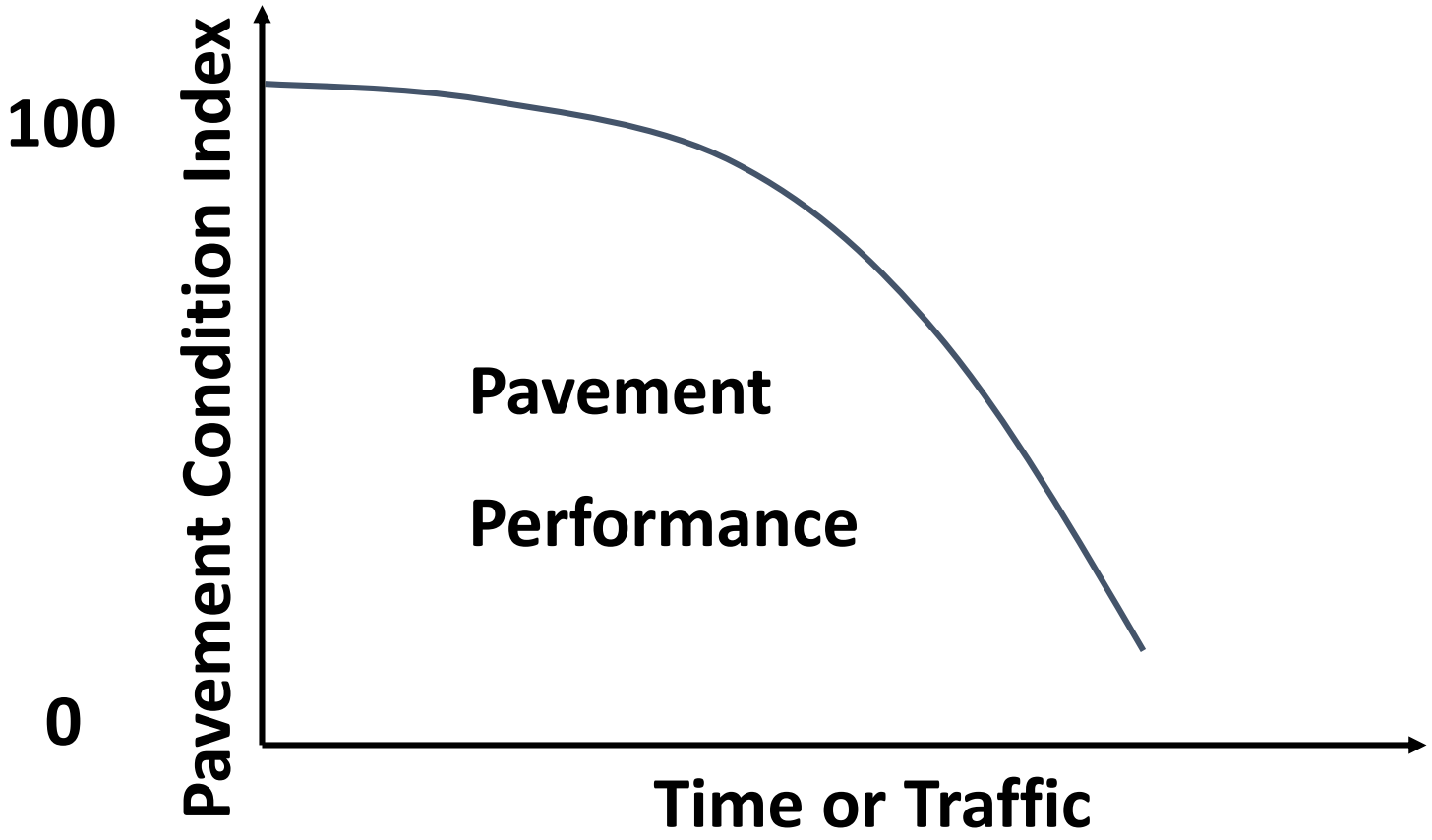
Constructability:
Designing Buildable Pavements

