatus

- ❑ Superpave Gyratory Compactor
  - ❑ 600kPa (±18kPa) applied and maintained
  - ❑ 30.0 ±0.5 gyrations per minute
  - ❑ Ability to measure and record specimen height once per gyration to the nearest 0.1mm
  - ❑ 100mm (4") molds tilted at 1.25 (±2) degrees **EXTERNALLY**
  - ❑ 150mm (6") molds tilted at 1.16(±2) degrees **INTERNALLY**

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Apparatus

- Molds
- Funnel
- Scale
- Forced-Draft Oven
- Paper Disks
- Thermometers





5

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Molds

- 100mm (4")
  - 100.00mm ±0.10mm inside diameter
  - 250mm minimum length, 7.0mm thick steel walls
  - 100mm (4") molds tilted at 1.25 (±2) degrees **EXTERNALLY**

Troxler Pine

- 150mm (6")
  - 150.00mm ±0.10mm inside diameter
  - 250mm minimum length, 7.5mm thick steel walls
  - 1.16(±2) degrees **INTERNALLY**

Troxler Pine

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Preparation of the Apparatus

- Turn the compactor on at least 5 minutes before use
- Lubricate per the manufacturer's manual
- Verify per the manufacturers manual
  - Height – daily (Troxler)
  - Angle (6 months / 480 hours)
  - Pressure (6 months / 480 hours)
  - Rotation (not specified)
  - Number of gyrations – each use

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Mix Preparation

- Laboratory-mixed samples must be held at compaction temperature for a 2.0 – 3.0 hours before molding
- Plant-produced samples must be maintained at a temperature above 200°F for at least 1 hour before molding
- All Samples – must be at compaction temperature for a minimum of 15 minutes, not to exceed 4.0 hours

TABLE 2

Superpave Binder Grade	Lab Mixing Temp.	Lab Compaction Temp.
PG 58-28	310°F (154°C)	280°F (138°C)
PG 58-34	310°F (154°C)	280°F (138°C)
PG 64-22	325°F (163°C)	300°F (149°C)
PG 64-28	325°F (163°C)	300°F (149°C)
PG 70-28	325°F (163°C)	300°F (149°C)
PG 76-28	325°F (163°C)	300°F (149°C)

Table 1

Number of Gyrations	Multiplier
50	470
75	474
100	478
125	482
SMA	470

- For 100mm (4") specimen molding - use the multiplier in Table 1 x the **Gmm (Rice)** to generate a sample weight in grams
- For 150mm (6") specimen molding – the multiplier will be 1,670 x the Gmm (Rice) to generate the sample weight in grams, regardless of # of gyrations

8

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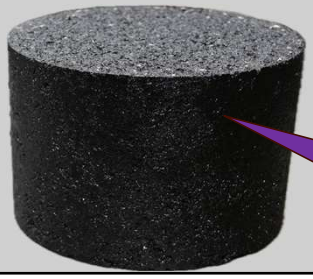
Compaction Procedure

- **For CP-L 5115, only 100mm (4") specimens are molded per Section 10.2**
- Height Limits for Acceptable Specimens
  - 100mm (4") = 63.5mm ± 5mm
  - 150mm (6") = 100mm ± 5mm



100mm specimens are used in the other 2 CP-L's in Level C

CP-L 5106 Hveem Stabilometer

CP-L 5109 Resistance to Moisture Induced Damage (Lottman)

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Compaction Procedure

- Molds and baseplates heated to compaction temperature at least 60 minutes – reheated after each use for 15 minutes
- All Samples – must be at compaction temperature for a minimum of 15 minutes, not to exceed 4.0 hours

TABLE 2

Superpave Binder Grade	Lab Mixing Temp.	Lab Compaction Temp.
PG 58-28	310°F (154°C)	280°F (138°C)
PG 58-34	310°F (154°C)	280°F (138°C)
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PG 70-28	325°F (163°C)	300°F (149°C)
PG 76-28	325°F (163°C)	300°F (149°C)

