Alaska Department of Transportation & Public Facilities

Comparing 401 and 408 Hot Mix Asphalt (and other things)

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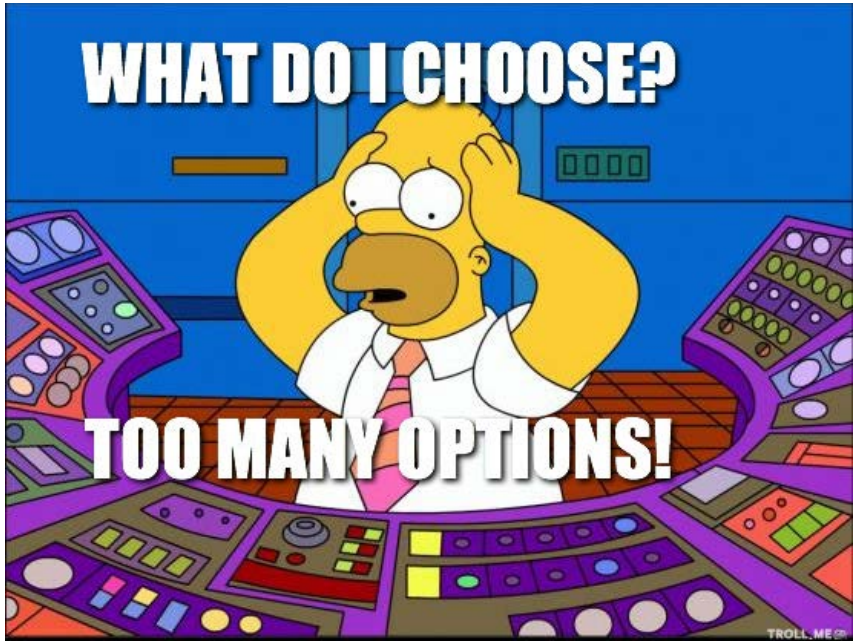
Keep Alaska Moving through service and infrastructure

What We Will Cover

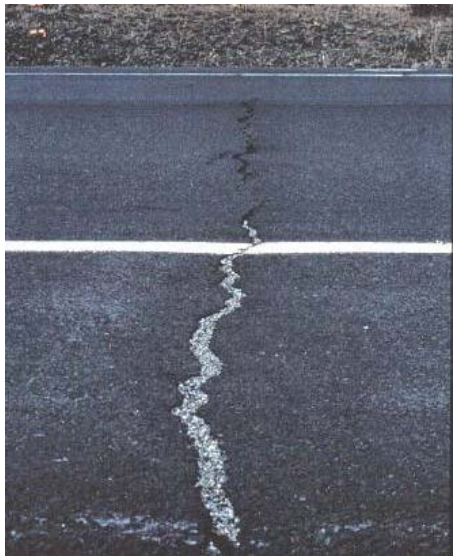
- Differences Between HMA Types
  - Type II
  - Type IV
  - Type V
- Differences Between HMA Classes
  - Class A
  - Class B
- Differences Between Oils
  - PG 52-28, PG 52-40, etc.
- Why Do We Pick What We Do?



Existing Road Condition

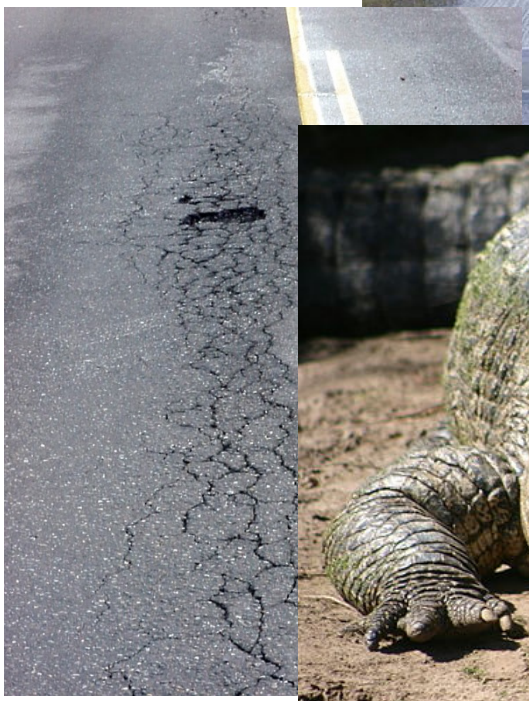
- Why are we doing this project?
- What are the problems with the road?