2018 Pavement Conference

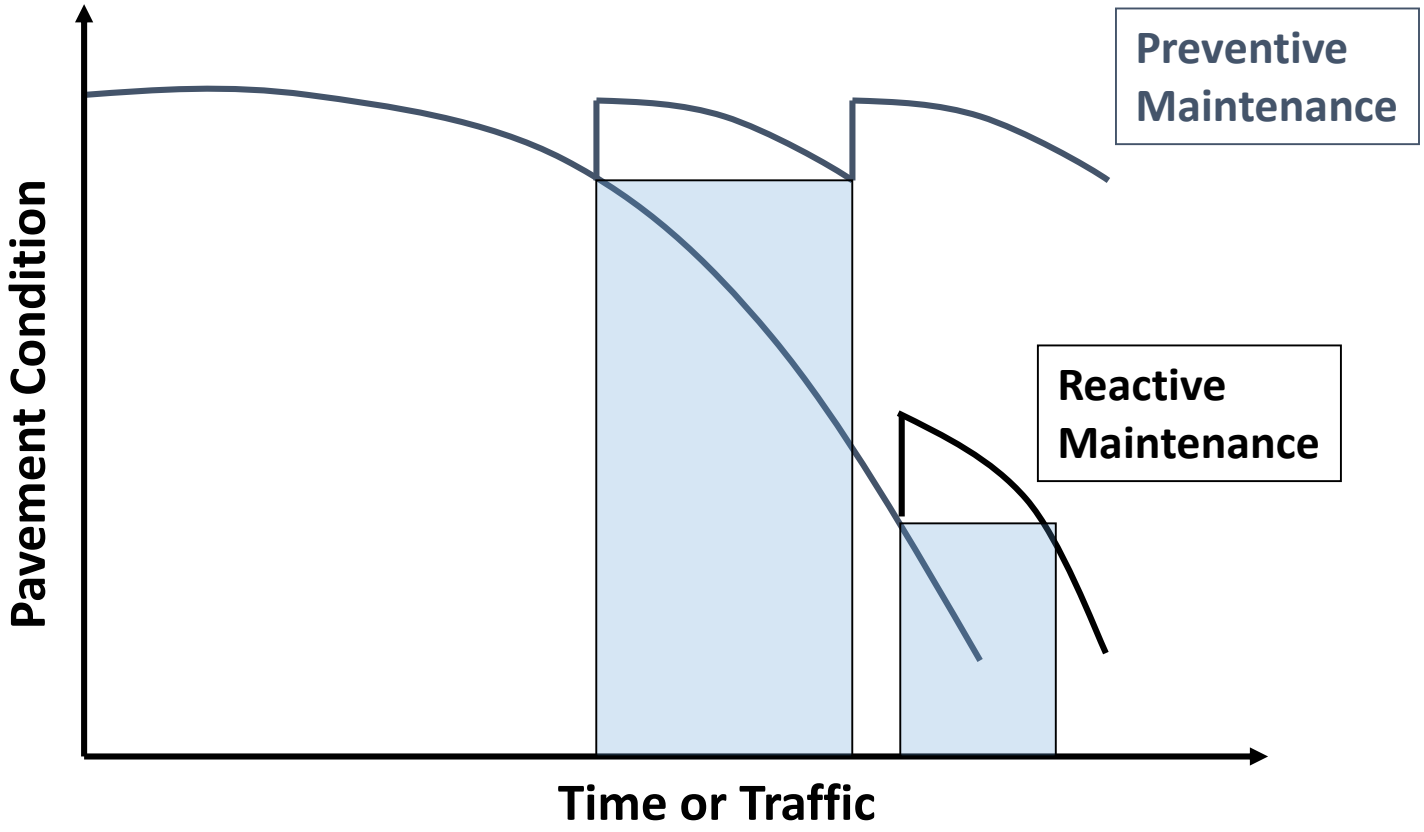
Charleston, WV

October 23-26, 2018

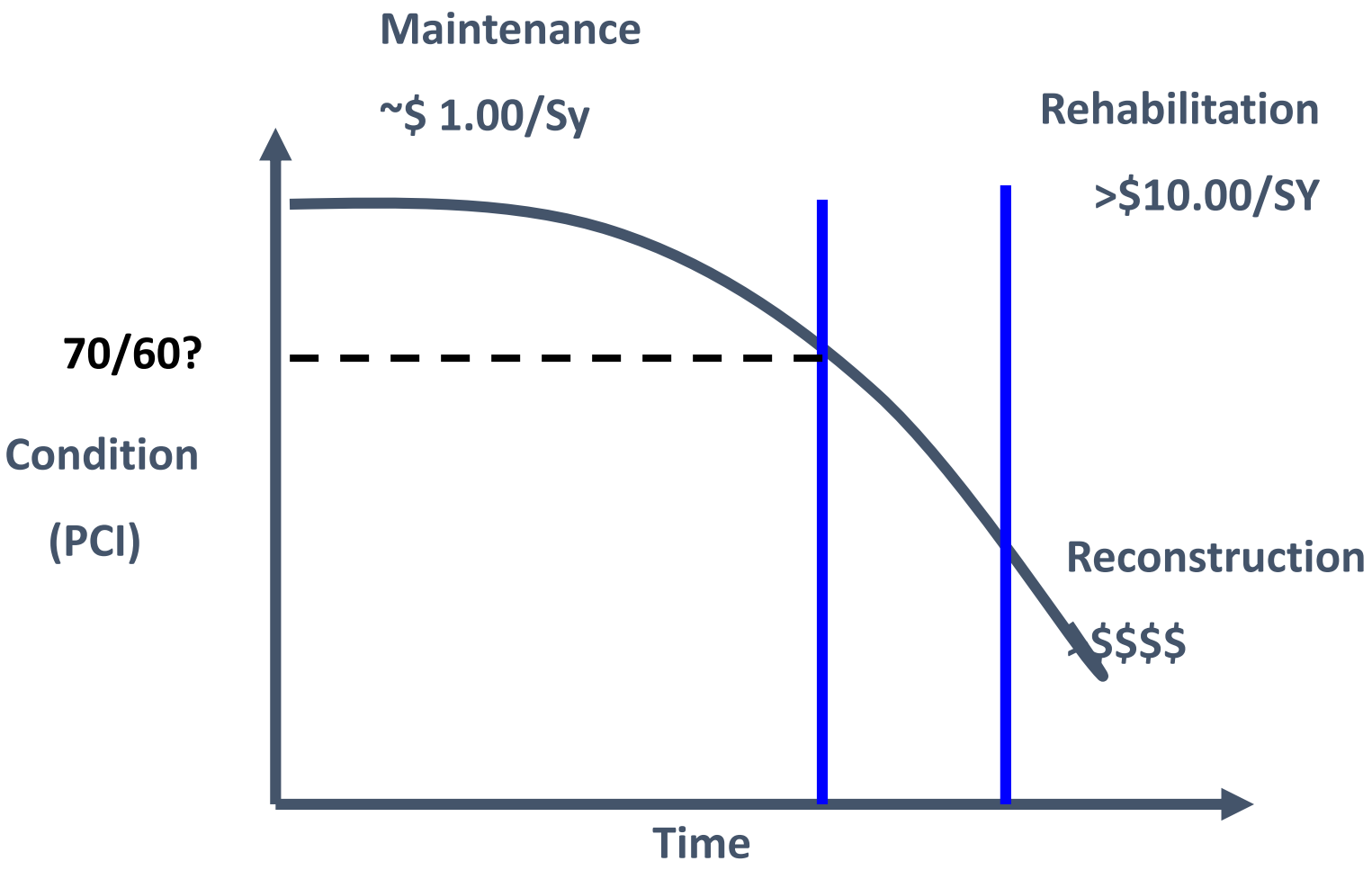
Pavement Condition



Pavement Condition



Pavement Life Cycle



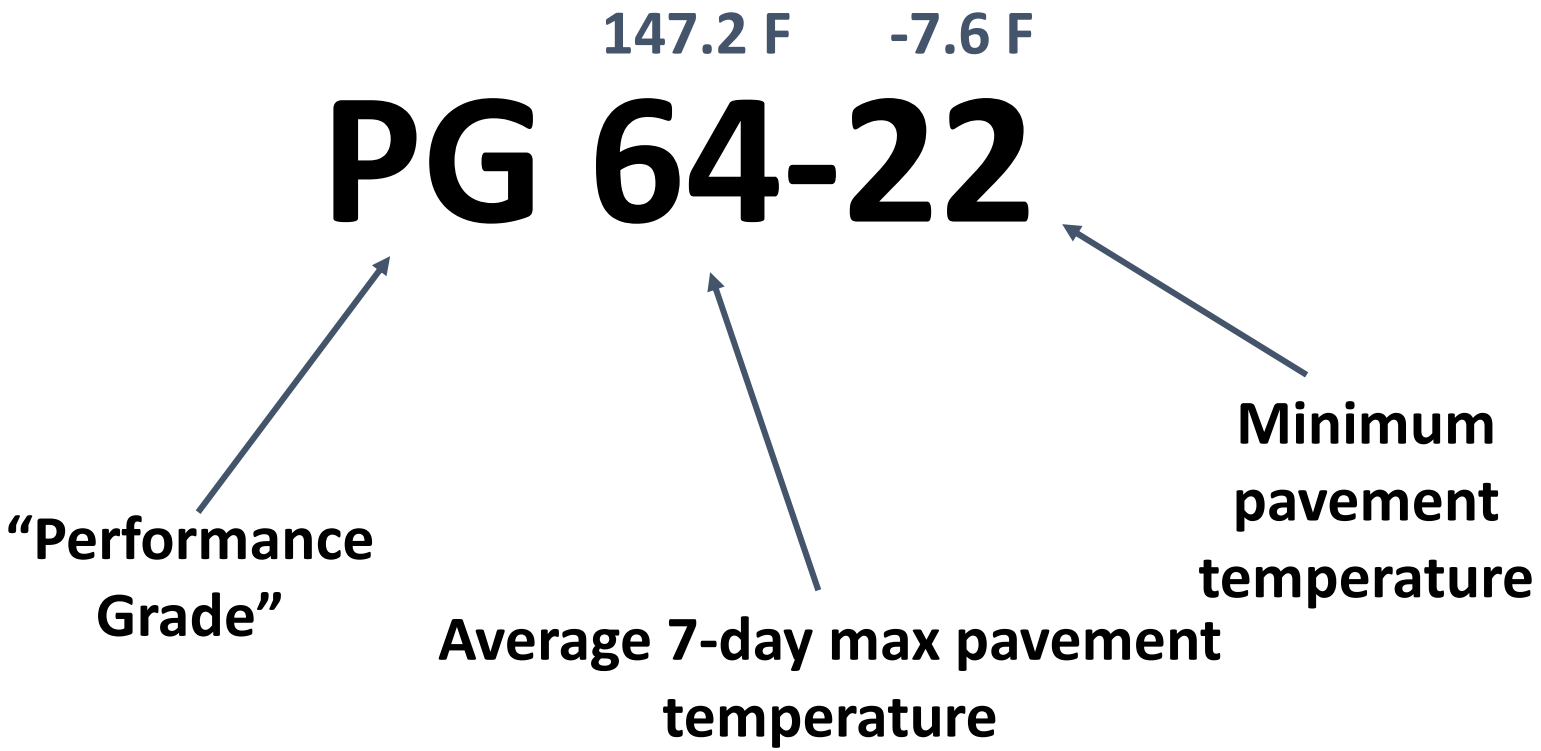
Rutting

Superpave

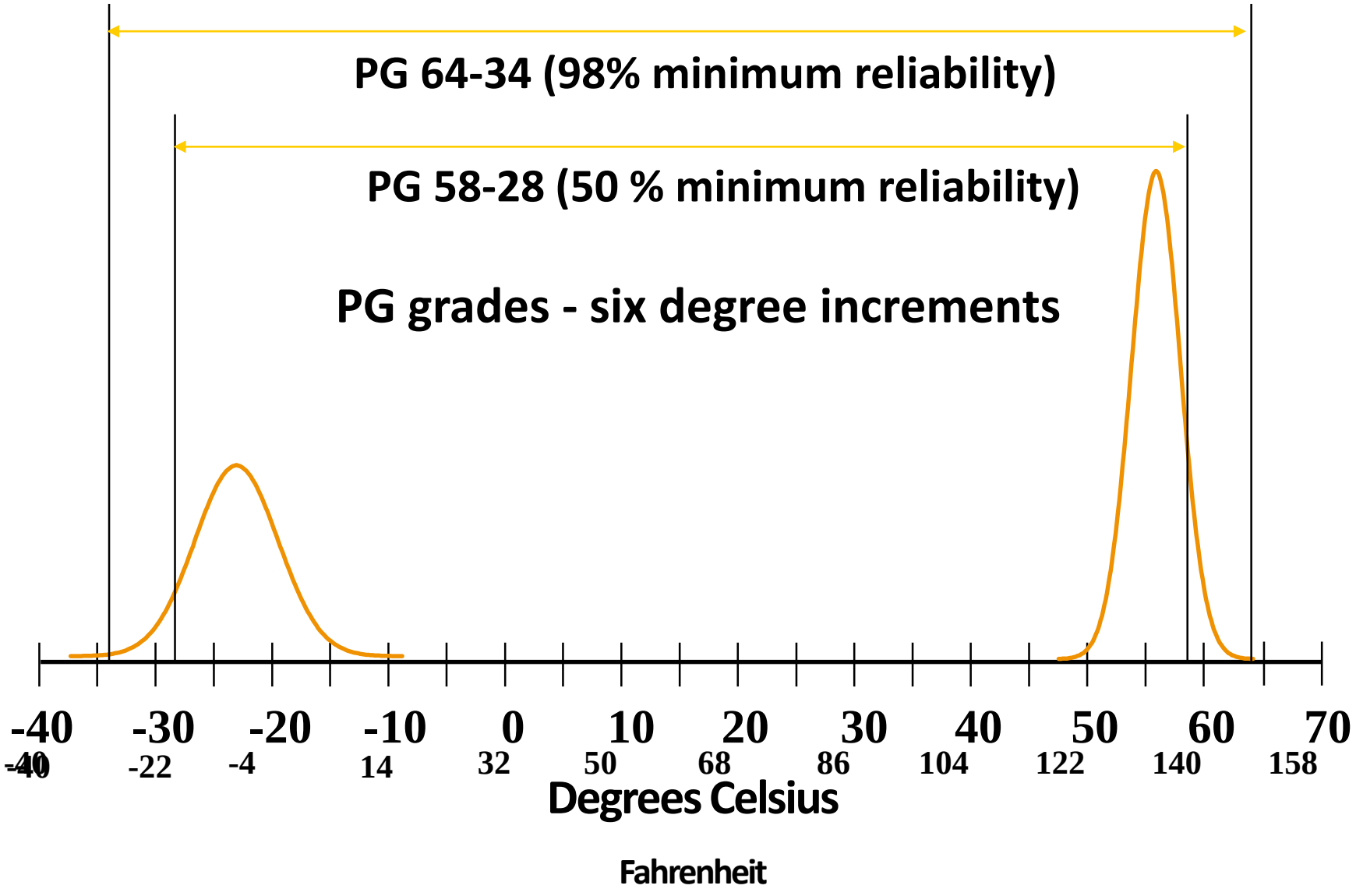
Strategic Highway Research Program (SHRP)