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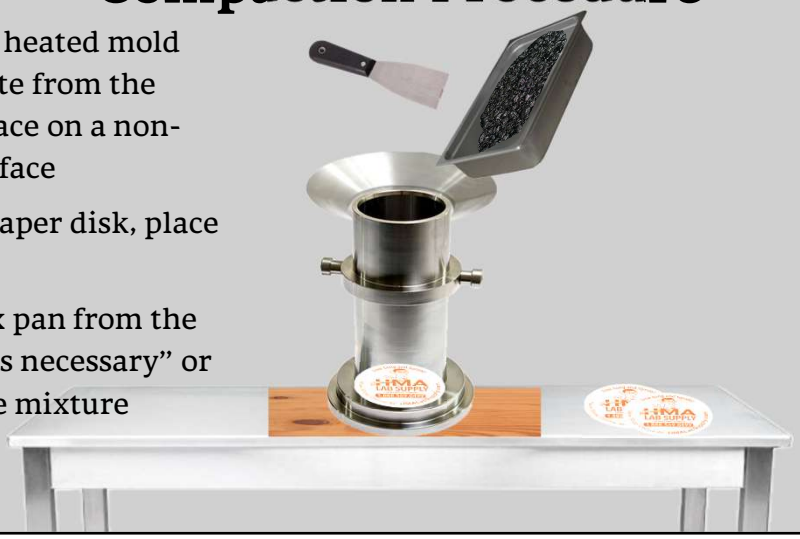
Compaction Procedure

- Remove the heated mold and baseplate from the oven and place on a non-metallic surface
- Insert one paper disk, place funnel
- Remove mix pan from the oven, "stir as necessary" or break up the mixture



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Compaction Procedure

- Dump the loose mixture into the mold in one swift motion
- Level the mix as necessary, place the second paper disk and place the mold into the compactor

12

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Compaction Procedure

SEGREGATION

Samples should have a uniform appearance and texture

Improper loading technique will increase likelihood of a segregated sample, assessed after compacted

A maximum of 60 seconds can elapse between removing the mold from the oven and initiating the compaction process **(PRESSING START)**

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Make sure the correct # of gyrations is applied

Compaction Procedure

PINE

- ❑ Insert the mold (seated)
- ❑ Lower and lock the arms
- ❑ Replace and lock the top
- ❑ Press **START**
- ❑ When complete – remove the top, press **RAM UP**
- ❑ Remove specimen, press **RAM DOWN**
- ❑ Mold back in the oven

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Compaction Procedure

- 3 specimens will be molded and their BsG averaged after cooling for "voids acceptance" projects
- Carefully place the specimens in a designated cooling area
- Remove papers without damaging the specimens

It may be beneficial to let "tender" mixes cool for several minutes before trying to remove the bottom paper – but don't wait too long!