- Why is the road in this condition?



Existing Road Condition Cont.

- Rutting
  - Studded Tire Wear
  - Shoving/Deformation



- Fatigue Cracking

Project Location

- Where is the project?
  - Urban
  - Rural

- Traffic Conditions?
  - AADT
  - Speed
  - Static Loading

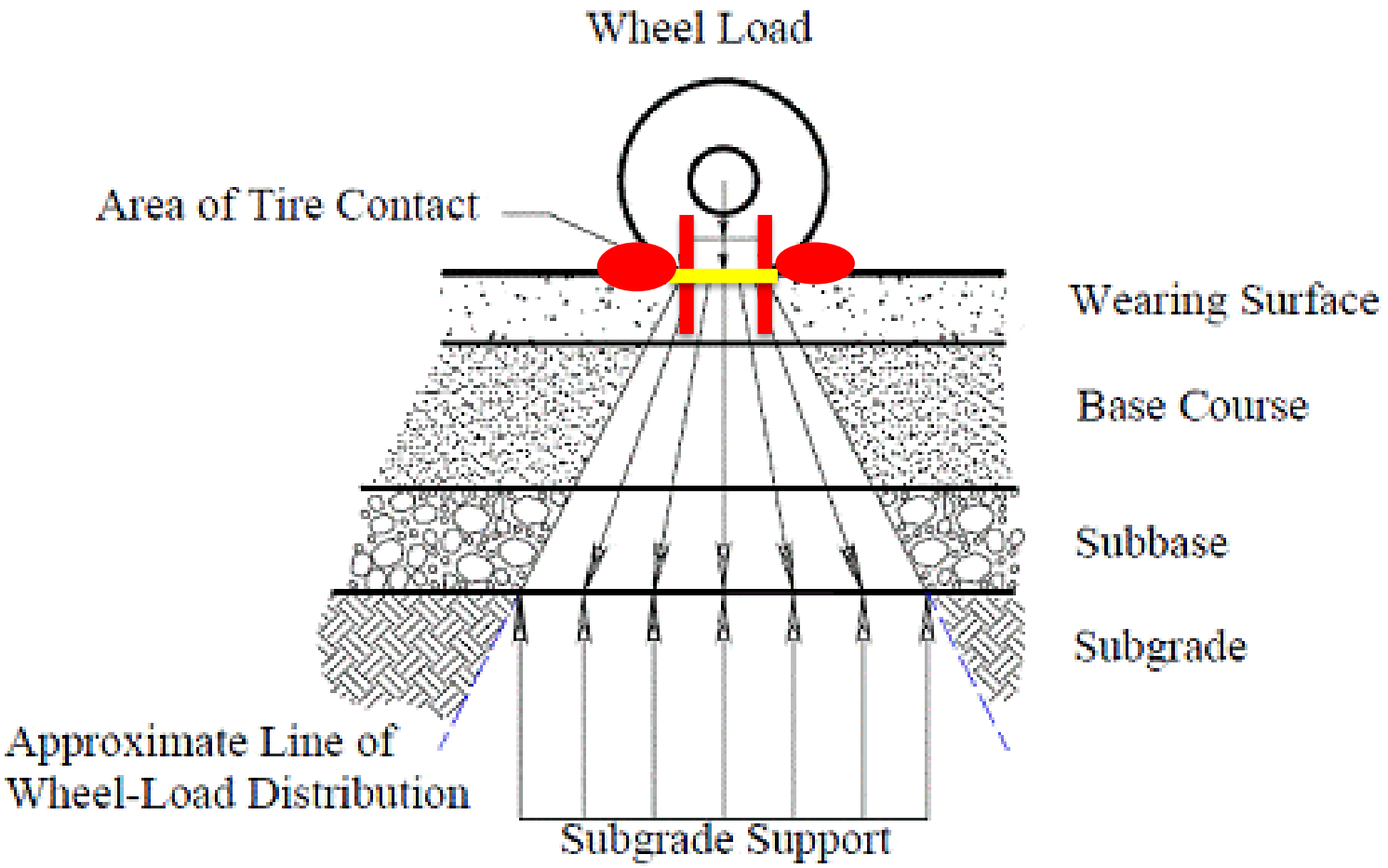
What We Know

- Project Location
- Existing Road Condition

What We Need

- Resist vertical compressive stress
- Shear Stress
  - These resist permanent deformation
- Horizontal Tensile Stress (at bottom of HMA)
  - Resists alligator cracking