- Superpave, which stands for
  - Superior
  - Performing Asphalt
  - Pavements
- Performance-based specification
  - Asphalt grades are called
    - Performance Graded (PG) Binders

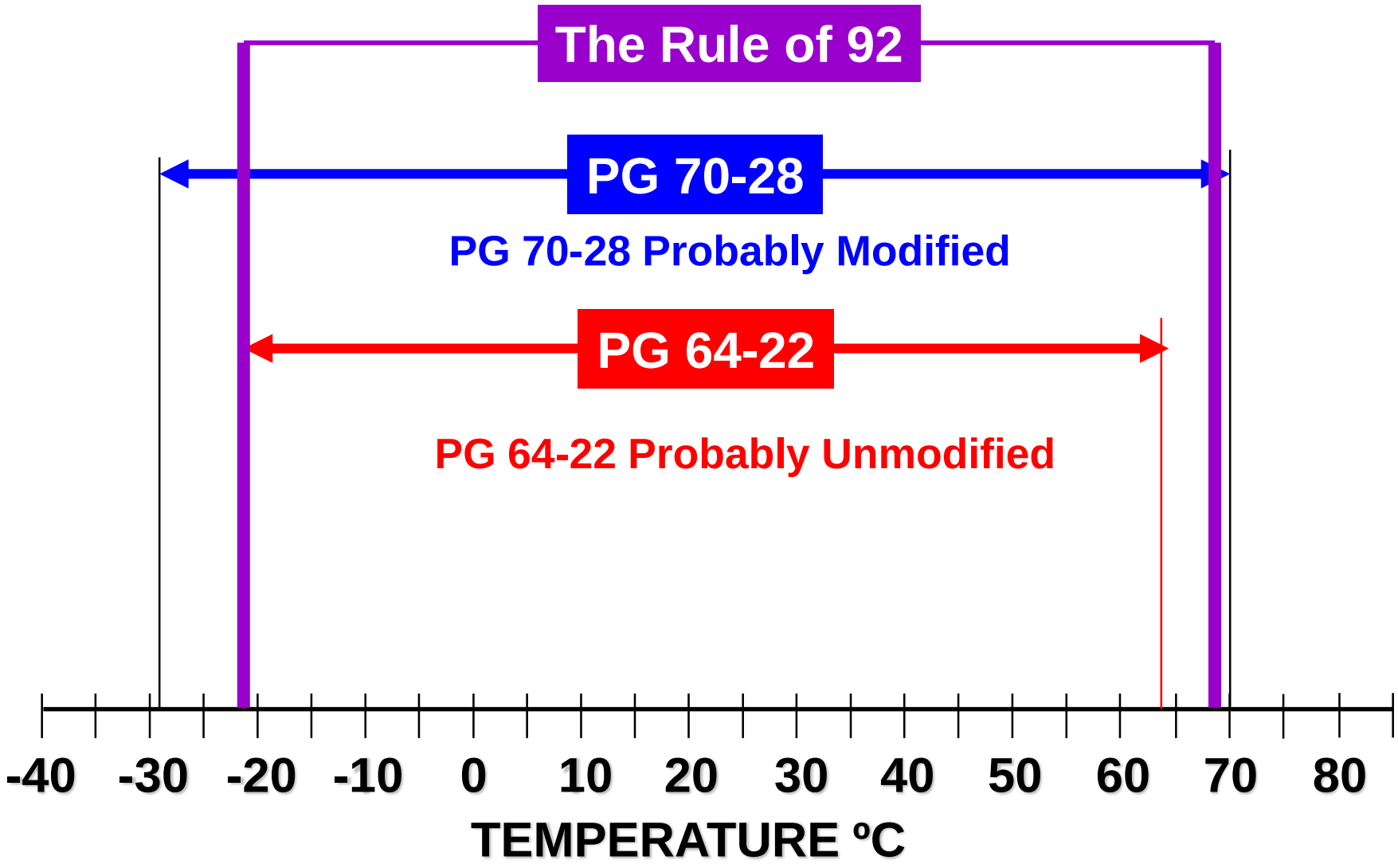
PG Binders


147.2 F
-7.6 F
PG 64-22
"Performance Grade"
Average 7-day max pavement temperature
Minimum pavement temperature

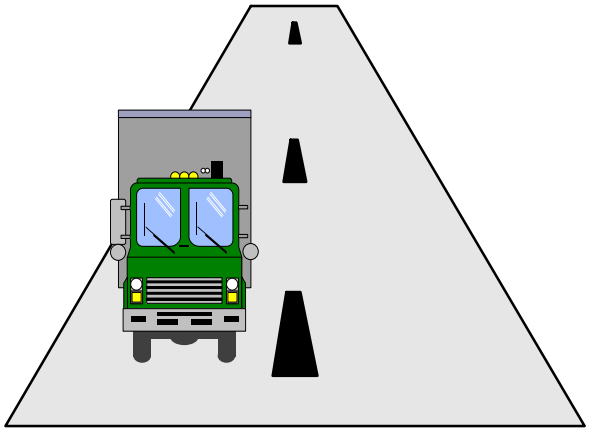
PG Binder Grades Topeka, KS



PG Binder Grades



Loading Rate of Loading



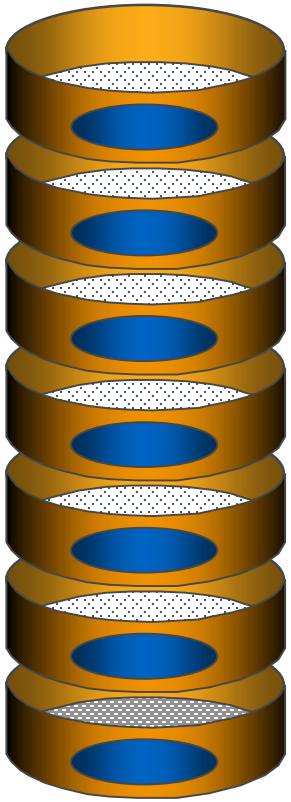
Example

- Mainline pavement
  PG 64-22 ← *70 mph*
- Toll booth
  PG 70-22 ← Slow
- Weigh Stations
  PG 76-22 ← **Stopping**

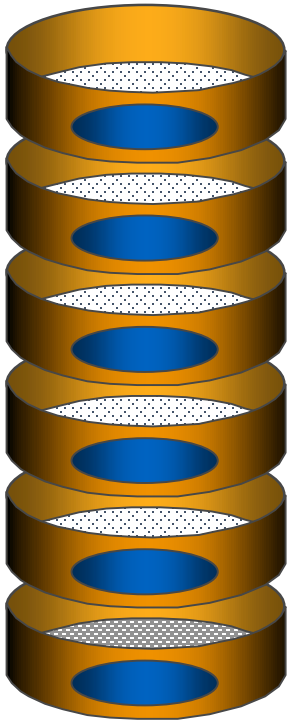
Asphalt Mixtures

Standard Superpave Sieves

2	in	50 mm
1 1/2	in	37.5 mm
1	in	25 mm
3/4	in	19 mm
1/2	in	12.5 mm
3/8	in	9.5 mm
#4	in	4.75 mm



# 8	2.36 mm
#16	1. 18 mm
#30	0.60 mm
#50	0.30 mm
#100	0.15 mm
#200	0.075 mm



Defined by aggregate size

Nominal Maximum Aggregate Size

- One size larger than first sieve to retain more than 10%

Maximum Aggregate Size

- One size larger than nominal maximum size

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Superpave mix designations

Superpave Designation	Max Size, mm
37.5 mm	50.0
25.0 mm	37.5
19.0 mm	25.0
12.5 mm	19.0
9.5 mm	12.5
4.75 mm	9.5