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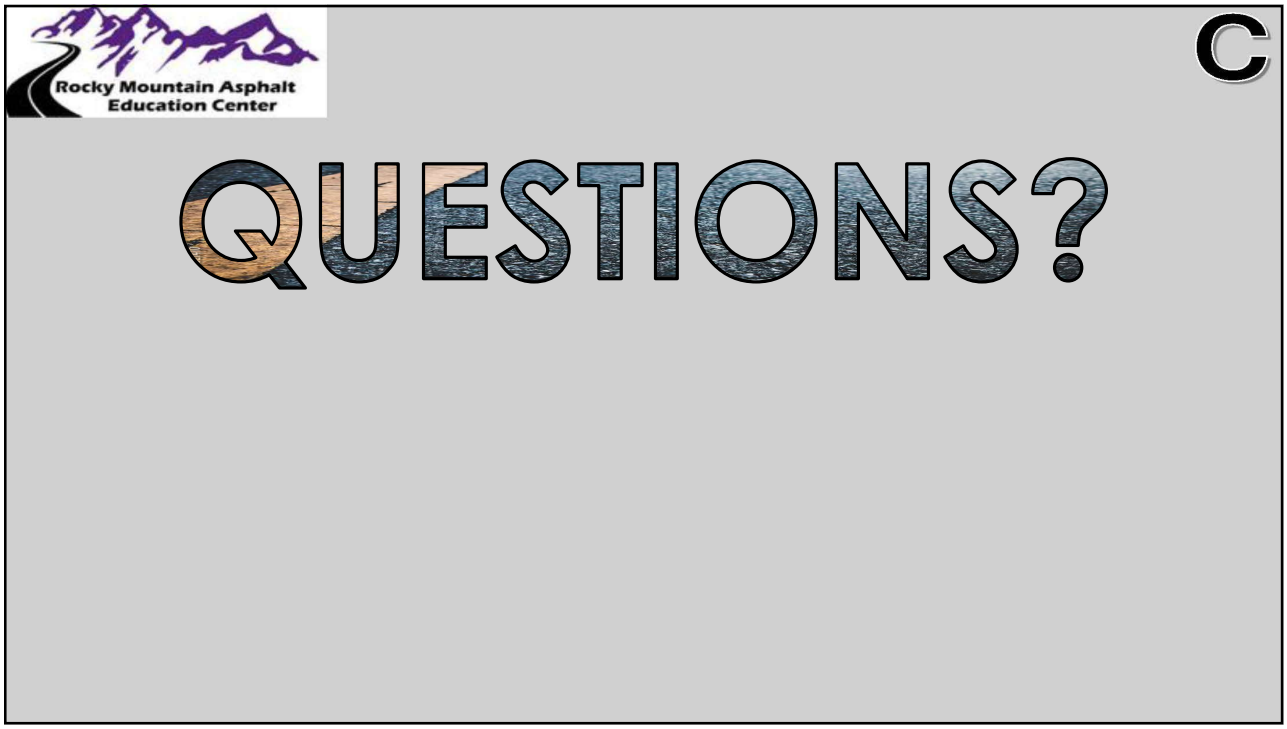
Precision

*"The results of two properly compacted tests on the same material, by the same operator, using the same equipment, should be considered **SUSPECT** if the bulk specific gravities differ by more than 0.020."*

Compare your bulks! – you should be able to have all 3 samples come in much closer than 0.020, often within a few thousandths with repetition and focused effort

16



17

Resistance of Compacted Bituminous Mixture to Moisture Induced Damage "Lottman"

CDOT CP-L 5109

1

Scope

- This method covers the preparation of specimens and measurements of diametral tensile strength, resulting from the effects of saturation and accelerated water conditioning of compacted bituminous mixtures in the laboratory
- Results used to predict long-term stripping susceptibility
- Evaluation of anti-stripping additives

Hydrated Lime is applied to the aggregate blend, or liquid anti-strip is added to the binder

2

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Safety

- ❑ Hot mix - long sleeves and hot gloves
- ❑ Heavy hot molds - appropriate footwear
- ❑ Moving parts in the compactor and the vertical press – hands clear
- ❑ Hot water bath – use caution

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Significance and Use

- ❑ Used both in the development of mix designs in the laboratory and on plant-produced asphalt
- ❑ Acceptance test on CDOT projects
- ❑ Adopted by municipalities for acceptance testing on larger programs

This test is typically run when the "10K sample" comes up – every 10,000 tons on a CDOT project

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Apparatus

- Superpave Gyratory Compactor
- Vacuum Pump
- Manometer
- Scale
- Container

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Apparatus

- Freezer
- Bags, plastic wrap, tape
- Testing Machine (Vertical Press)
- Loading Strips
- Water Bath 140°F
- Water Bath 77°F