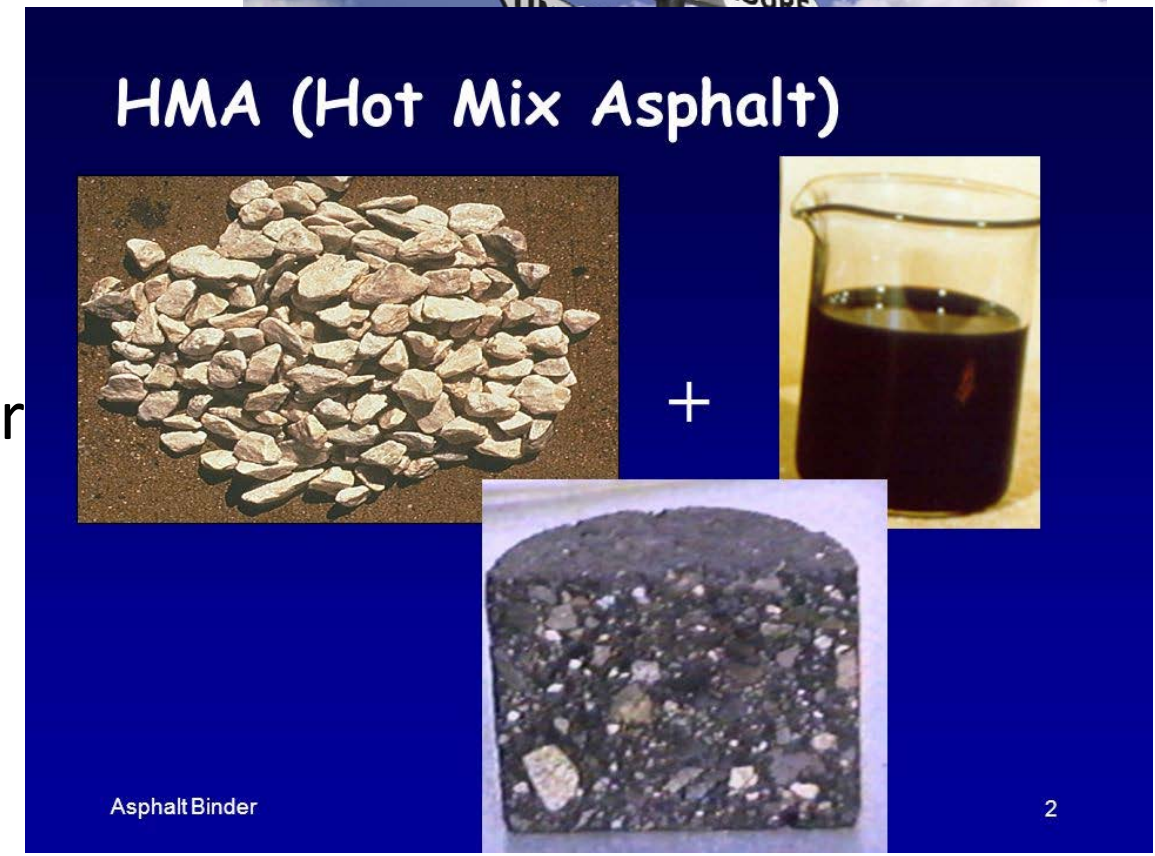
Pavement Loading



Types of HMA

- Types of HMA
  - Type II
  - Type IV
  - Type V

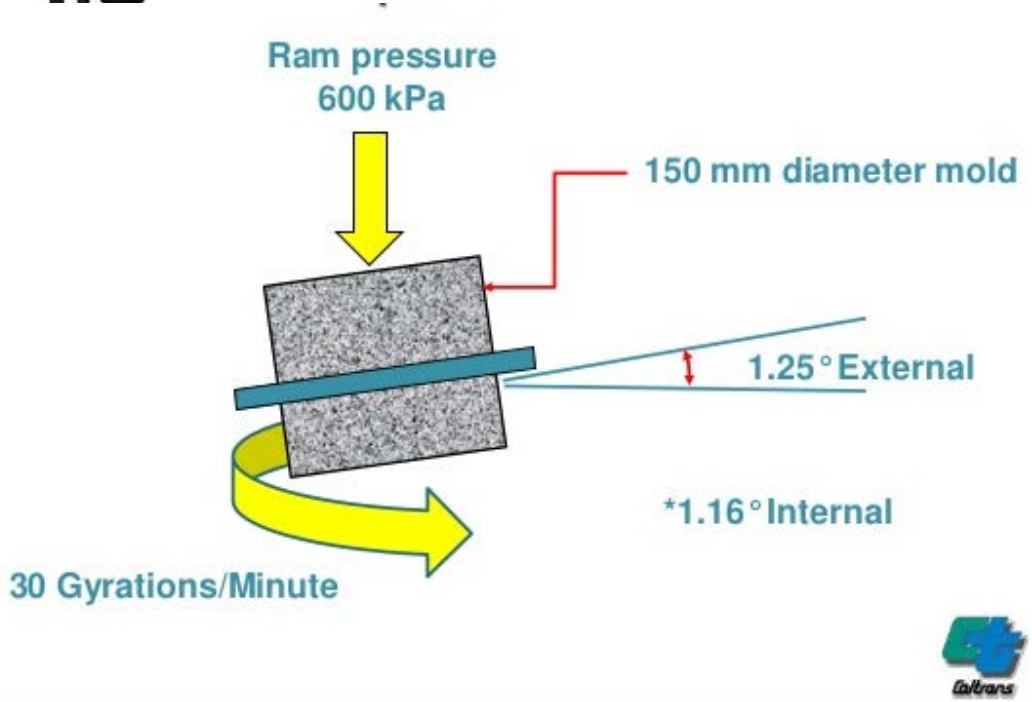