Asphalt Mixtures

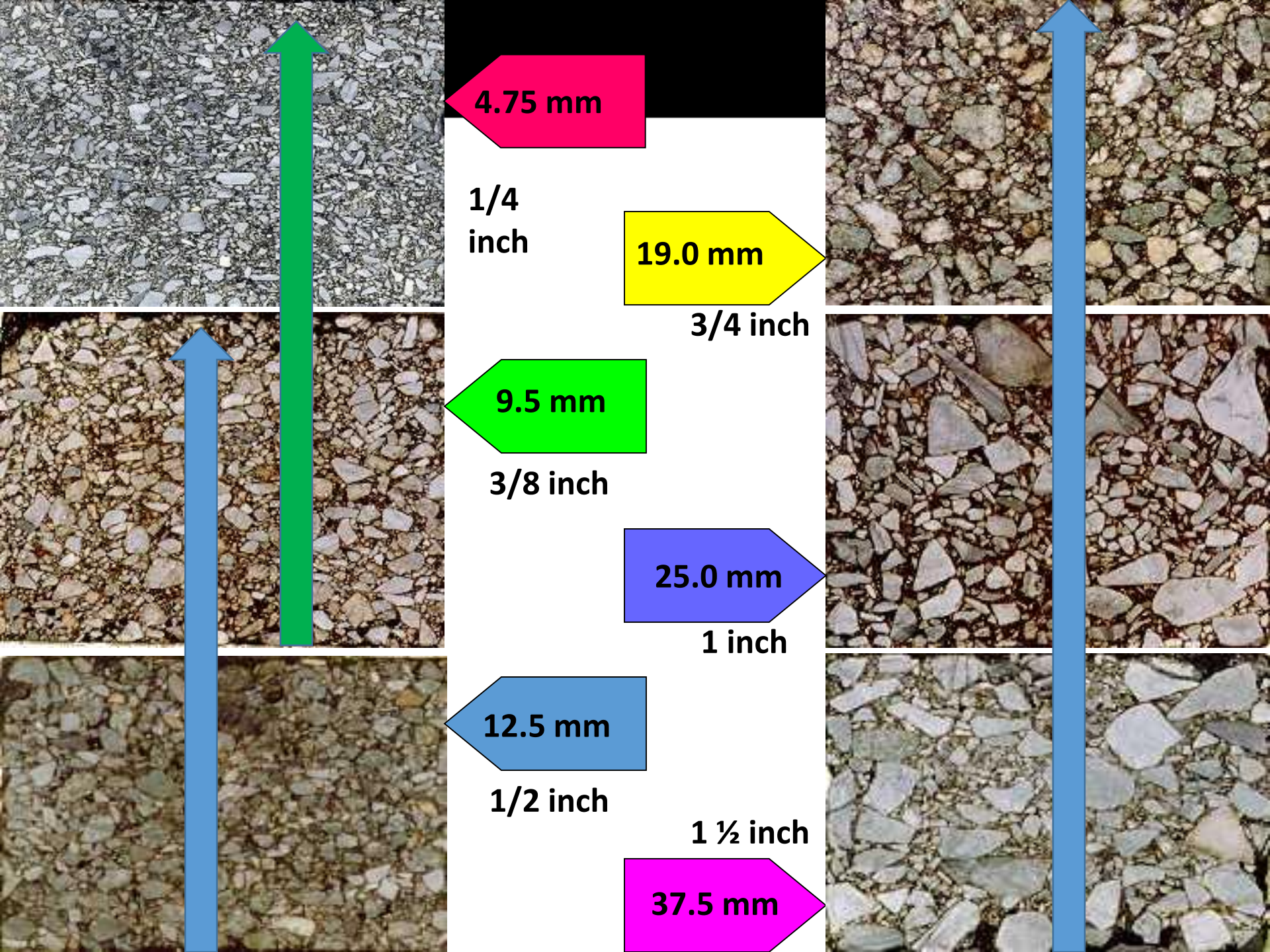
Mat thickness

- 3x max aggregate
- 4x larger stone mixes

Fracture aggregate

Open Texture

Water intrusion


4.75 mm
1/4 inch
19.0 mm
3/4 inch
9.5 mm
3/8 inch
25.0 mm
1 inch
12.5 mm
1/2 inch
1 ½ inch
37.5 mm

“AASHO Road Test”

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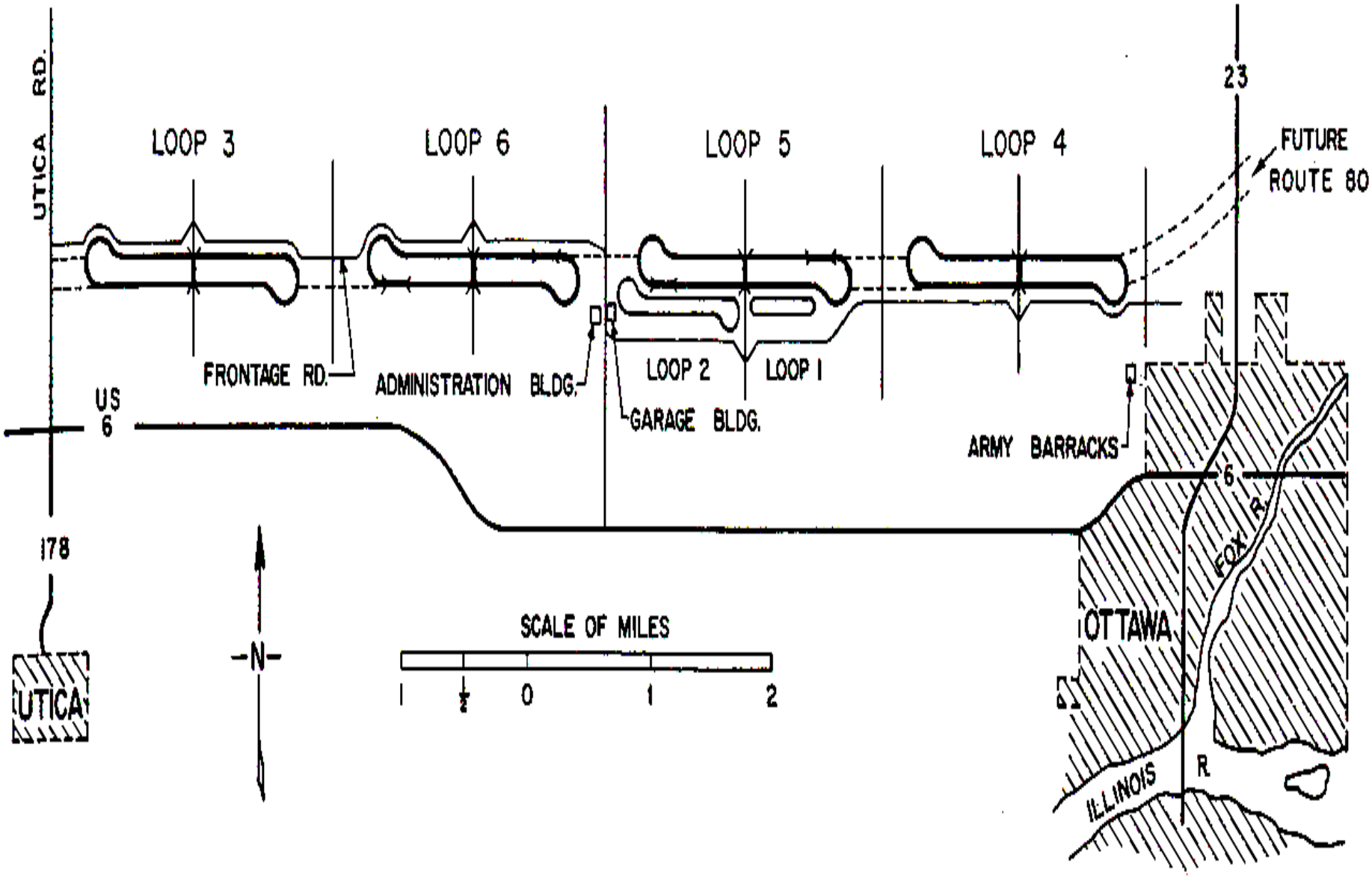

“AASHO Road Test”

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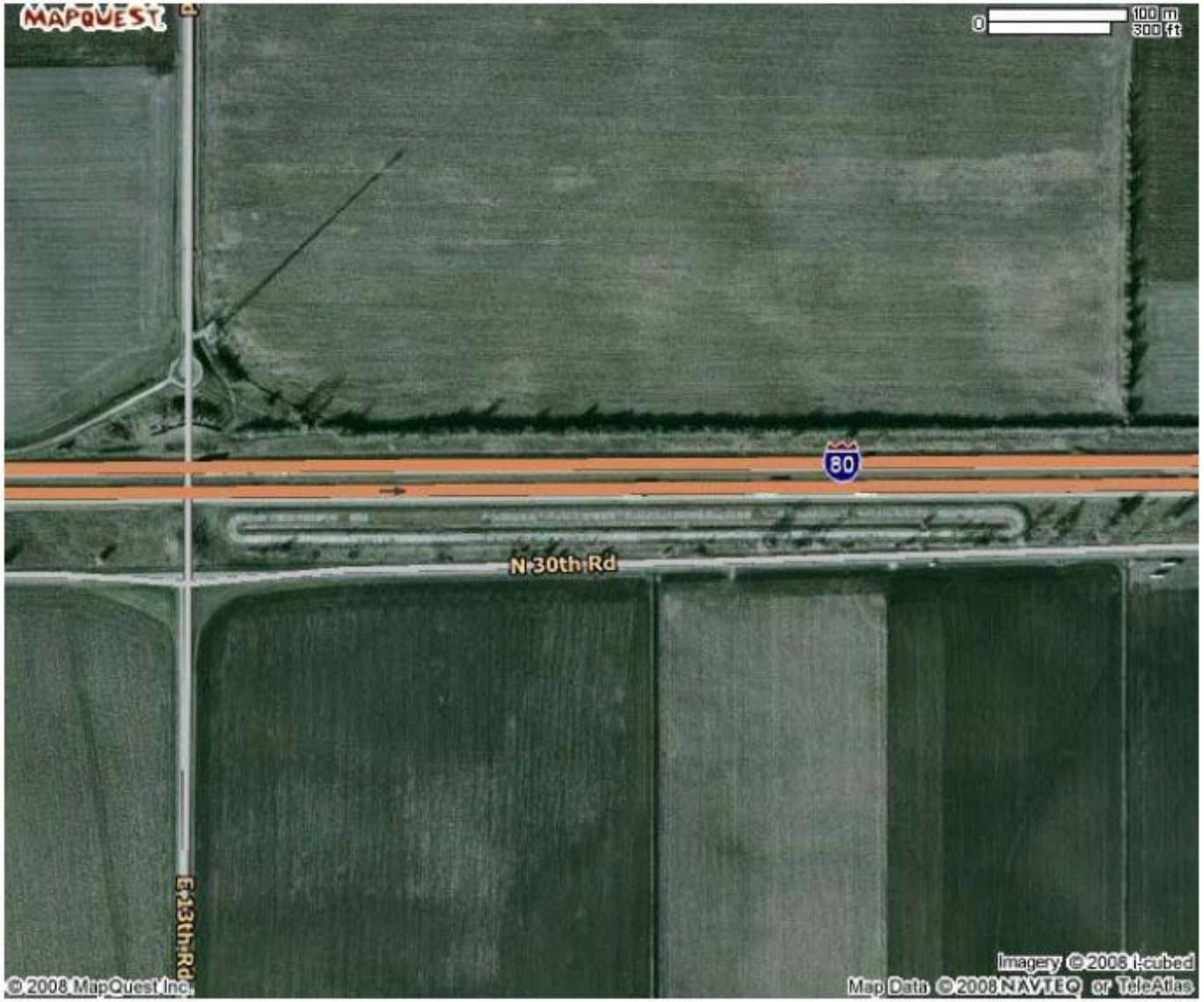

