

Chip Seal and Asphalt Basics

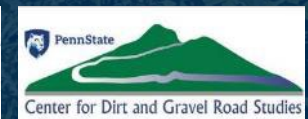


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PA DGLVR Workshop

9/22/22



Chip Seal and Asphalt Basics



- **DGLVR Program Policy & Requirements**
- Chip Seal Basics
- Scotia Range Road Example
- Asphalt Basics

Paying for Asphalt or Other Surfacing (7.4.2.1 - LVR)

Resurfacing costs can be considered by a district as a component part of a larger ESM project.

All ESM Practices must be addressed first!

- Drainage issues
- Base instability issues
- Other necessary and appropriate issues such as bank stability, road entrenchment, vegetation, etc.

Paying for Asphalt or Other Surfacing (7.4.2.1 - LVR)

Local Control!

It is at the discretion of individual districts and QABs whether resurfacing costs (sealing or paving) will be funded through the Program, either on individual projects or as countywide policy.

Paying for Asphalt or Other Surfacing (7.4.2.1 - LVR)

The use of petroleum solvent based “cutback asphalts” such as MC-30 and MC-70 are NOT allowed for use in the Program



More on materials selection later!

Surfacing *Unpaved* Road (7.4.2.2)

Dirt and Gravel Roads may not be converted to “tar and chip” or asphalt without Commission Approval.

- *Program funded projects & in-kind must follow Program Policies*
- *Eligible entities may choose to seal or pave a DGR project with their own funds*

Approved Products

All Program funded paving or sealing projects must follow the requirements of the Product Approval Instructions.

PA Dirt, Gravel, & Low-Volume Road Maintenance Program Product Approval Instructions

Created by the PA State Conservation Commission and the PSU Center for Dirt and Gravel Road Studies



PART III: TESTING APPLICABILITY

The product testing procedure outlined in this document is intended to test liquid or granular products, such as dust palliatives and soil stabilizers, which are applied to the wearing course or incorporated into the wearing course or the road base. Materials commonly used in the process of road building and road drainage are not subject to the testing procedure, including natural materials used as road fill.

Wearing Course Materials Approved for Use in the Program –

Driving Surface Aggregate is the only aggregate approved for the use of Dirt, Gravel and Low Volume Roads Program funding and must conform to SCC specifications.

Asphalt and Chipseal are the only paving or sealing materials approved for the use of Low Volume Road Program funding and must conform to PennDOT Pub 408 or Pub 447.

DGLVR Program Policy & Requirements

Approved Products

Asphalt and Chipseal are the only paving or sealing materials approved for the use of Low Volume Road Program funding and must conform to **PennDOT Pub 408 or Pub 447**.



PennDOT PUB 447



PennDOT PUB 408

Chip Seal and Asphalt Basics



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Chip Seal: A surface treatment where pavement or aggregate is sprayed with an emulsified asphalt and immediately covered with aggregate and rolled in place.

- Originally designed as a way to prolong the life of pavements
- Cost effective compared to resurfacing
- Extends surface life
- Restores surface friction
- Seals cracks and imperfections
- Not for use on distressed or failing pavement →



Asphalt

- Viscous black liquid, fractional distillation of oil (a by-product of oil refining process)
- Contains numerous organic compounds
- Applications: road construction, roofing shingles, waterproofing



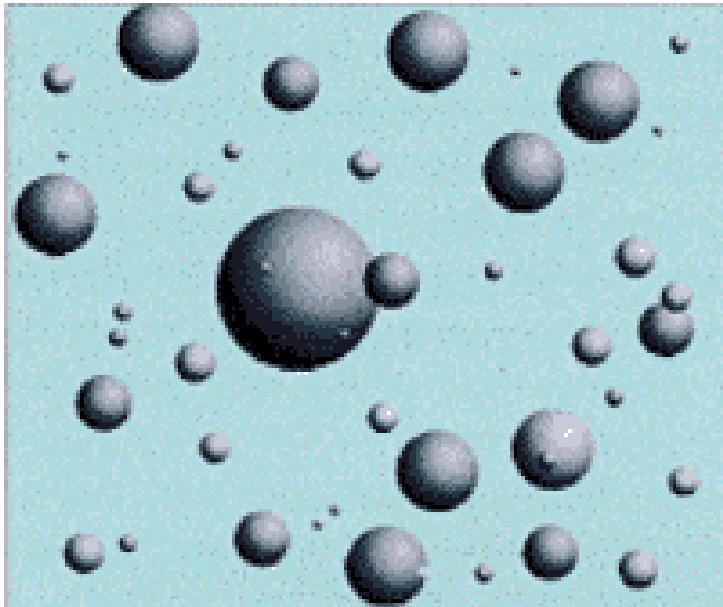
Fractional Distillation: Separating volatile components of a mixture (oil) from one another by heating the mixture in a column and collecting and condensing the vapors drawn from different levels of the column.