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Laboratory Mixed Material

- After mixing – place mix in pan and cool for 2.0 ± 0.5 hours
- Then placed in oven at 140°F ±1.8° (60°C ±1°) for 20 ± 4 hours
- Then placed in oven 2.5 ± 0.5 hours at compaction temperature
- This short-term aging is only required for laboratory mixed samples

Pans having 40-100 square inches of area and 1-3 inches in depth

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Compacting Lottman Pucks

- **Six (6), 100mm** volumetric samples (pucks) will be compacted after the initial three (3) samples were compacted during CP-L 5115
- Samples are compacted to target 7.0% ± 1.0% air voids, using either adjusted sample **HEIGHTS** or adjusted sample **WEIGHTS**
- See section 6.4 to adjust sample weights

To adjust sample heights

$$\frac{\text{(Ave. Bulk SpG @ N(des) x Ave. Ht. @ N(des)}}{\text{(0.925 x Rice)}}$$

8

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Lottman Height Adjustment Calculation

Results are from CP-44 Method A

Results are from CP-L 5115

Results are from CP-51

$$\frac{(\text{Ave. Bulk SpG @ N(des)} \times \text{Ave. Ht. @ N(des)})}{(0.925 \times \text{Rice})}$$

EXAMPLE

Average Bulk SpG:	2.350
Average Heights:	62.9 mm
Max SpG (Rice):	2.570

$$\frac{2.350 \times 62.9 = 147.815}{0.925 \times 2.570 = 2.377} = \textbf{62.2 mm}$$

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Compacting Lottman Pucks

- After the pucks have cooled to room temperature, perform BsG on each and calculate air voids (CP-44 Method A)
- Sort specimens into two subsets of three specimens so that the average air voids of the two subsets are approximately equal

Wet (Treated) Subset

Dry (Untreated) Subset

TABLE 2

Superpave Binder Grade	Lab Mixing Temp.	Lab Compaction Temp.
PG 58-28	310°F (154°C)	280°F (138°C)
PG 58-34	310°F (154°C)	280°F (138°C)
PG 64-22	325°F (163°C)	300°F (149°C)
PG 64-28	325°F (163°C)	300°F (149°C)
PG 70-28	325°F (163°C)	300°F (149°C)
PG 76-28	325°F (163°C)	300°F (149°C)

Samples must be at compaction temperature for a minimum of 15 minutes and not to exceed 4.0 hours

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Dry Subset

- Kept dry and stored at 77°F ±1.0F (25°C ±0.5°C) for several days during treatment of the wet subset
- Must be brought to testing temperature 77°F ±1.0F (25°C ±0.5°C) for 3.5 ± 0.5 hours at the same time as the wet subset before breaking

If you don't have an incubator (low temperature oven), or a 77°F water bath with watertight containers or sealed plastic bags can be used to maintain constant temperature

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Treating the Wet Subset

Saturation

- Place the wet subset in a vacuum container with at least one inch (1") of *"room temperature"* water above the top of the specimens
- Apply 28 ±2mm of Hg (mercury) for a period of 5 ±0.25 minutes
- Release the vacuum slowly and remove the specimens after *"greater than 5 seconds"*

The specimens must either be rested on their side or elevated with some type of spacer underneath

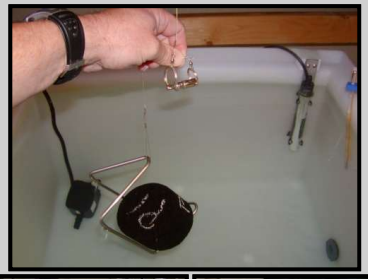
12

Treating the Wet Subset

Saturation and Swell

The results from these calculations are used "for information only"

- Run CP-44 Method A again immediately after removing from the vacuum container
- Record "B Saturated" and "C Saturated" values
- See Section 12 for calculations on Saturation and Swell values



13

Treating the Wet Subset

Dipping, Wrapping, Freezing

- Submerge the specimens underwater for one (1) second (to have them dripping wet again after the SSD condition)
- Wrap tightly with plastic wrap, tape, and into a (labeled) plastic bag
- Place the bag of saturated, wrapped specimens into the freezer for a minimum of 16 hours

