

Importance of Controlling Segregation in All Asphalt Layers

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Asphalt Mixture Segregation

- What is it?
- What does it look like?
- How is it quantified?
- How does it affect pavement performance?

Segregation Defined

- I cannot define it, but I know it when I see it!



Segregation Defined

- “Separation of the coarse aggregate particles in the mix from the rest of the mass.”
—Jim Scherocman, Asphalt Magazine
- “When segregation is present in a mixture, there is a concentration of coarse materials in some areas of the paved mat, while other areas contain a concentration of finer materials.”
—Segregation, Causes and Cures, AASHTO

Segregation Defined

- “Segregation is a lack of homogeneity in the hot mix asphalt constituents of the in-place mat of such a magnitude that there is a reasonable expectation of accelerated pavement distress(es).”
—NCHRP Report 441: Segregation in Hot Mix Asphalt Pavements

Segregation



Segregation Quantified

- Good luck!
- Visual “measurement”
- Change in gradation and asphalt binder content
- Mechanical measurements
 - Segregation can affect pavement performance

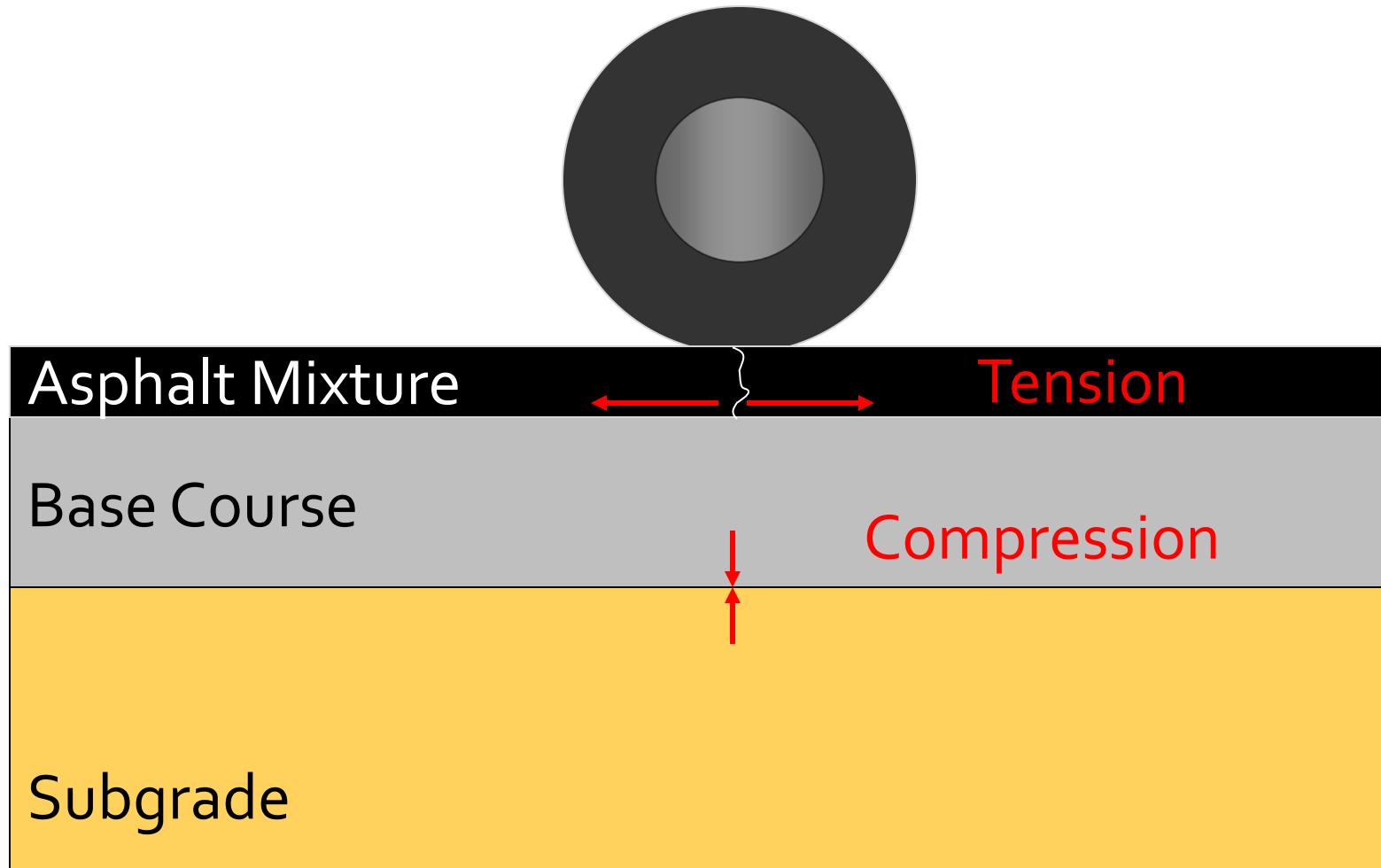


Pavement Design Assumptions

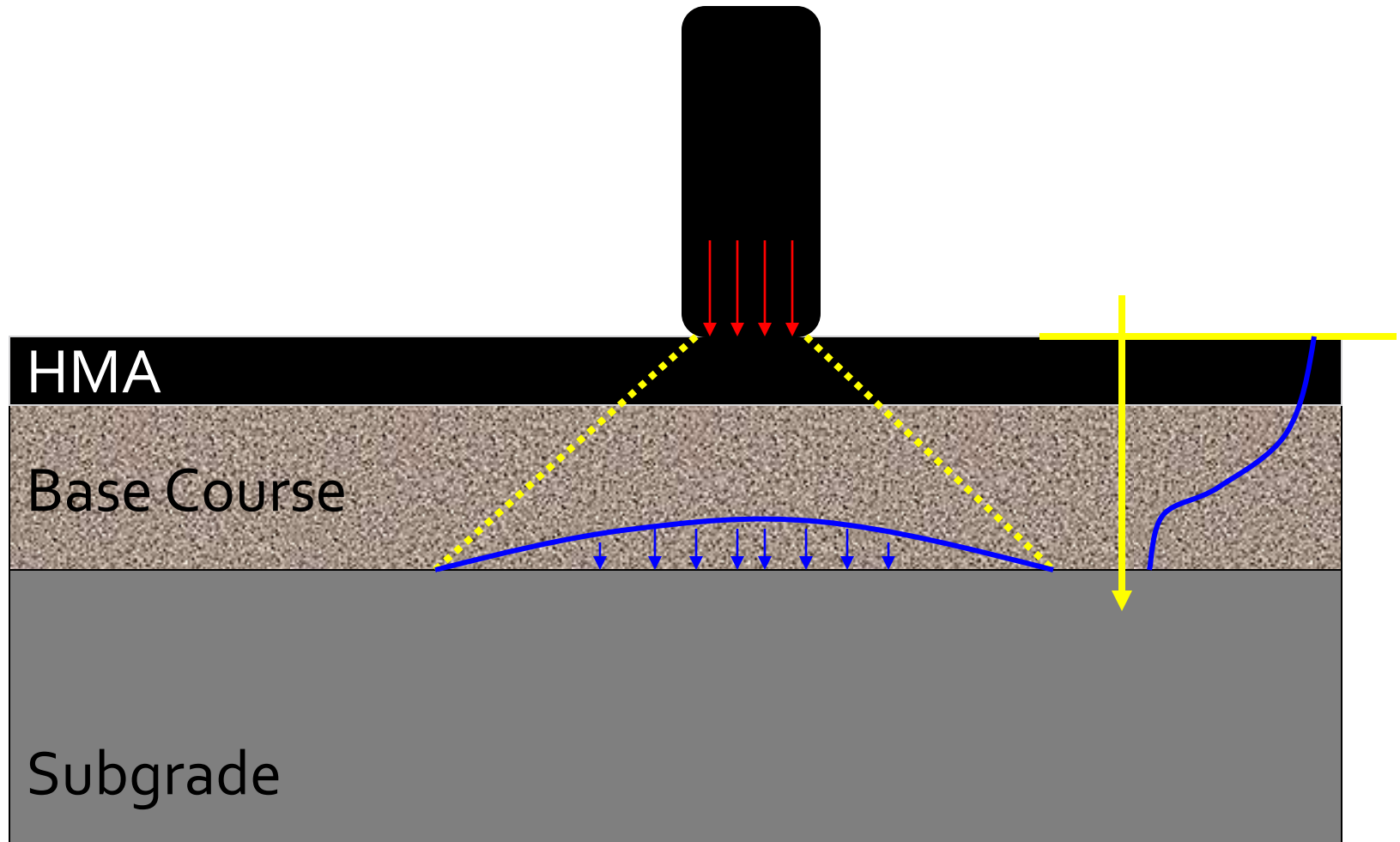
- Homogeneous material properties
- Isotropic layers
- Materials characterized by modulus value