Asphalt Binders

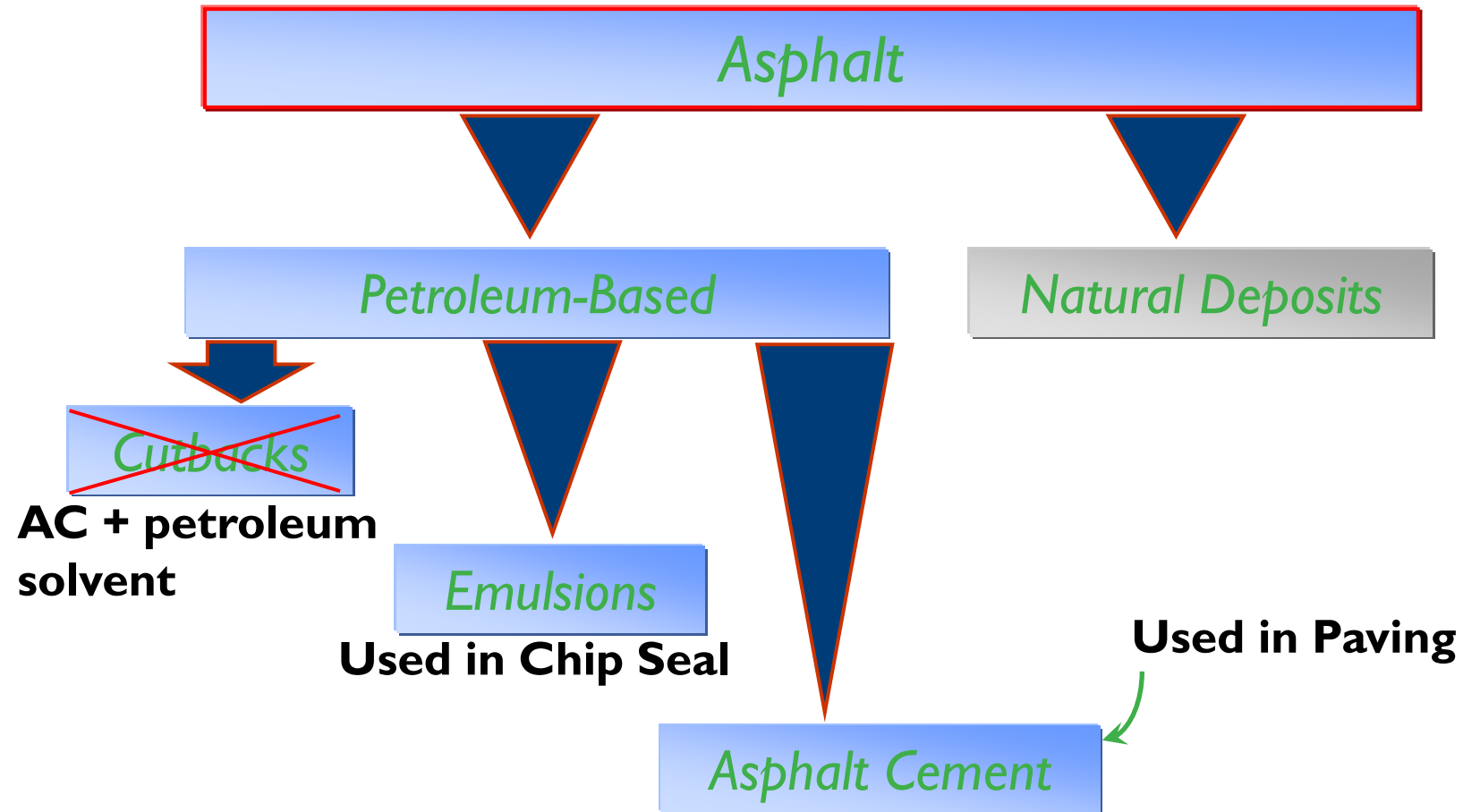
- Terms for Binders:
 - Neat Binder (Unmodified)
 - Asphalt, Asphalt Cement, Asphalt Binder
 - Bitumen, Virgin Binder
 - Modified Binder
 - Polymer Modified Binder (PMB)
 - Crumb Rubber Modified Binder (CRM Binder)
 - Fiber re-enforced Binder
- Emulsions – Often used in chip seal and primers
- Cutbacks – **NOT Allowed in the Program!**