14

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Treating the Wet Subset

The 140°F Water Bath

- Remove the sample bag from the freezer, remove the specimens and the plastic wrap and tape
- Place the specimens in the 140°F ± 1.0° (60°C±0.5°) water bath for 24± 1.0 hours

Freezer temperature -2.5°F ± 7.5° (-19°C ± 4°)

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Treating the Wet Subset

The 77°F Water Bath

- Remove the specimens from the 140°F (60°C) water bath
- Place the specimens into the 77°F± 1°) (25°C ± 0.5°) water bath for 3.5 ± 0.5 hours

The water temperature will increase with the introduction of the "hot" specimens" – no more than 15 minutes can pass before the temperature is returned to 77°F

Ice cubes may be used to counter the rising temperature, as needed

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Testing

- Remove each (one at a time) specimen from the 77°F (25°C) incubator (**Dry**) and the 77°F (25°C) water bath (**Wet**) and place between the loading strips and into the testing machine (vertical press)
- Record the maximum compressive strength (PEAK or MAX LOAD)

RATE OF LOADING
0.2"/min

The two subsets of three specimens shall be testing within 30 minutes

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Calculations

TENSILE STRENGTH

EXAMPLES
P = 2,235lbs
t = 2.48"

$$St = \frac{2P}{\pi t D}$$

Where:
S_t = tensile strength, psi,
P = maximum load, pounds,
t = specimen thickness (height), inches, to 0.01 of an inch,
D = specimen diameter, 3.937 inches for 100 mm molds or 5.906 inches for 150 mm molds.

$$\frac{2 \times 2{,}235}{3.1415 \times 2.48 \times 3.937} = \frac{4{,}470}{30.672} = 146$$

TENSILE STRENGTH RATIO

$$\%TSR = (S_2 / S_1) \times 100$$

Where:
S_1 = average tensile strength of dry subset,
S_2 = average tensile strength of moisture conditioned subset

$$146 / 171 = 0.854 \times 100 = 85$$

EXAMPLES
S2 = 146psi
S1 = 171psi

18

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Reporting

- ❑ Average % Air Voids for each subset – nearest 0.1%
- ❑ Dry Average Tensile Strength (S1) – whole number
- ❑ Wet Average Tensile Strength (S2) – whole number
- ❑ Perecent Tensile Strength Ratio (TSR) – whole number

NOTE:
There are specifications provided in this procedure to run this test on 150mm (6") specimens. Be sure to use the values provided on large diameter samples

19

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Resistance to Deformation of Bituminous Mixtures by Means of Hveem Apparatus (Stabilometer)

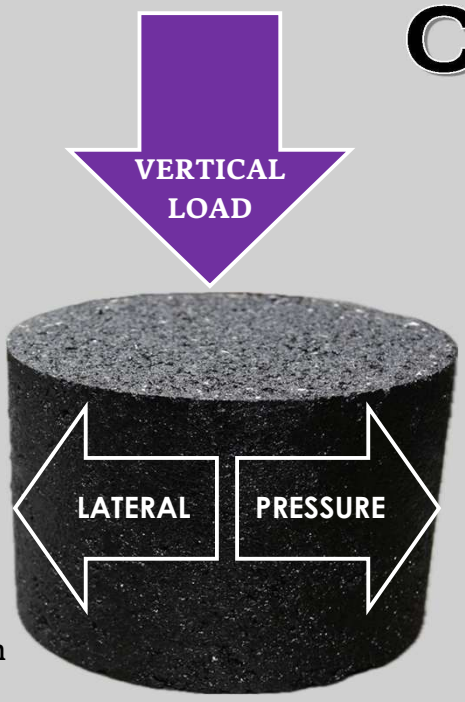
CDOT CP-L 5106

1

Scope

- This method covers the determination of the resistance to deformation of compacted bituminous mixtures by measuring the lateral pressure developed from applying a vertical load by means of the Hveem Stabilometer