- Classes of HMA - for Type II & IV
  - Class A
  - Class B



Differences Between HMA Types

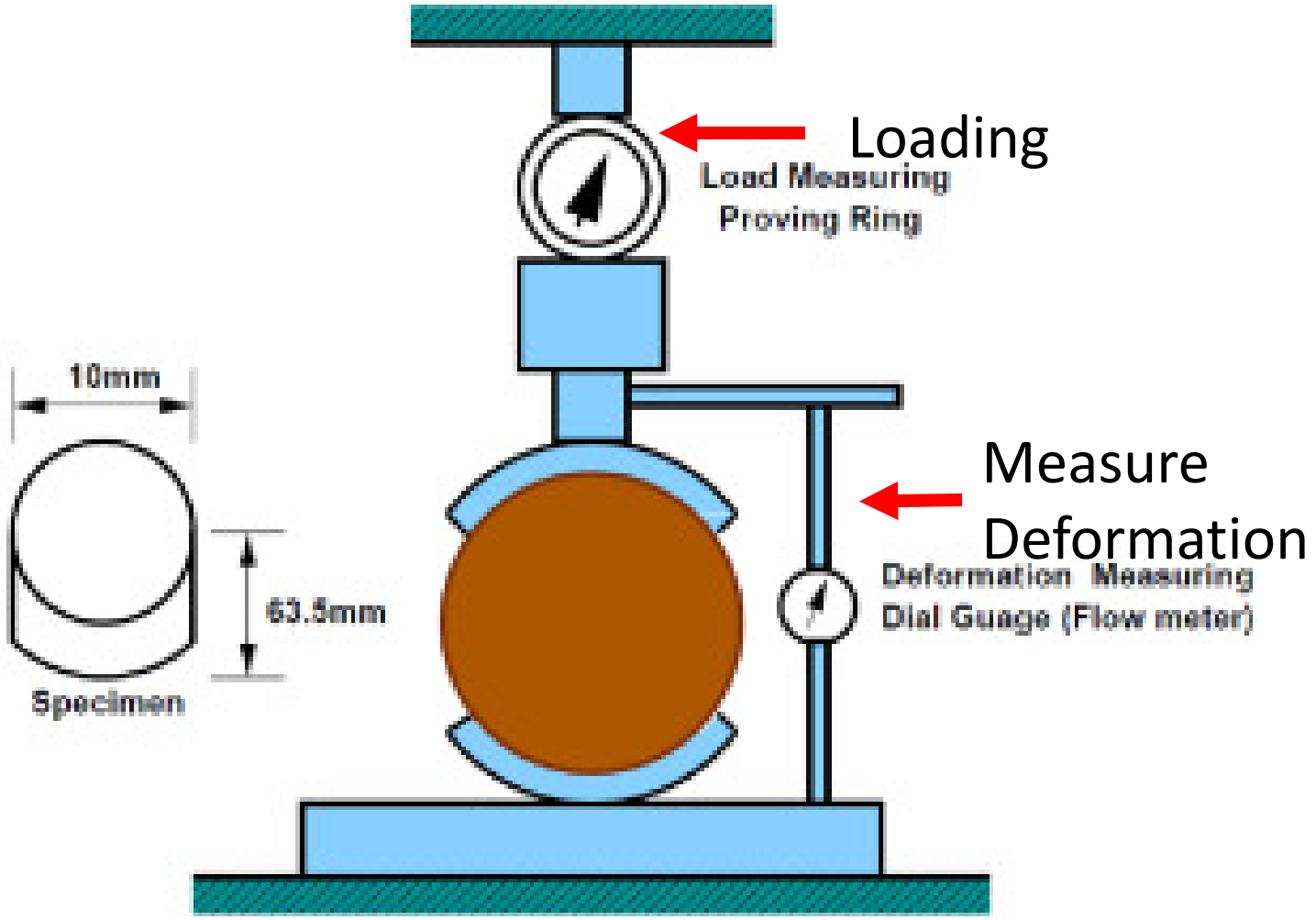
- Marshall Mix Design
  - Type II
  - Type IV