“AASHO Road Test”

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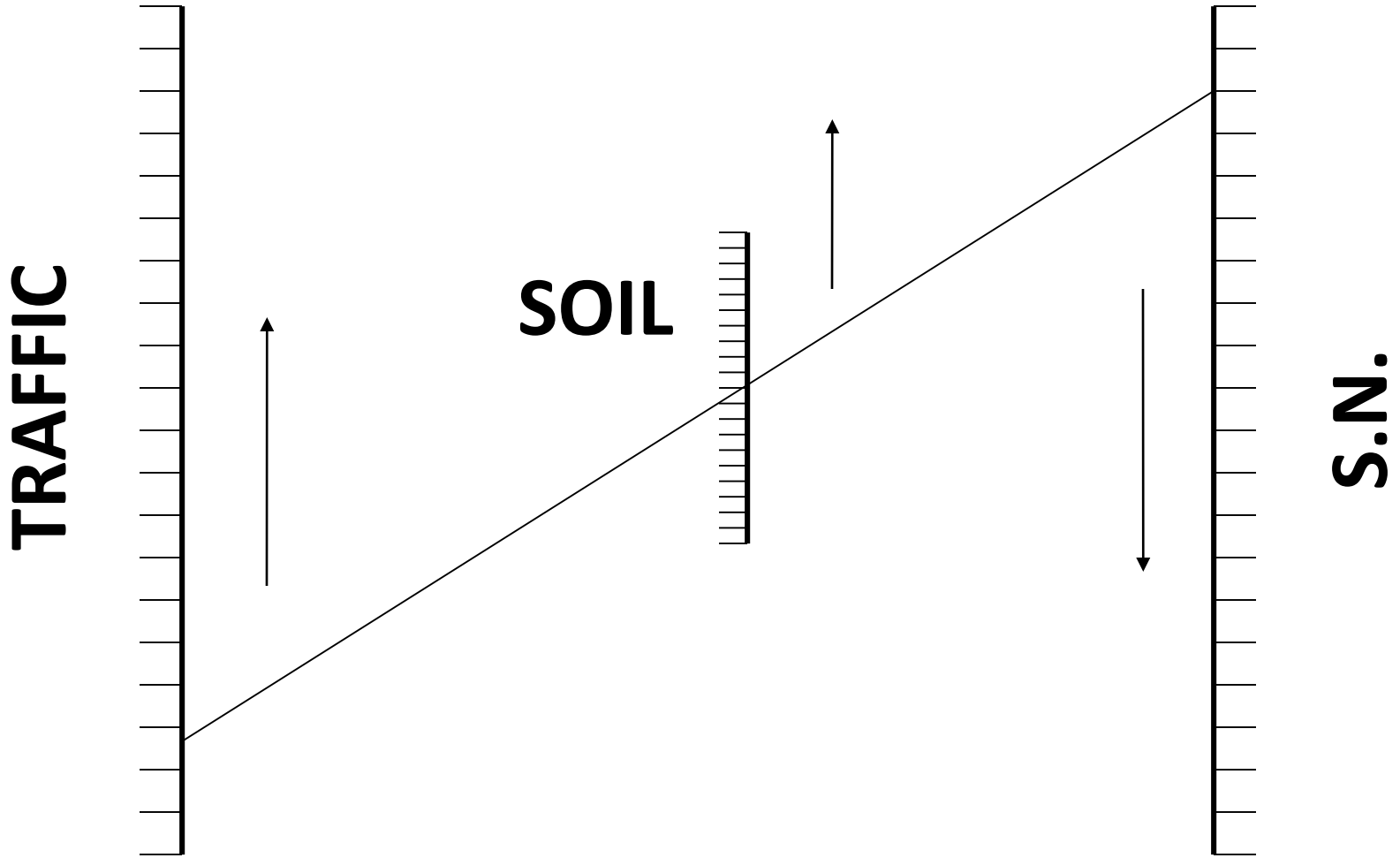
(a)

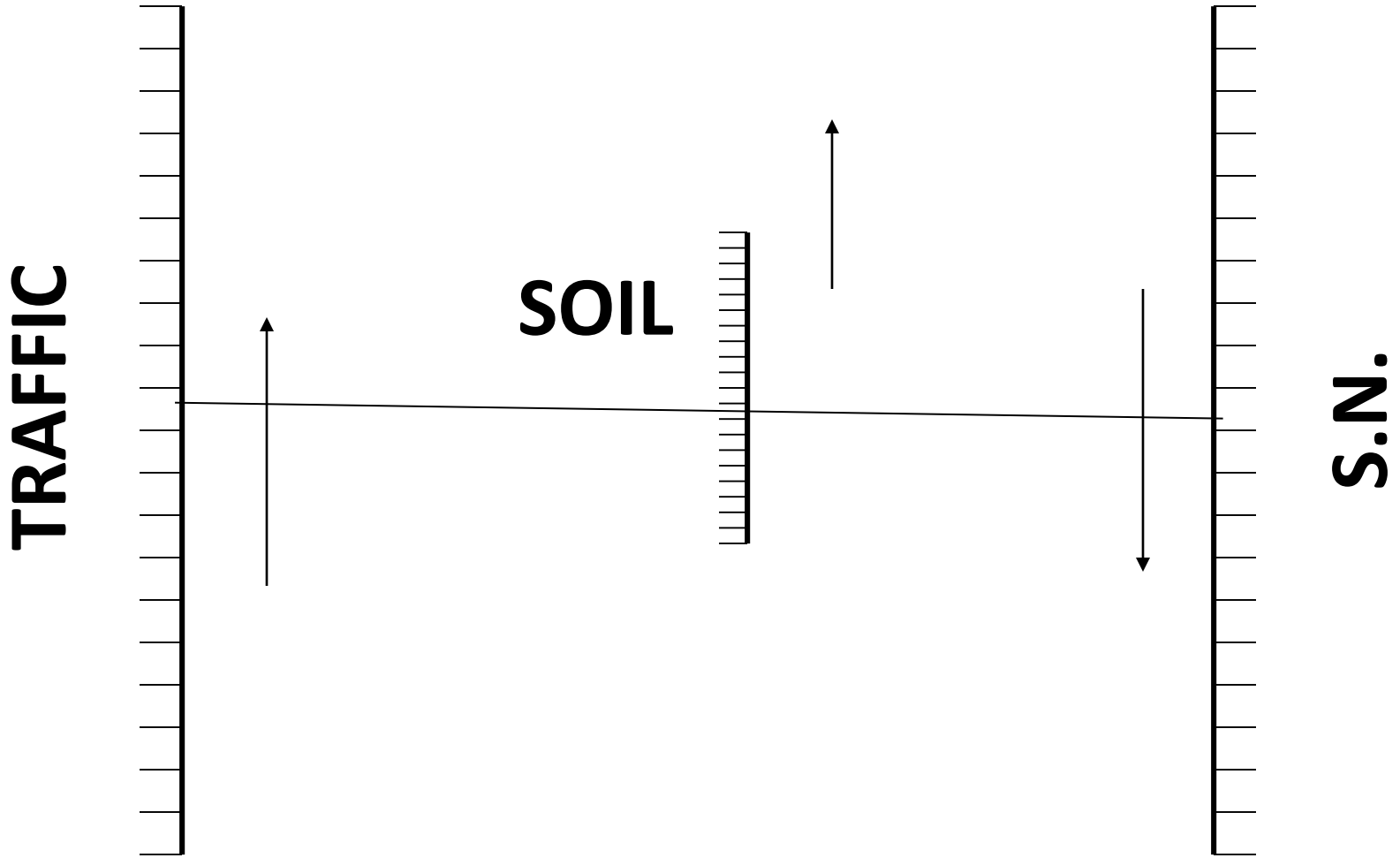
(b)

FIGURE 14 Loop 1 of the AASHO Road Test in September 2005: (*a*) PCC pavement and (*b*) HMA pavement.