Asphalt Emulsions

Finely divided asphalt droplets, dispersed in a water phase using an emulsifier (chemical stabilizer)



Chipseal Basics



Preparing the road

- If sealing an existing low volume paved road, the road should be prepared by sweeping to remove fines.
- If sealing a D&G road with SCC approval, the road should be graded and prepared with proper crown (2-4% for sealed surface).
- Recommended minimum of a double chip seal.

Reminder: Prior to beginning any Program funded Chip Seal job all ESM practices must be completed

- 1) Emulsified asphalt is then applied to the road using a special spray truck.
- 2) Immediately after applying the emulsion, a layer of crushed gravel is applied by a spreader.
- 3) Next, the gravel is compacted and embedded into the asphalt by rubber-tired rollers.
- 4) Chip seal can require up to two days to cure properly and evaporate the remaining water in the emulsion.
- 5) After curing, the loose gravel is swept off the surface. This may take several sweepings.

Chipseal Methodology

1) Emulsified asphalt is then applied to the road using a special spray truck.

Class of Material	Type of Material	Application Temperature F	
		Minimum	Maximum
RS-2PM	Polymer-Modified Emulsified Asphalt	140	175
CRS-2PM	Polymer-Modified Cationic Emulsified Asphalt	140	175
HFRS-2PM	Polymer-Modified High Float Emulsified Asphalt	140	175
RS-2 ⁽¹⁾	Emulsified Asphalt	140	175
CRS-2 ⁽¹⁾	<u>Cationic Emulsified Asphalt</u>	140	175
HFRS-2 ⁽¹⁾	<u>High-Float Emulsified Asphalt</u>	140	175

(1) Only for use on municipal projects and State projects approved by the District Executive in writing.



Cationic = positively charged

Chipseal Methodology

2) Immediately after applying the emulsion, a layer of clean crushed gravel is applied by a spreader.

TABLE 1 (Continued)								
Standard Sizes of Coarse Aggregate								
Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent								
Size No.	Nominal Size Square Openings	3/4 inch	1/2 inch	3/8 inch	No. 4	No. 8	No. 16	No. 50
67	3/4 inch to No. 4	90 to 100	-	20 to 55	0 to 10	0 to 5		
68	3/4 inch to No. 8	90 to 100	-	30 to 65	5 to 25	0 to 10	0 to 5	
7	1/2 inch to No. 4	100	90 to 100	40 to 70	0 to 15	0 to 5		
78	1/2 inch to No. 8	100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5	
8	3/8 inch to No. 8	-	100	85 to 100	10 to 30	0 to 10	0 to 5	



Typically used in single or double layer chip seal



Chipseal Methodology

3) Next, the gravel is compacted and embedded into the asphalt by rubber-tired rollers.



Chipseal Methodology

- 4) Chip seal can require up to two days to cure properly and evaporate the remaining water in the emulsion.
- 5) After curing, the loose gravel is swept off the surface. This may take several sweepings.



When does Chip Seal make sense for a D&G road?

- High traffic areas (>250 cars/day)
- Heavy loads (i.e. agricultural areas)
- Long steep grades (>8-10%)
- Aprons off paved roads

Reminder - *Dirt and Gravel Roads may not be converted to “tar and chip” or asphalt without Commission Approval.*

Chip Seal and Asphalt Basics



- DGLVR Program Policy & Requirements
- Chip Seal Basics
- **Scotia Range Road Example**
- Asphalt Basics

Scotia Range Road

Scotia Range Road is a 3.1-mile-long road near State College that is owned by the PA Game Commission (PGC) and accesses a shooting range.