- **Su**perior **Per**forming Asphalt **Pave**ments (Superpave) – Type V



Differences Between HMA Types Continued

- Marshall (401)
  - Determine optimum asphalt binder content
    - Prepare samples at varying binder contents
    - Asphalt binder content corresponds to 4% air voids
  - Test Stability and Flow
    - Stability is peak load
    - Flow is deformation


Loading
Load Measuring
Proving Ring
10mm
63.5mm
Specimen
Measure
Deformation
Deformation Measuring
Dial Guage (Flow meter)

Differences Between HMA Types Continued

- Type II vs. Type IV – Gradation
  - Type II ¾” Aggregate
  - Type IV 3/8” Aggregate

Class A

- 15% RAP
- 75 Blow Marshall
  - 1% Lower Oil Than Class B
- Stricter Stability/Flow

Class B

- 25% RAP
- 50 Blow Marshall
  - 1% Higher Oil than Class A
- Lower Fracture

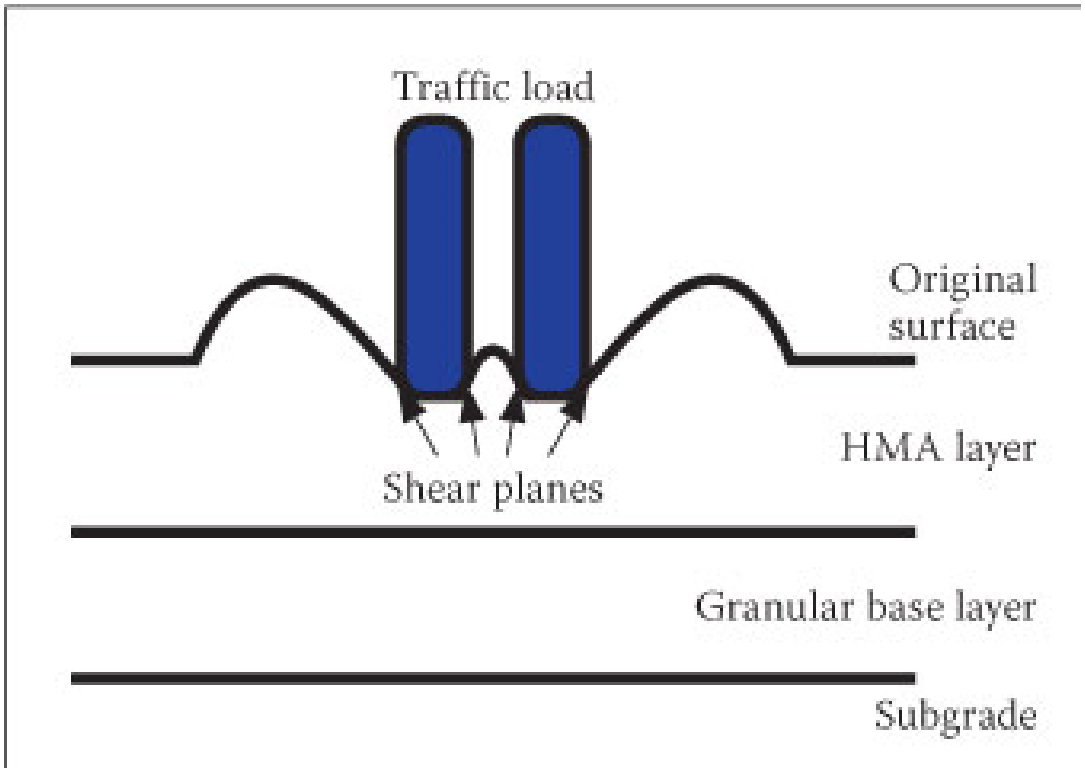
Differences Between HMA Types Continued

- Superpave (408)
  - Coarse & fine aggregate angularity
  - Volumetric test (no stability / flow)
  - Prepare samples – two at proposed asphalt content, two above, two below
  - Gyrate (compact) samples
  - Select optimum binder content at 4% air voids

We do have a rut index test for deformation

Differences Between HMA Types Continued

- Why use rut index?
  - Resist deformation



Primary Differences

	Type II, Class A	Type II, Class B	Type IV	Type V (Superpave)
Fracture, %	90, 2 Face	**80, 1 Face**	90, 2 Face	**98**, 2 Face