Flexible Nomograph



Flexible Nomograph



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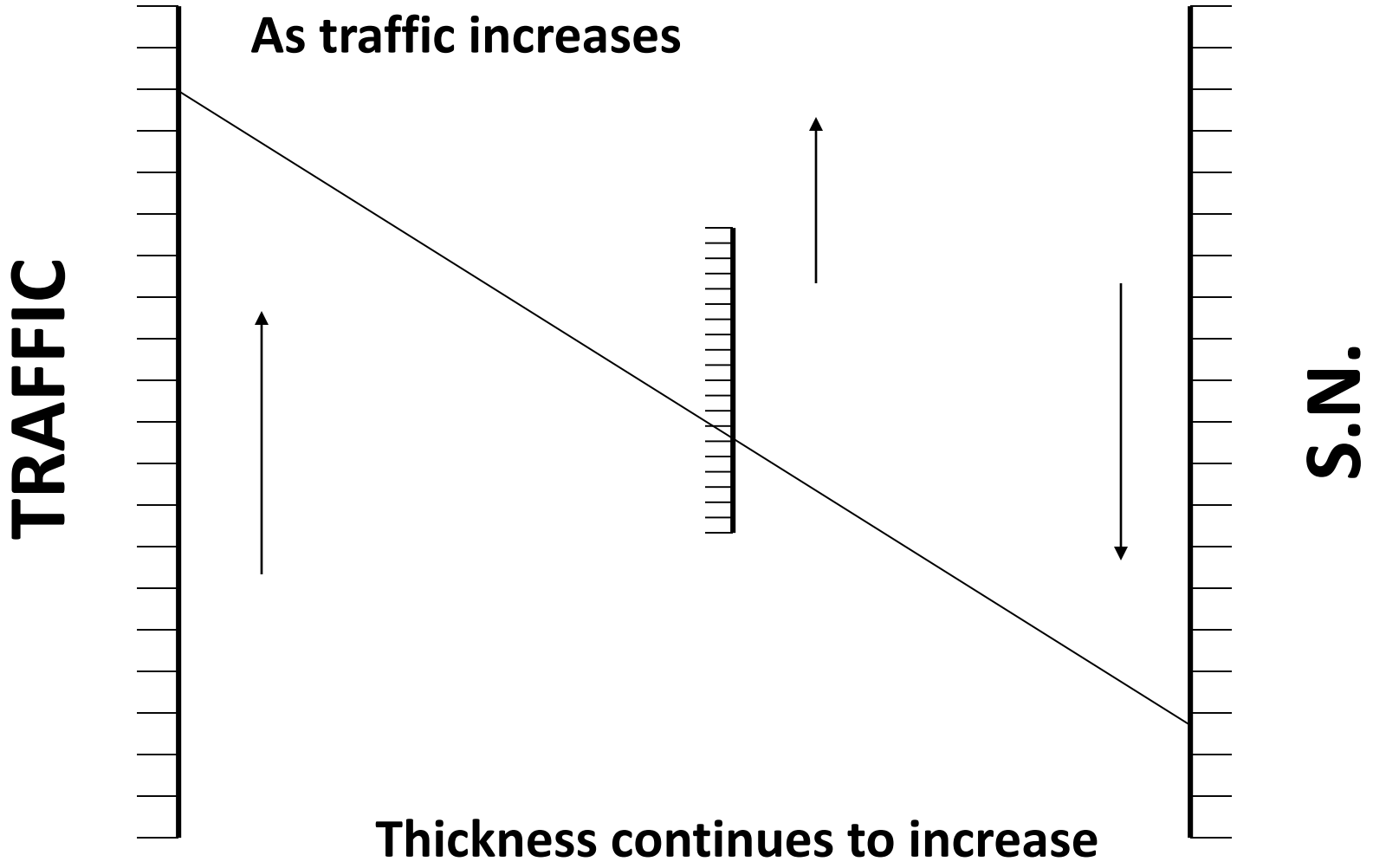


Mechanistic Design

Mechanistic -

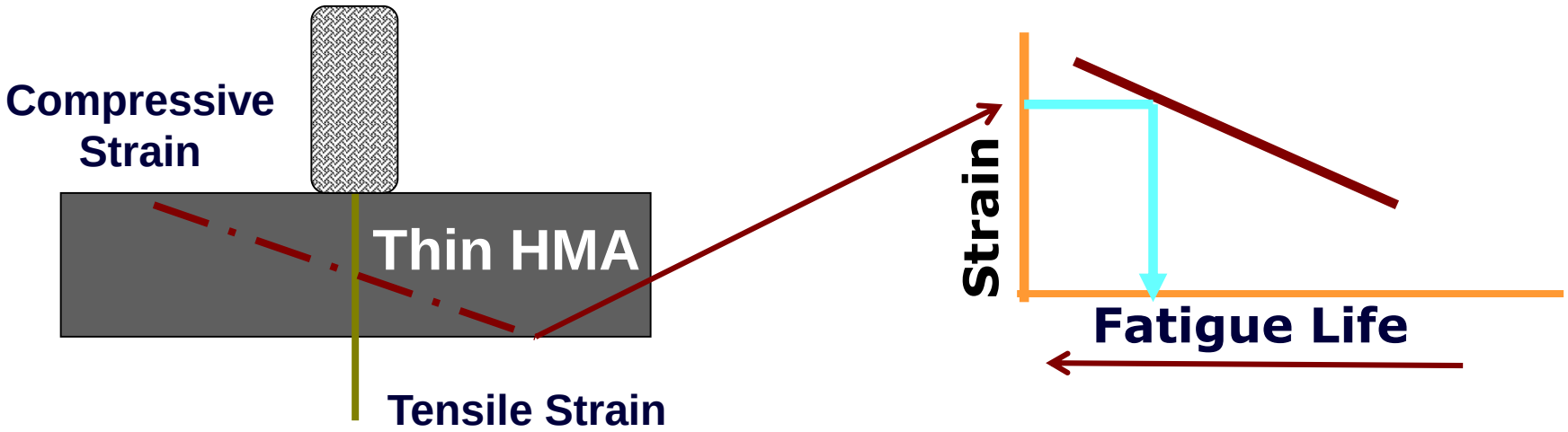
> **"Concerning the Relationships Between Applied Forces and Material Responses."**