- DSA placed in 2012
- Heavy loads from timber sales
- ~80 cars/day with higher volumes around hunting seasons and special events
- Demonstration project to test Chip Seal treatments

Scotia Range Road

Bid and materials requirements followed PennDOT Pub 447

Class of Material	Type of Material	Application Temperature F	
		Minimum	Maximum
RS-2PM	Polymer-Modified Emulsified Asphalt	140	175
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(1) Only for use on municipal projects and State projects approved by the District Executive in writing.

Double Coat - 2 layers of #8

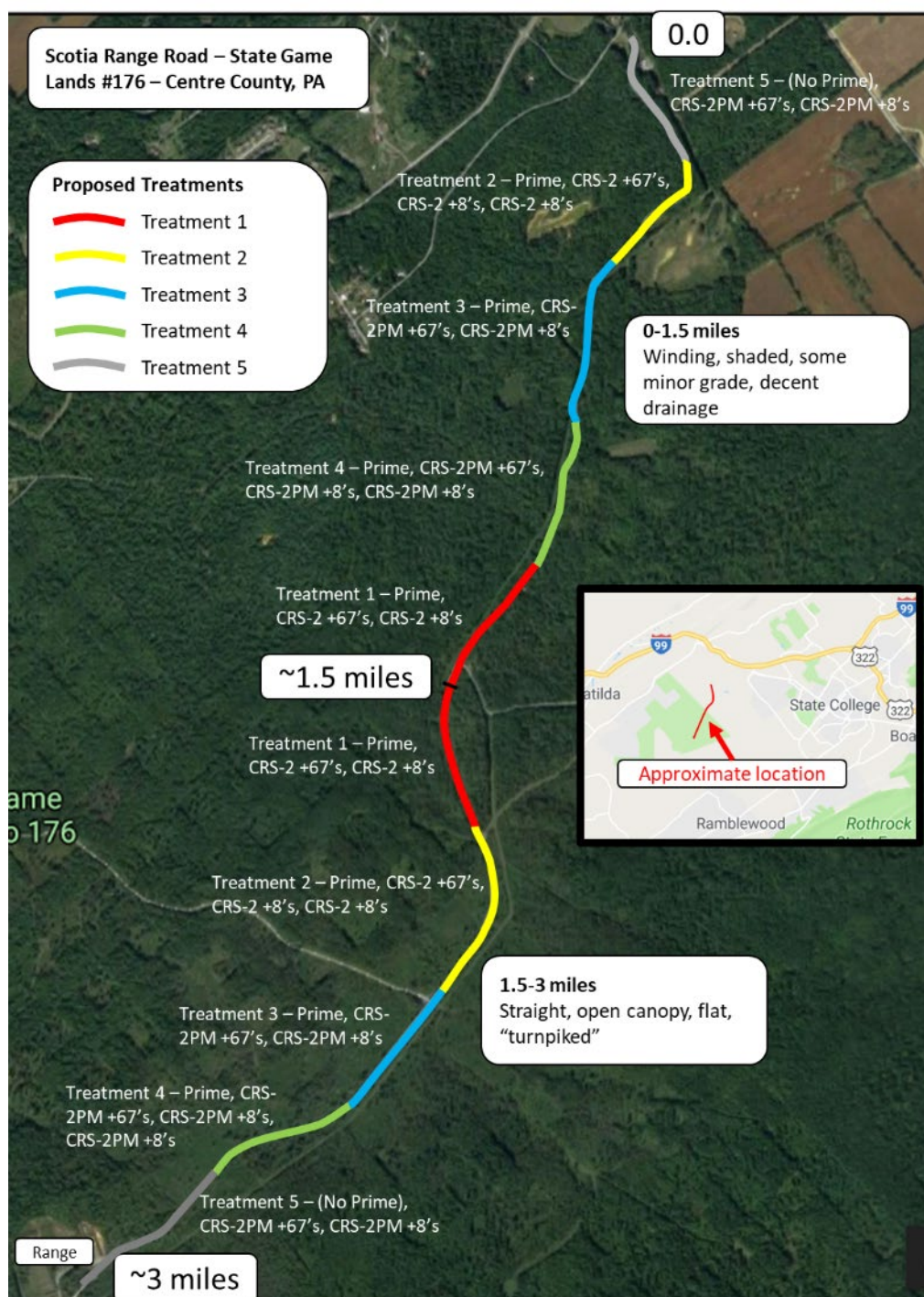
Triple coat - 1 layer #67 and 2 layers #8