Compaction	Marshall 75 Blows	Marshall 50 Blows	Marshall 50 Blows	Gyratory
RAP, %	15	25	25	**0**
Nordic, %	-	-	-	**8**
Mat Density, %	92	92	92	**93**
Cost	Intermediate Cost	Cheapest	Typically Pre-Level	Most Expensive

HMA Selection

Do You Have?	You Need
Heavy Static Loading	Resist Compressive/Shear Forces
High Speed Traffic	Resist Studded Tire Wear (High Density/Hard Aggregate)
High Traffic Volumes	
High Stud Use	
Heavy Stop/Go Traffic	Resist Shoving/Plastic Deformation

Consider Using Type V

HMA Selection Continued

Do You Have?	You Need
Moderate Static Loading	Resist Compressive/Shear Forces
High/Moderate Speed Traffic	Resist Studded Tire Wear
Moderate Traffic Volumes	
Moderate Stud Use	
Moderate Stop/Go Traffic	Resist Shoving/Plastic Deformation

Consider Using Type II, Class A

HMA Selection Continued

Do You Have?	You Need
Low/No Static Loading	Resist Compressive/Shear Forces
Low/Moderate Speed Traffic	Resist Studded Tire Wear
Low Traffic Volumes	
Low Stud Use	
Limited Stop/Go Traffic	Resist Shoving/Plastic Deformation

Consider Using Type II, Class B

But Wait, There's Oil Too!

- Even more choices!
  - Type II, Class B, PG 52-28
    - Or maybe 52-40?
      - No… 52-34?
        - » Dangit… 64-40!?
- So how do you make the right choice?
  - Understand what the numbers mean
  - Like with HMA, know your project conditions

What Do the Numbers Mean?