Fatigue Cracking



Rutting



Segregation and Performance



Mixture Property Reduction

Mixture Property	Low	Medium	High
Permeability	Increases with level of coarse segregation		
Dynamic modulus	10-20%	20-30%	30-50%
Loss of fatigue life	38%	80%	99%
Rutting	No strong influence		Mixed results

Source: NCHRP Report 441

Segregation and Performance

- Using decreased mixture properties, the Pavement ME Design program was used to predict distresses
- 20-year design life
- Just over 11 million heavy trucks
- Columbus, Ohio weather
- Three pavement layers, 1.5 inches surface mixture, 2.5 inches intermediate mixture, 3.0 inches base mixture, over 10 inches of prepared A-6 subgrade

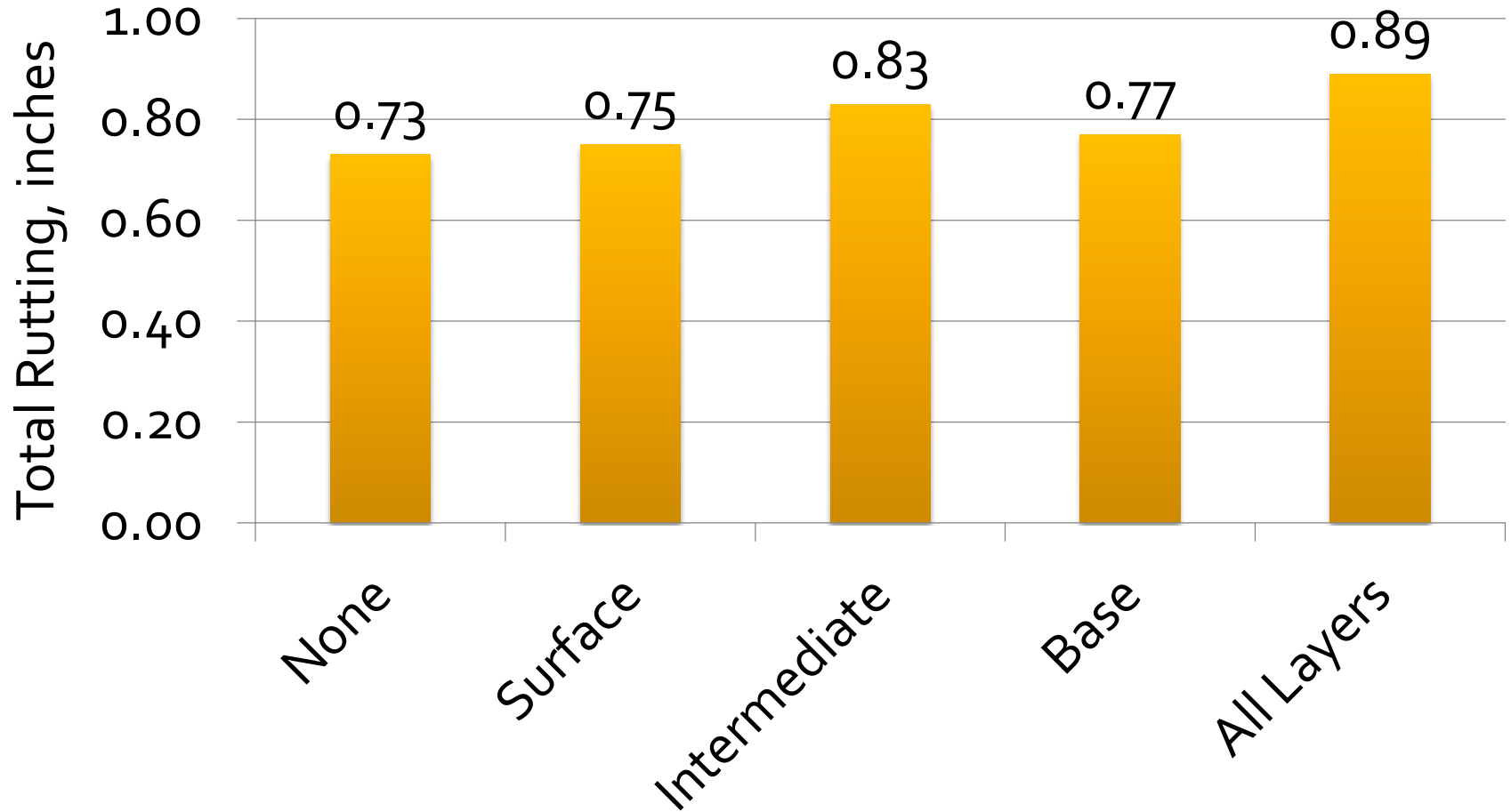
Segregation and Performance

- Five different scenarios
 - No segregation in any layers
 - Only surface layer segregation
 - Only intermediate layer segregation
 - Only base layer segregation
 - All three asphalt layers segregated
- Segregation represented by 40% modulus reduction, reduction in binder content, and increase in air voids

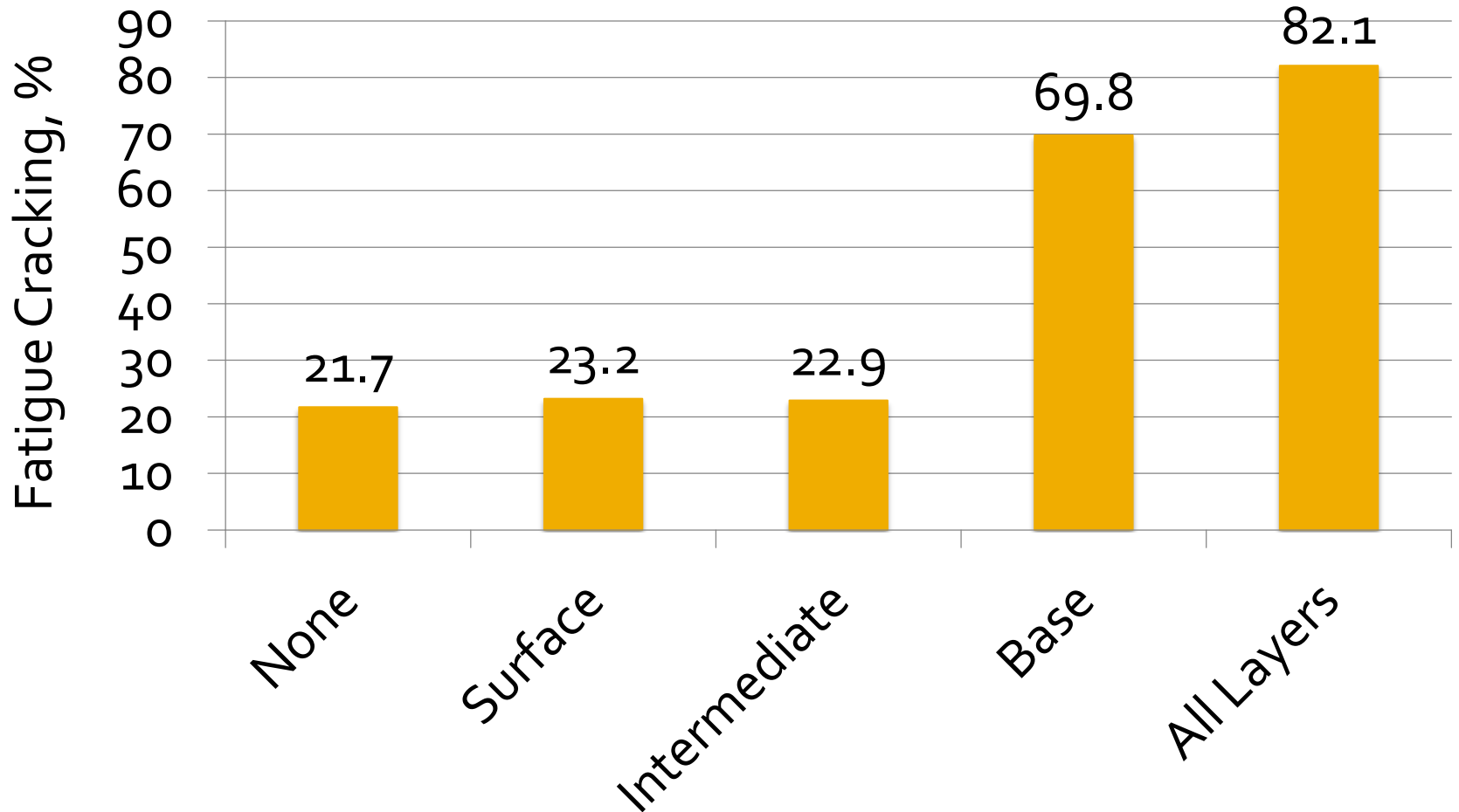
Pavement ME Design

- Total rutting, inches
- Asphalt mixture rutting, inches
- Bottom-up fatigue cracking, % lane area
- Top-down fatigue cracking, feet/mile
- Asphalt thermal cracking, feet/mile
- Terminal IRI, inches/mile