Tested both CRS-2 and CRS-2PM

TABLE 1 (Continued)
Standard Sizes of Coarse Aggregate

Amounts Finer than Each Laboratory Sieve (Square Openings), weight percent

Size No.	Nominal Size Square Openings	3/4 inch	1/2 inch	3/8 inch	No. 4	No. 8	No. 16	No. 50
67	3/4 inch to No. 4	90 to 100	-	20 to 55	0 to 10	0 to 5		
68	3/4 inch to No. 8	90 to 100	-	30 to 65	5 to 25	0 to 10	0 to 5	
7	1/2 inch to No. 4	100	90 to 100	40 to 70	0 to 15	0 to 5		
78	1/2 inch to No. 8	100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5	
8	3/8 inch to No. 8	-	100	85 to 100	10 to 30	0 to 10	0 to 5	



Scotia Range Road

Completed in June 2019 as a demonstration project to test different combinations of chipseal thickness and emulsions. Tour stop during 2019 workshop.

- ~3 mile long road with 7 year old DSA
- Five Treatment options
- Repeated treatments in shaded and open sections
- Tested “traditional” emulsions and Polymer Modified emulsions
- Tested both priming the road and no prime
- Tested both double and triple coat

Scotia Range Road

Road prepped by PGC to set crown and remove potholes



Scotia Range Road

Sections with E-1 (Pub 447) prime coat sprayed day before



Five Treatments repeated in Shade and Open Sections



#67 base of triple layer



#67 base left with #8 topcoat right

Five Treatments repeated in Shade and Open Sections



#67 base of triple layer



#67 base left with #8 topcoat right

Scotia Range Road

Five Treatments repeated in Shade and Open Sections



Scotia Range Road

How is the road holding up?

2019



2021



2022



Scotia Range Road

How is the road holding up?

2019



2021



2022



Scotia Range Road

How is the road holding up?

Potholes



Edge cracking



Edge berms



Overall, very minor issues and most correspond to grading imperfections prior to chipseal