Basic Premise -

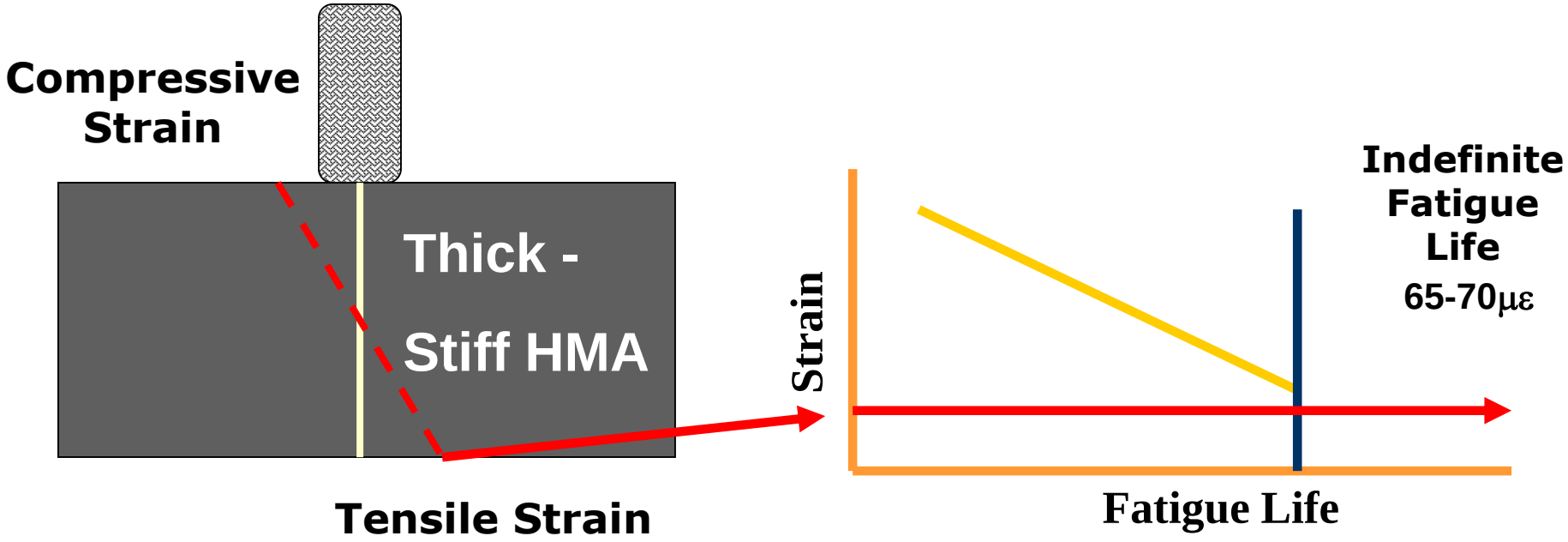
> **Low Deflections = Long Life**

» Thin Asphalt Pavement = Higher Strain

» Higher Strain = Shorter Fatigue Life

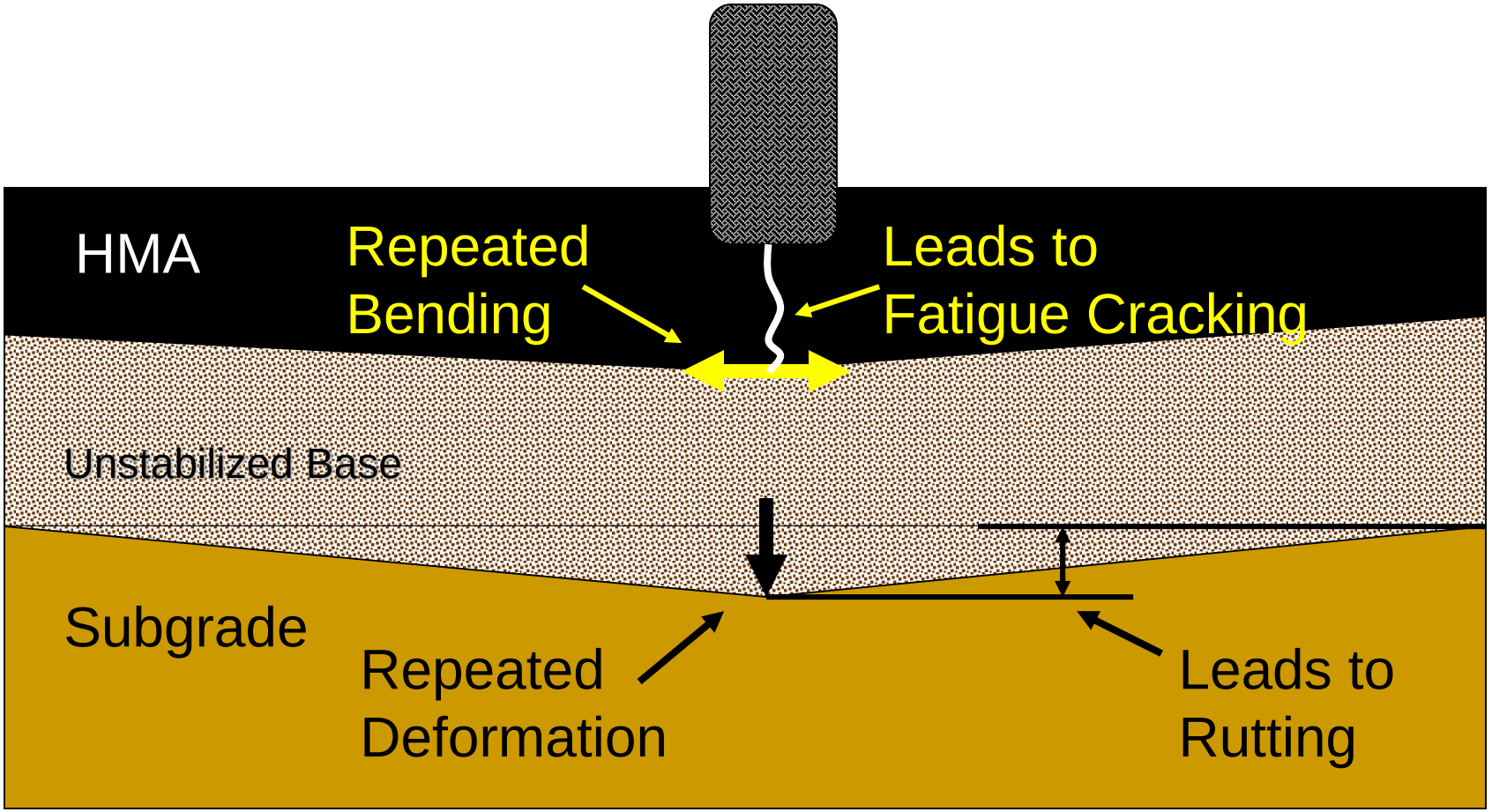


- **Lower Tensile Strain**
  - **Increasing Pavement Thickness**
  - **Increasing Layer Stiffness**