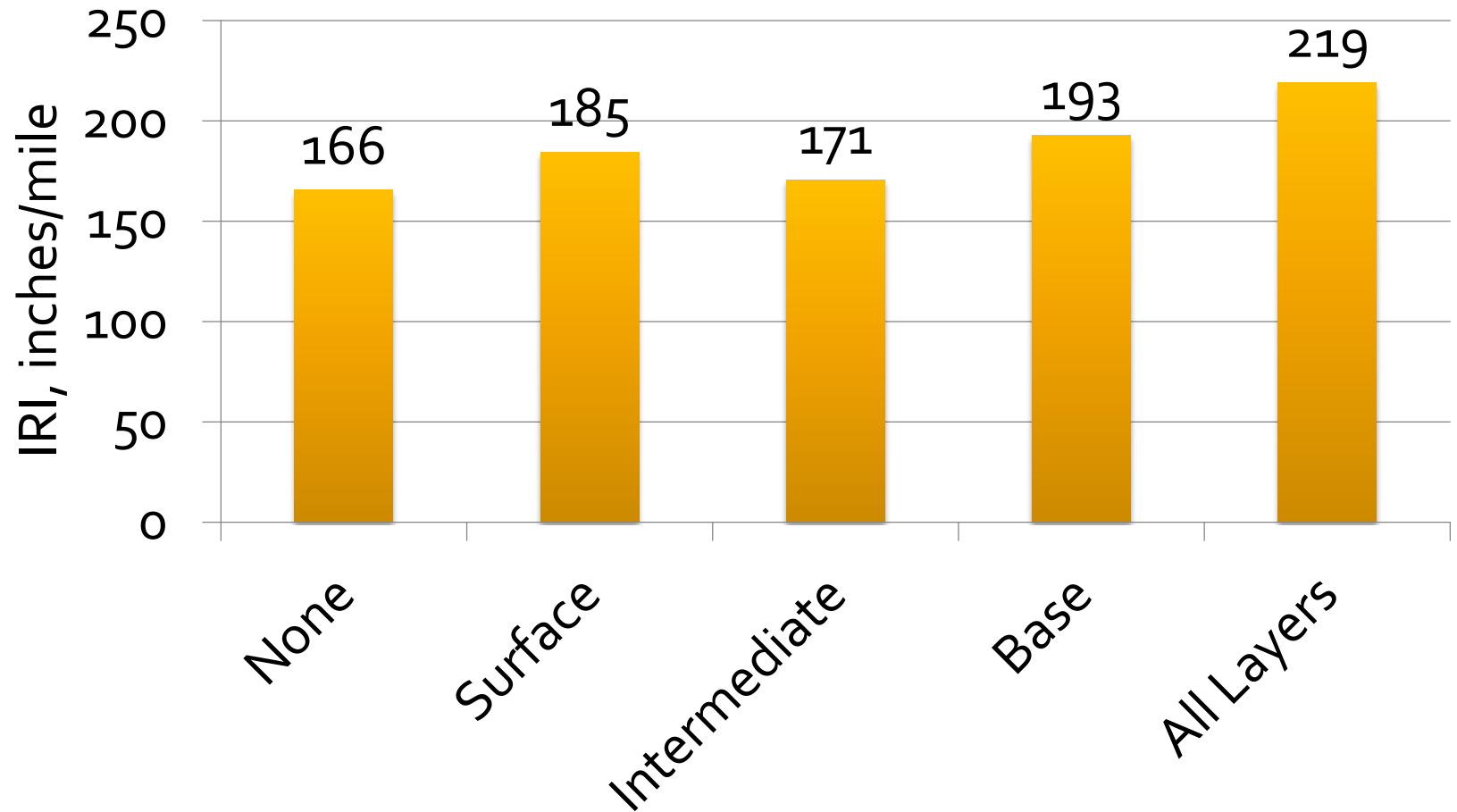
Predicted Rutting



Predicted Fatigue Cracking



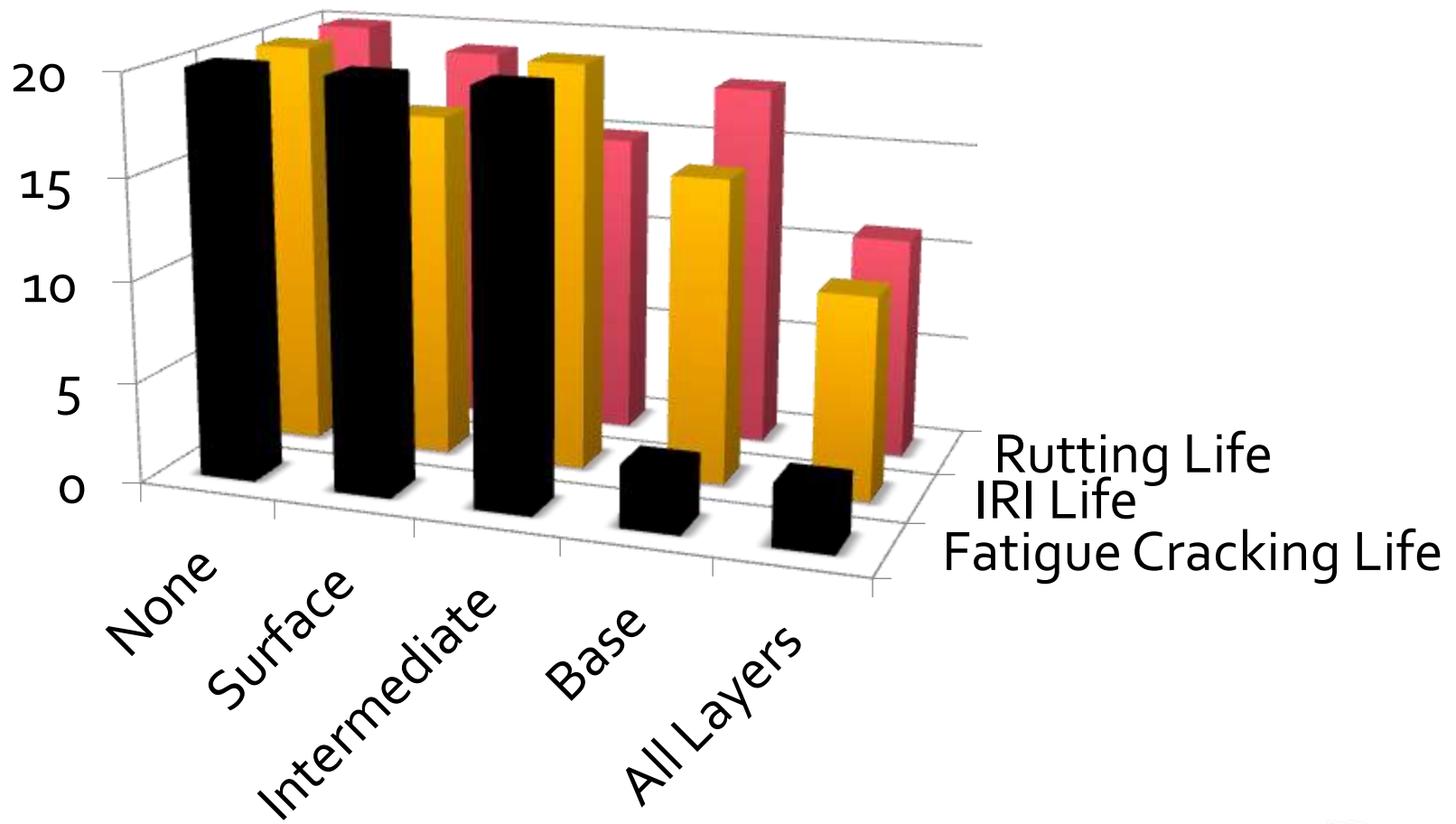
Predicted IRI



Predicted Pavement Distress

Segregation Case	Rutting Increase, %	Fatigue Cracking Increase, %	IRI Increase, %
Surface	2.7	6.9	11.5
Intermediate	13.7	5.3	3.1
Base	5.5	221.3	16.5
All layers	21.9	277.9	32.2

Predicted Pavement Life



Summary

- Uniformity in all layers is important
- Lack of density and permeability can greatly affect asphalt mixture performance
- Lack of uniformity in any layer can increase likelihood of distresses and decrease pavement life

Thank You!