- PG is <u>Performance Grade</u>

- The idea is the binder properties relate to the conditions its used

Increasing stiffness

Thermal cracking, Low Temperature, °C	High Temperature, °C: 52	58	64	70	76
-16	52-16	58-16	64-16	70-16	76-16
-22	52-22	58-22	64-22	70-22	76-22
-28	52-28	58-28	64-28	70-28	76-28
-34	52-34	58-34	64-34	70-34	76-34
-40	52-40	58-40	64-40	70-40	76-40

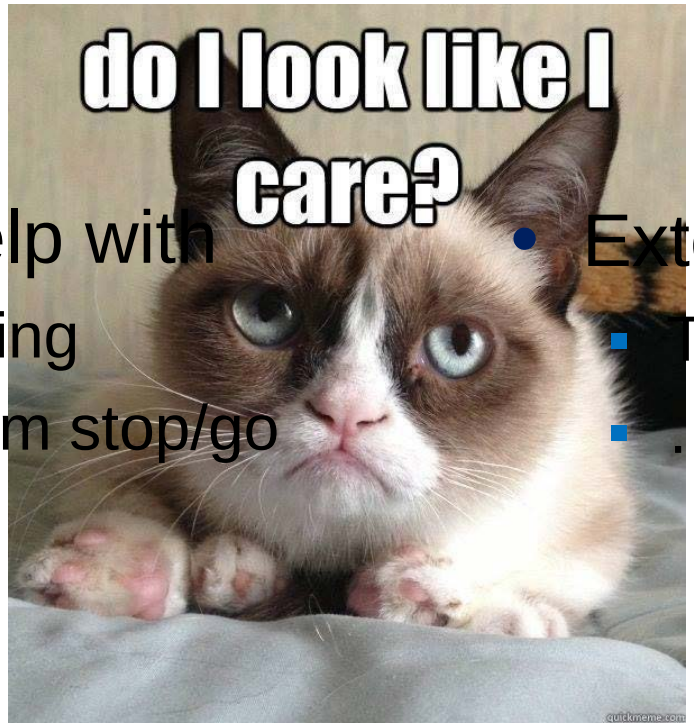
= Crude Oil
= High Quality Crude Oil
= Modifier Required

What is a modifier?

- Polymer
- Extender

OK, So What?

- Polymers Increase
  - Stiffness
  - Elasticity
- Extenders Improve
  - Low temperature performance



- Polymers help with
  - Static Loading
  - Shoving from stop/go traffic
- Extenders Help With
  - Thermal cracking
  - …and rutting?

Choose Oil for the Mix

- Project Conditions
  - High speed
  - High AADT (studs)
  - Heavy Loading
  - Stop/Go Traffic
- PG 64-40
  - Modified top end for elasticity/stiffness
  - Low end for thermal cracking / studded tire

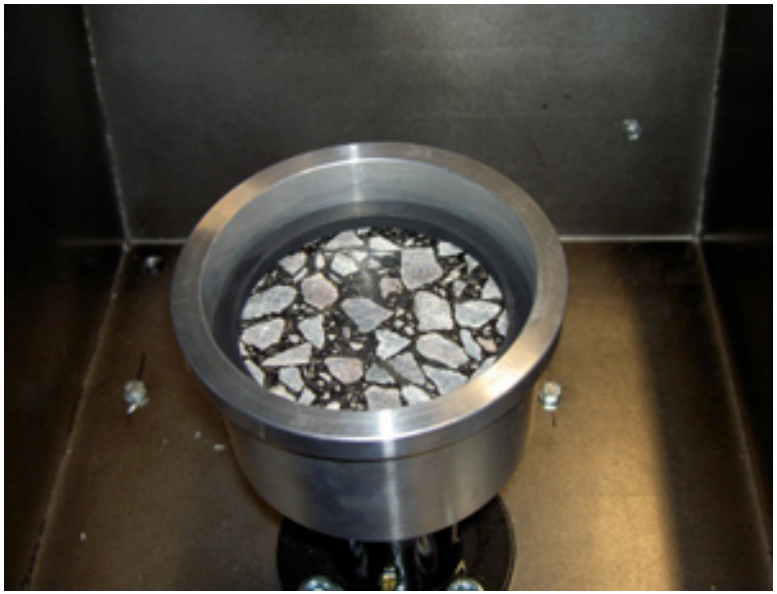
.. will get to that

PG 52-28 & PG 58-34

- Project Conditions
  - Low/Moderate AADT (studs)
  - Limited Static Loading
  - Limited Stop/Go Traffic
- PG 52-40
  - Low end for thermal cracking resistance