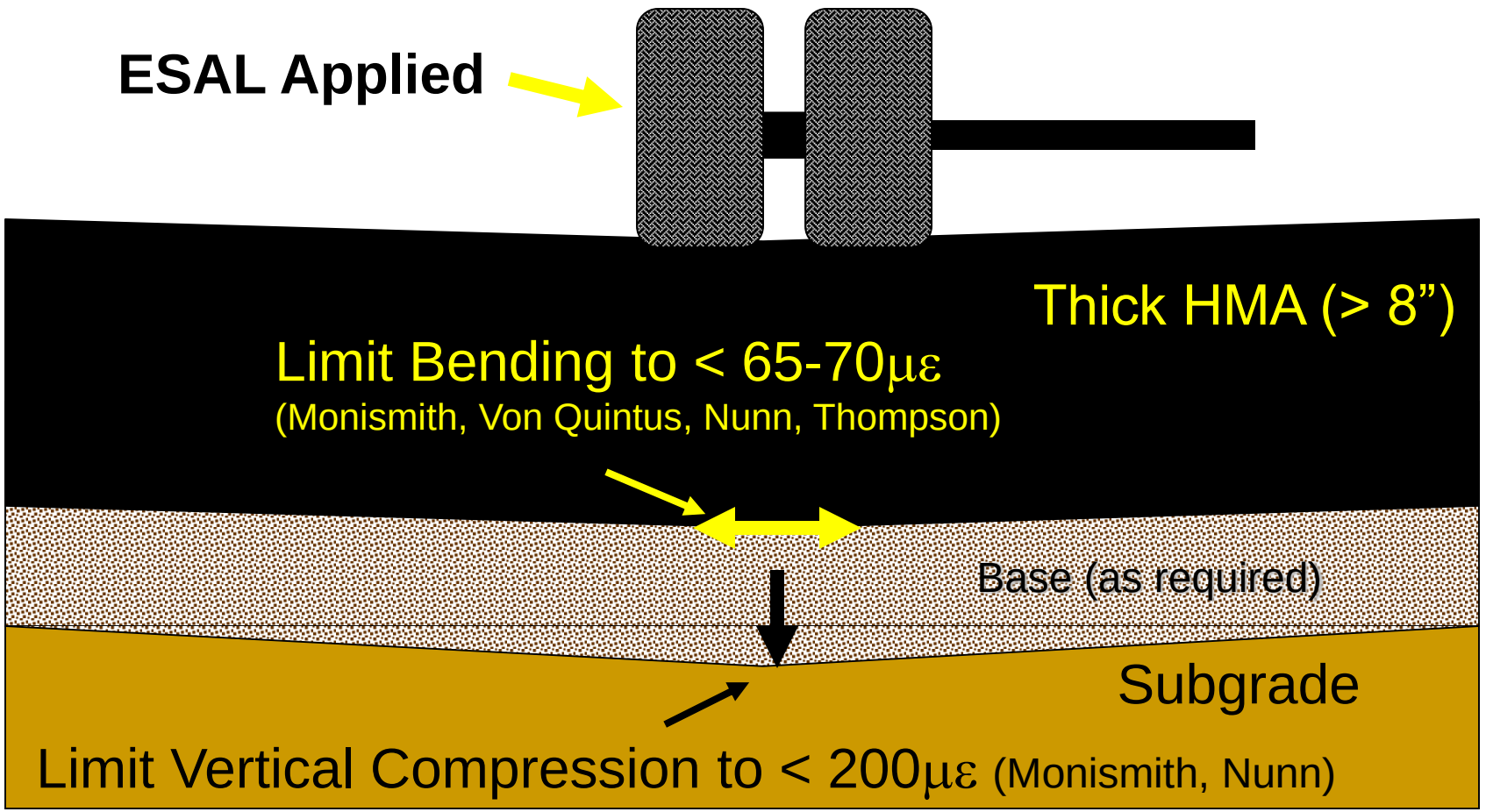


- **Strain Below Fatigue Limit = Indefinite Life**

Bottom-up Fatigue and Rutting



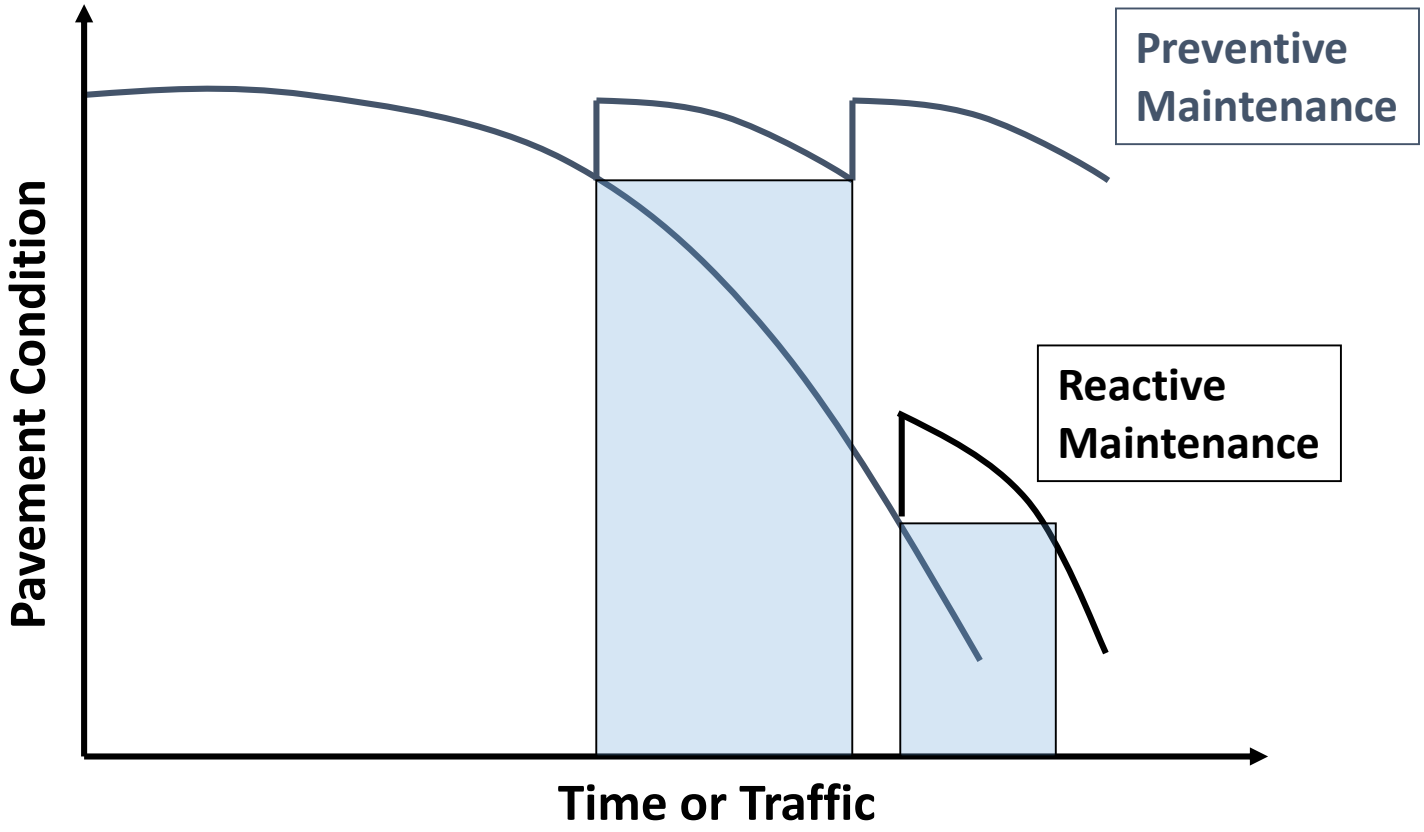
Mechanistic Performance Criteria



TRL

New Jersey I-287
Surface Cracking

Pavement Condition



Perpetual Pavement

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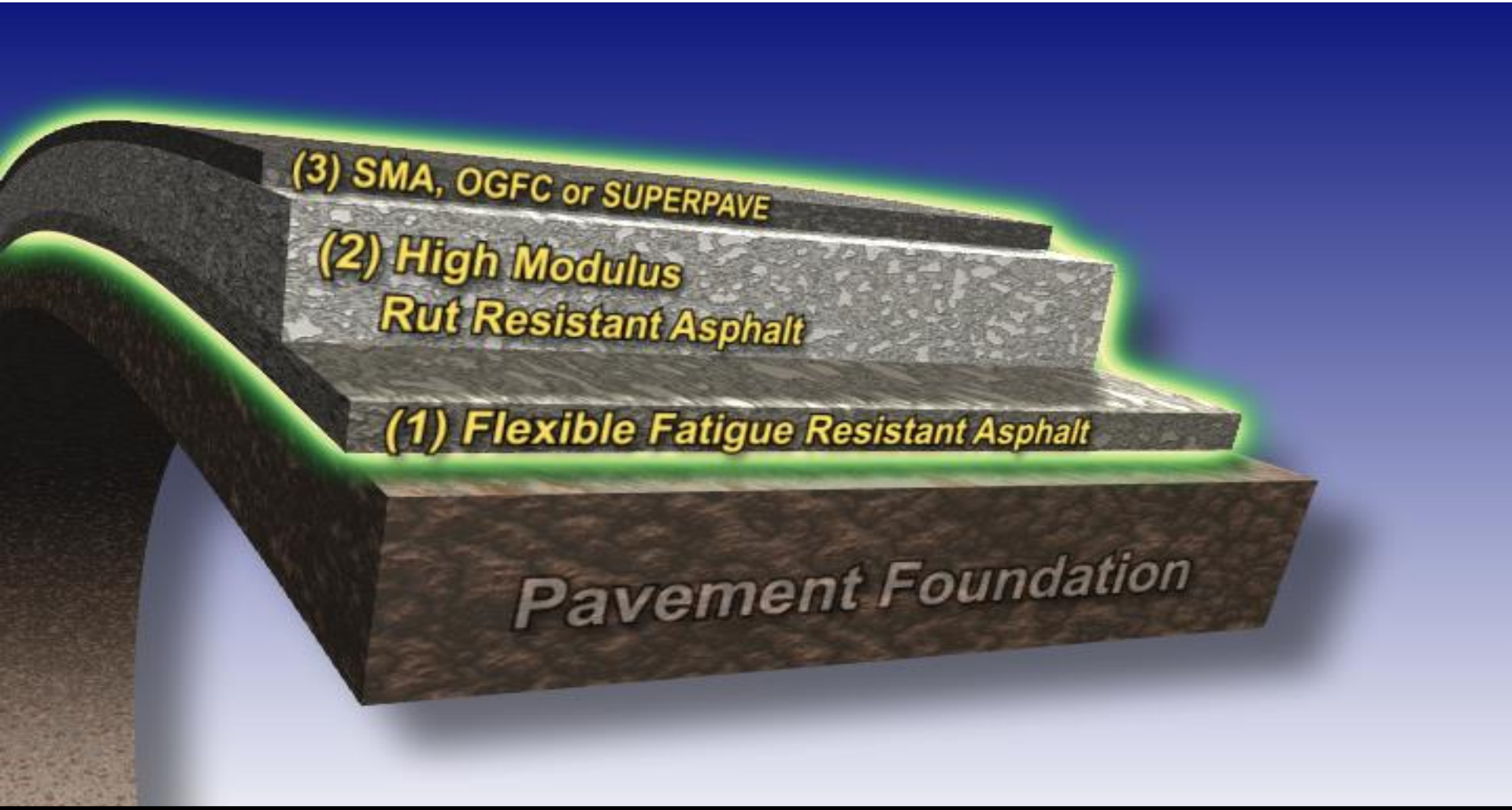
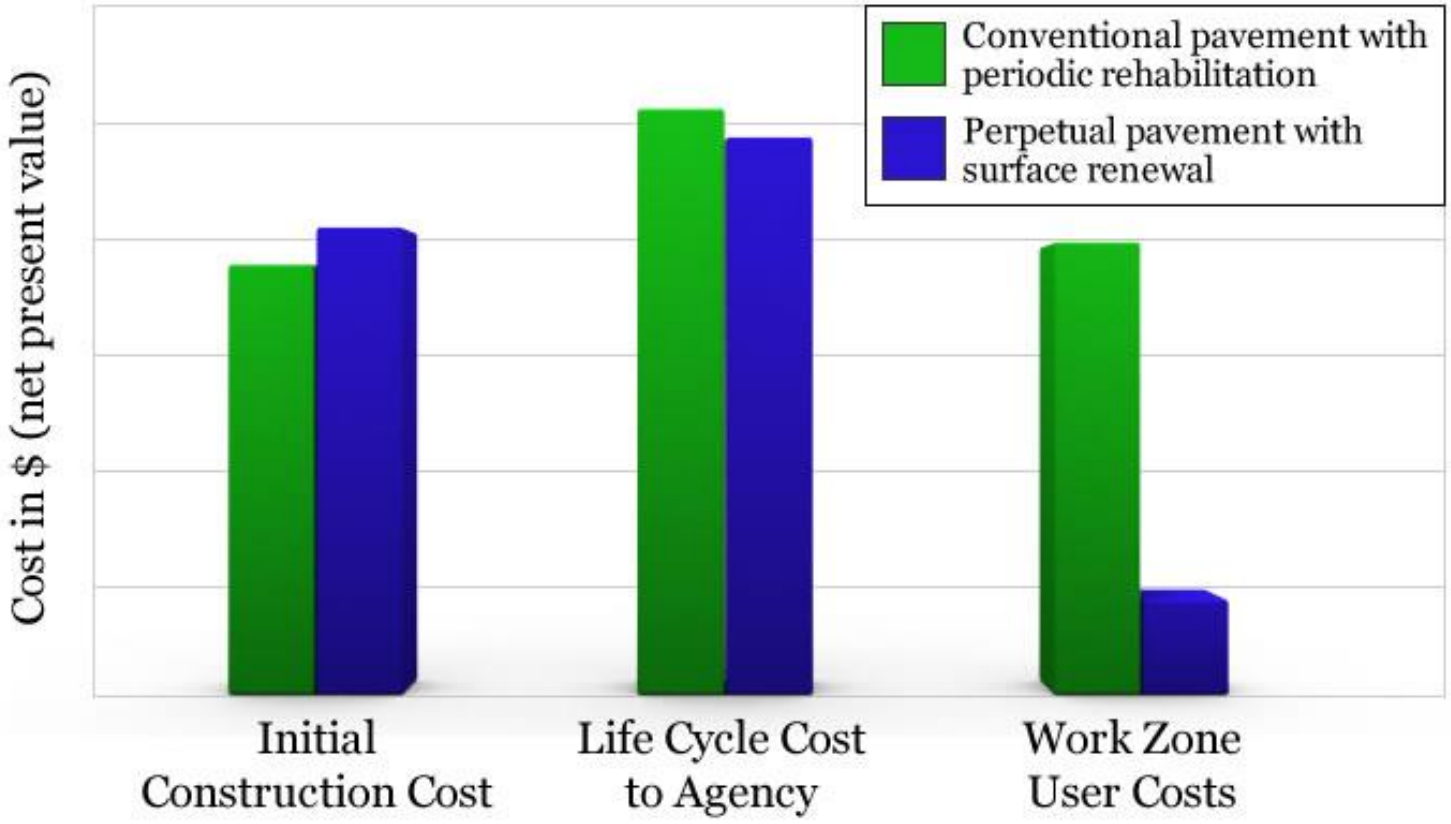


Reality

Ohio DOT
Long Life Pavement Study

- **Recommended 16.25 inches full depth asphalt for all interstate pavements**
- **When the study was published several rehabilitations were under construction at 17 in.**

Cost and Benefits



Perpetual Pavement

Perpetual Pavement Design Software

- **PerRoad 4.4**
- **PerRoad Express**

  - **Dr Dave Timm at Auburn University**
    - **Developed and maintains the software**
  - **Couples layered elastic analysis with a statistical analysis procedure (Monte Carlo simulation)**
  - **To estimate stresses and strains within a pavement**
  - **Predicts whether your design will perform as a Perpetual Pavement**

http://www.asphaltroads.org/PerRoad/

Thanks,

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