100mm specimens only, compacted in accordance with CP-L 5115



2

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Safety

- Hot specimens and equipment – long sleeves and hot gloves
- Heavy hot Stabilometer assembly - appropriate footwear
- Moving parts in the vertical press – hands clear

3

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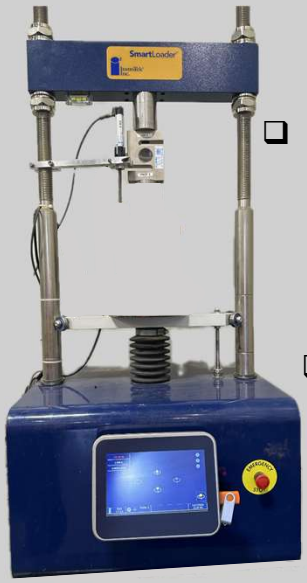
Apparatus

- 140°F Oven
- Testing Machine (Vertical Press)
- Calibration Cylinder
- Follower
- Adjustable Base
- Hveem Stabilometer



4

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Adjustment of the Stabilometer

- Heat the adjustable base, follower, and calibration cylinder to 140°F ±5° (60°C ± 3°)
- Place the Stabilometer on the heated adjustable base

Keep the heated base off the metal work surfaces in the lab

5

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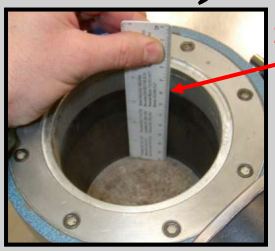
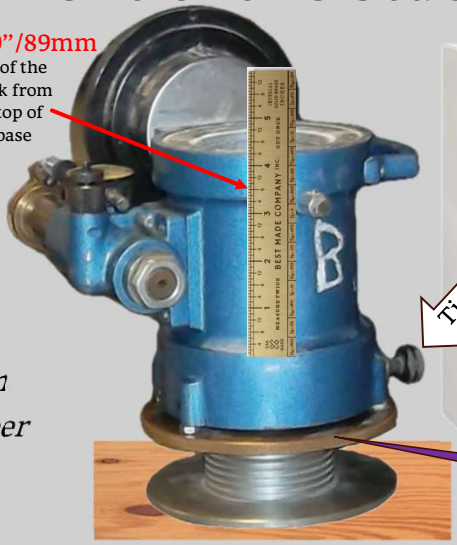
Adjustment of the Stabilometer



3.50"/89mm
Top of the black from the top of the base



Tighten!

- *"Adjust the Stabilometer base so that the distance from the bottom of the upper tapered ring is 89mm (3.50")"*

Turn the brass ring to adjust the height inside the Stabilometer

6

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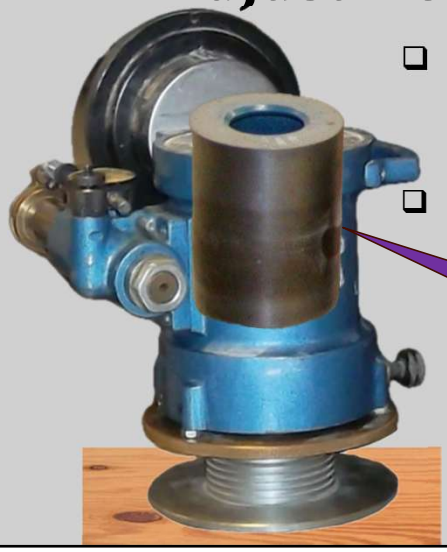
Adjustment of the Stabilometer



- Insert the follower and turn handle clockwise to 20psi
- Allow the needle to stabilize

The pressure needle will continue to rise for approximately 1-2 minutes while heat from the follower is being transferred into the oil in the Stabilometer