Chip Seal and Asphalt Basics

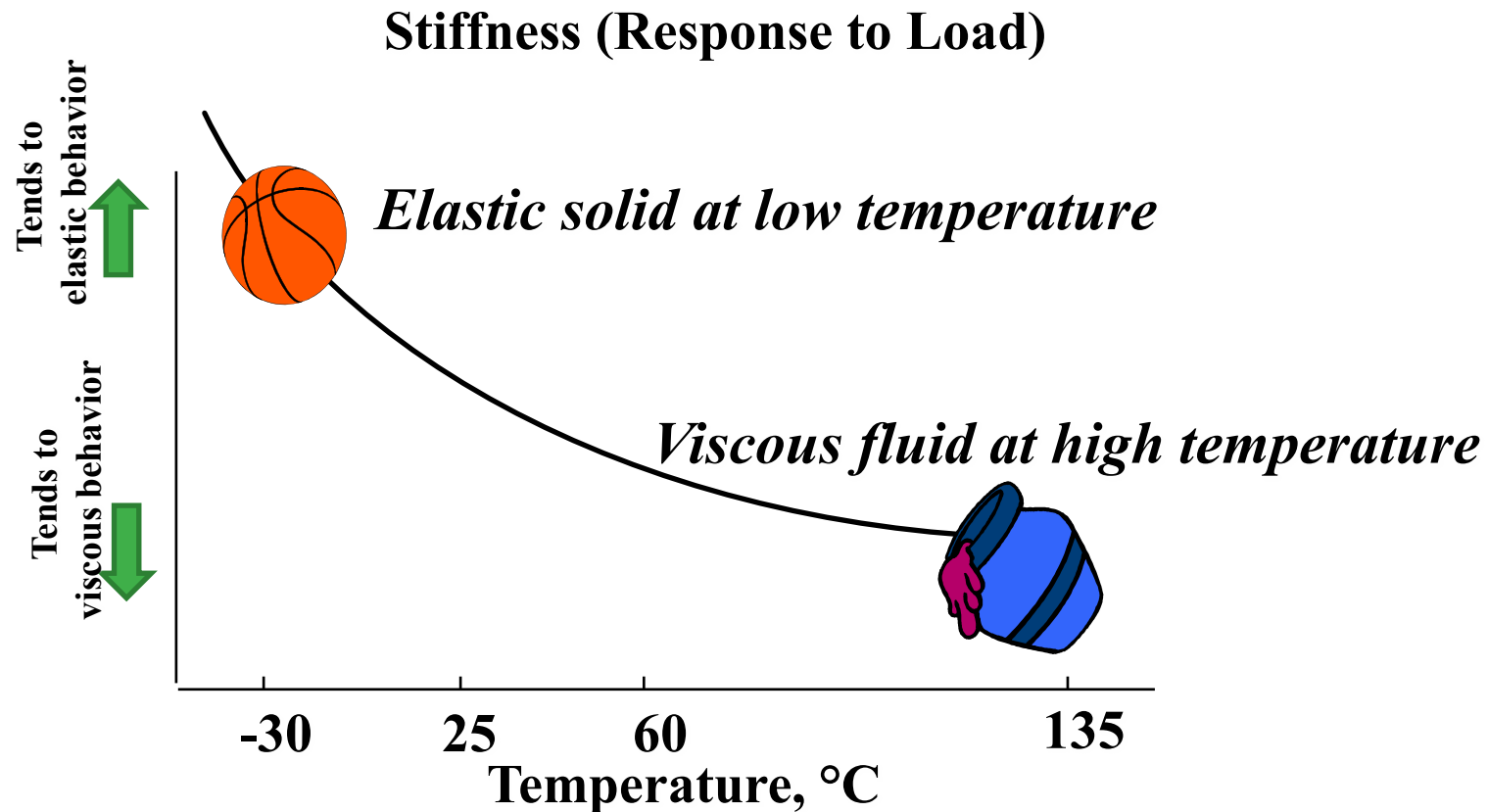


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Asphalt Pavement: Is a mixture of aggregates, binder and filler, used primarily for constructing and maintaining roads and parking areas.

- Designed to be a durable, long lasting driving surface
- Generally cost effective compared to concrete (oil price dependent)
- Provides a smooth running surface
- Can be recycled

Asphalt Properties highly depend on Temperature



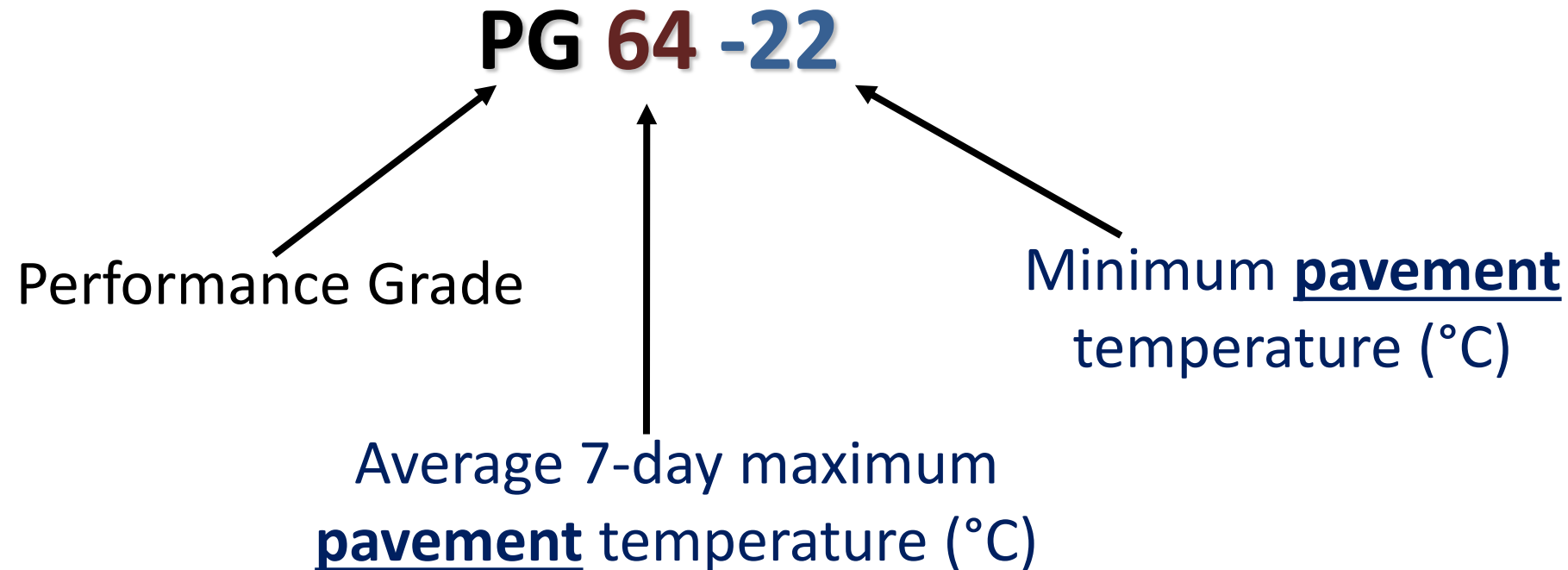
Asphalt hardens with time due to loss of volatile components and oxidation.