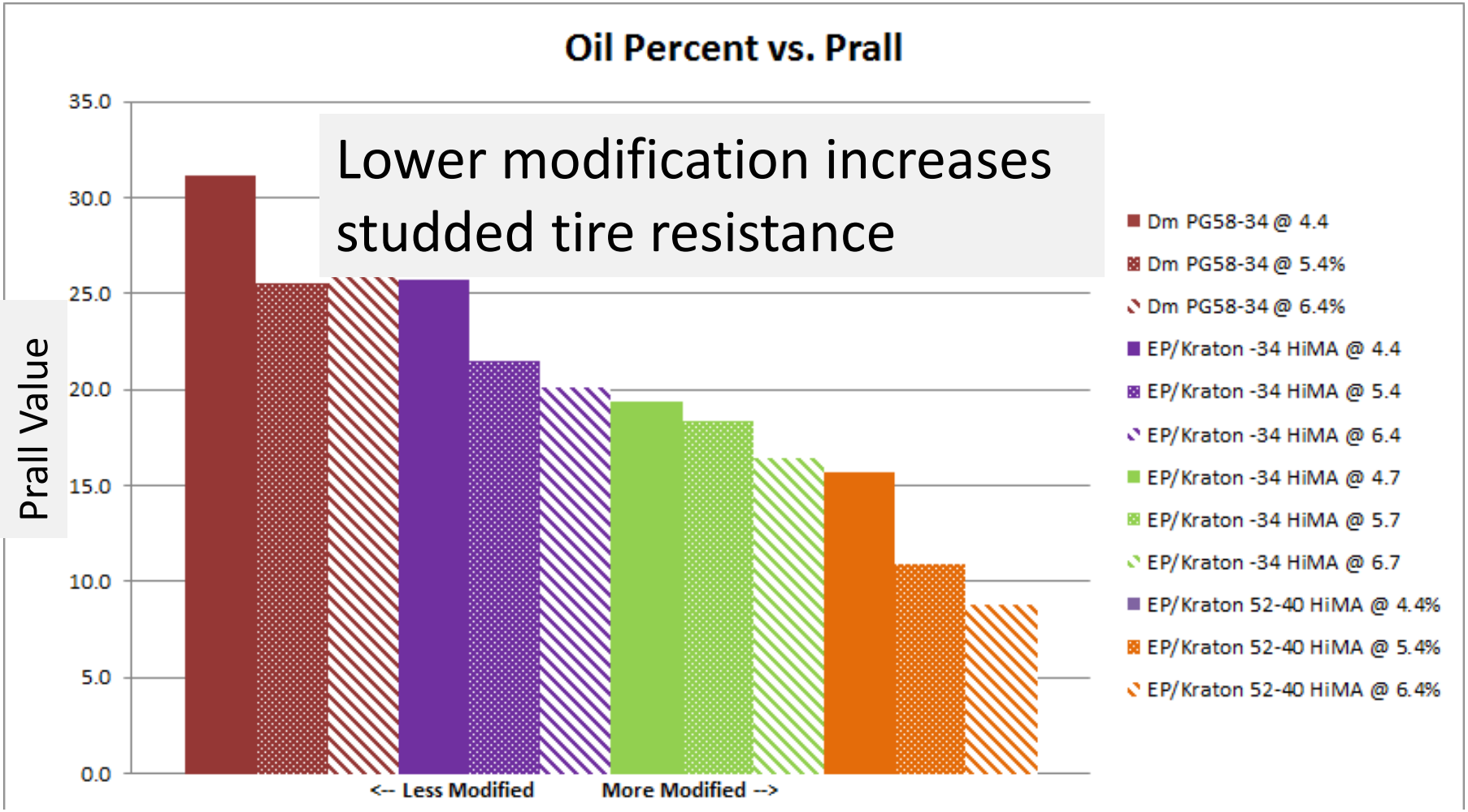
PG Grading and Studded Tires

- Prall Test
  - Simulate studded tires
  - Metal balls impact at near freezing temperature



- Testing shows that lowering low end improves prall test results

Oil Content/Grade vs. Prall



Bringing it Together

- Urban, high traffic volumes with static loading
  - Type V, PG 64-40
- Rural, low traffic volumes, low/minimal static loading
  - Type II, Class B, PG 52-40
- Moderate traffic volumes, low to moderate static loading
  - Type II, Class A, PG 52-40
- Overlays
  - PG 52-28
  - Vary based on location/loading

Questions?

If a dog wore pants would he wear them

like this or like this?