7

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Adjustment of the Stabilometer

- Remove the follower and insert the calibration cylinder
- Turn the handle clockwise to 100psi
- Allow the needle to stabilize again above 100psi for a short period

8

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Adjustment of the Stabilometer

- Immediately after the needle stabilizes, reset the pressure to 100psi
- Zero the turns dial indicator (large needle)
- Turn the pump handle smoothly counterclockwise exactly two (2) turns to rest at 5 ±0.5 psi

Adjust the air valve up or down as described in the APPENDIX to rest at 5psi as needed

9

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Adjustment of the Stabilometer

- Approximately monthly – while the calibration cylinder is still in place and the pressure at 5psi, measure the exposed piston 2.8 ± 0.2” (71.0 ± 5.0mm)

2.8 ± 0.2”

Add or remove oil as necessary to maintain this horizontal measurement

10

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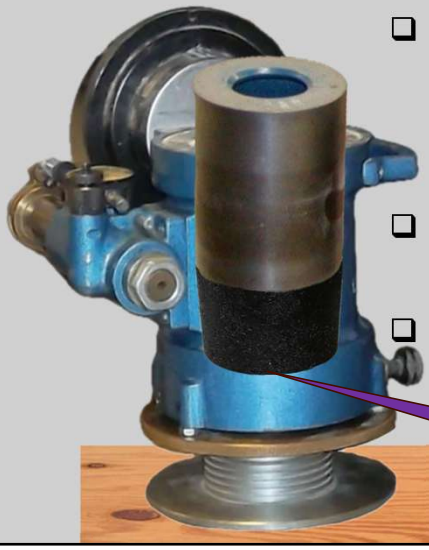
Procedure



- Bring the specimen to 140˚F ±5˚ (60˚C ± 3˚) for 2-24 hours using a forced-draft oven
- Insert the heated specimen and the follower
- Set the horizontal pressure to exactly 5psi

Talcum powder or similar can be used as a bond-breaker on the specimen

11

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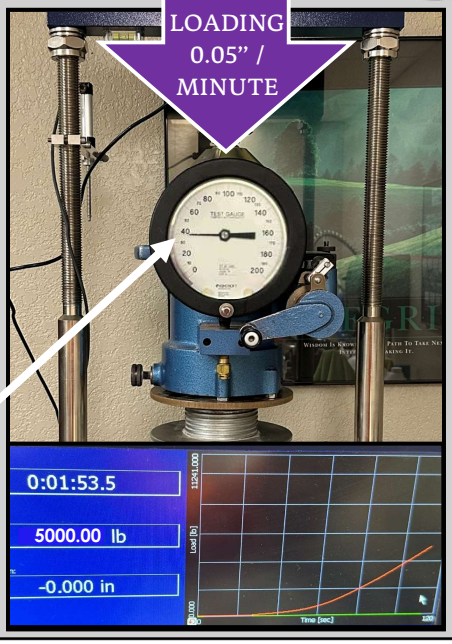
Procedure

- Place the loaded Stabilometer in the compression testing machine (centered)
- Start the vertical movement, and stop it when the vertical load reaches 5,000lb
- Record the horizontal pressure **(Ph)** at exactly 5,000lb vertical load

RATE OF LOADING 0.05" / MINUTE



EXAMPLE
Ph = 37

12

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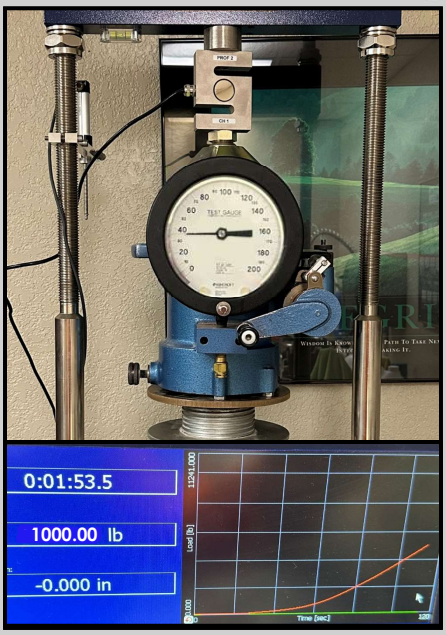
Procedure