- **With aging, asphalt becomes**
 - Hard
 - Highly viscous
 - Brittle



Superpave Asphalt Binder Specification

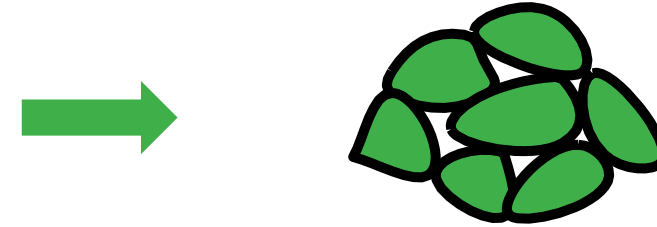
The binder designation is based on expected **extremes** of hot and cold pavement temperatures.



Asphalt Basics

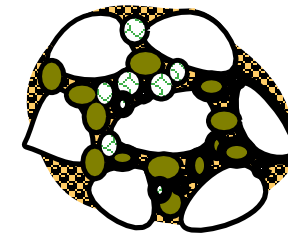
* Uniformly graded

- Particles of almost the same size
- Few points of contact
- Poor interlock (shape dependent)
- High permeability



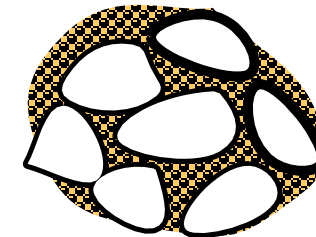
* Well graded (Dense Graded)

- Particles of all sizes
- Good interlock
- Low permeability



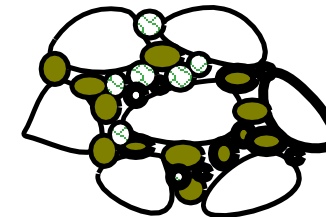
* Gap graded

- Gap in mid range sizes
- Good interlock
- High or Low permeability



* Open graded

- Extremely low content of very fine size
- High permeability



Prior to beginning any Program funded asphalt paving job all ESM practices must be completed.

- If paving an existing low volume paved road, the road should be prepared by sweeping to remove fines and a tack coat used.
- If sealing a D&G road with SCC approval, the road should be graded and prepared with proper crown (2-4% for sealed surface)

Chipseal Methodology

- 1) Asphalt pavement delivered to site from batch plant
- 2) Tack coat placed if paving over existing asphalt
- 3) Asphalt placed with a motorized paver (2-4% slope)
- 4) Asphalt compacted with a smooth, double drum roller

Chipseal Methodology

1) Asphalt pavement delivered to site from batch plant



Delivery of asphalt mix to paver



Delivery of asphalt mix to materials transfer vehicle

Chipseal Methodology

2) Tack coat placed if paving over existing asphalt



Chipseal Methodology

3) Asphalt placed with a motorized paver (2-4% slope)



Chipseal Methodology

4) Asphalt compacted with a smooth, double drum roller



Questions?



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