- Reduce the vertical load to 1,000lb
- Reset horizontal pressure back to 5psi (going slightly below 5 and back up to it)



13

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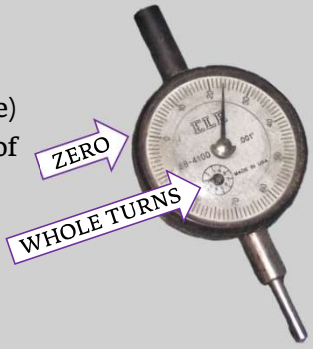
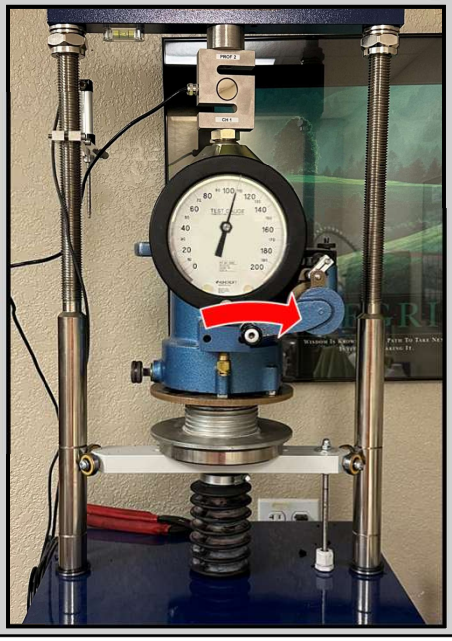
Procedure

- While vertical load holds at 1,000lbs:
- Zero the turns dial (big needle) and take note of the number of "whole turns"
- Turn the pump handle clockwise at a rate of "2 turns per second" and record the number of turns (**D**) it took to reach 100psi



EXAMPLE
D = 2.60



14

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Calculations

$$S = \frac{22.2}{[(P_h \times D)/(P_V - P_h)] + 0.222}$$

EXAMPLE
Ph = 37
D = 2.60
Pv = 410 (always)

$$\frac{37 \times 2.60 = 96.2}{410 - 37 = 373.0} = 0.258 + 0.222 = \frac{22.2}{0.480}$$

S = 46

S = Stabilometer value,
P_h = horizontal pressure, for corresponding P_v in kPa (or psi),
D = displacement on specimen,
P_v = Vertical pressure (typically 2830 kPa (410 psi) for Superpave

15

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Height Correction

- Calculate a height correction for each sample using these two formulas

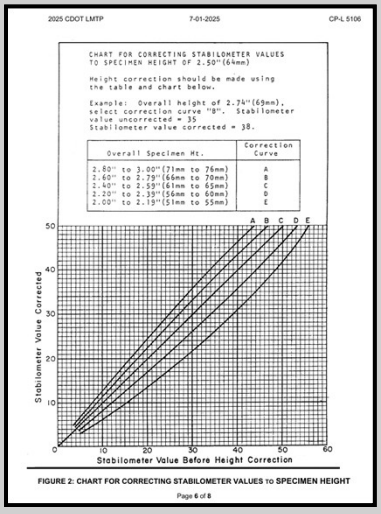
For specimen heights greater than 2.5"

$C = (H - 2.5) \times (0.107 + 0.786S - 0.009886S^2)$

For specimen heights less than 2.5"

$C = (H - 2.5) \times (0.15 + 1.10S - 0.01384S^2)$

C = correction factor added to the stability value calculated in Subsection 6.1.
S = Stabilometer value,
H = specimen height in inches to 0.1.



16

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QUESTIONS?

17