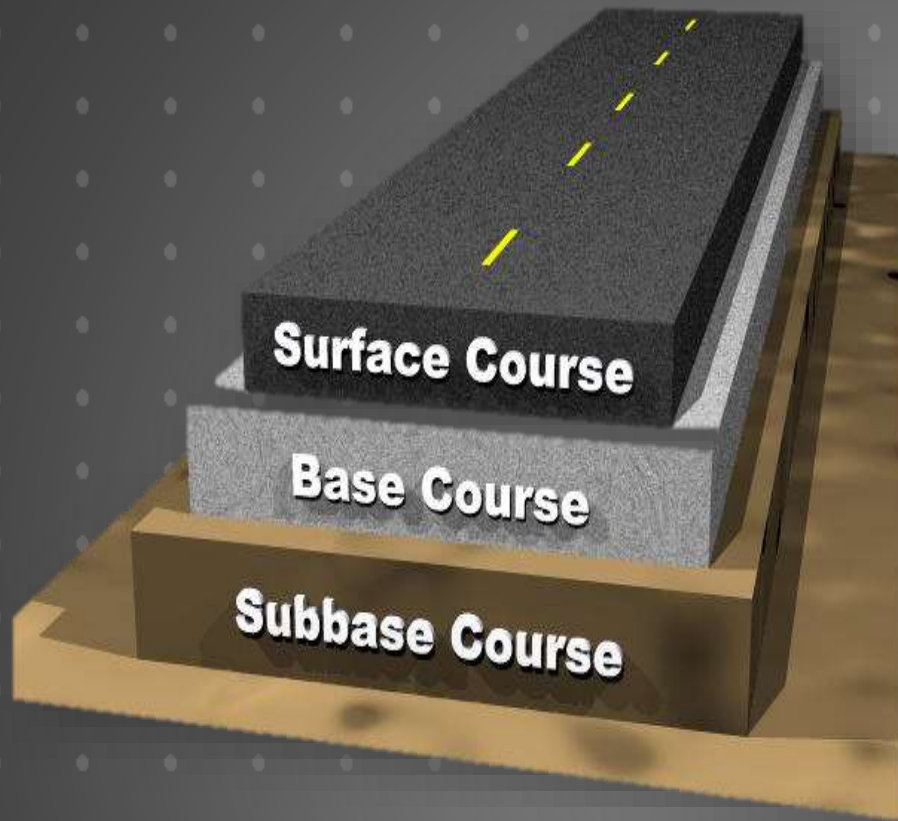


# 2016 NORTH DAKOTA ASPHALT CONFERENCE

*Ramblings on Local  
Road Maintenance,  
Rehabilitation &  
Design*

**April 5, 2016      Bismarck, ND**

Ken Swedeen  
Dakota Asphalt Pavement  
Association



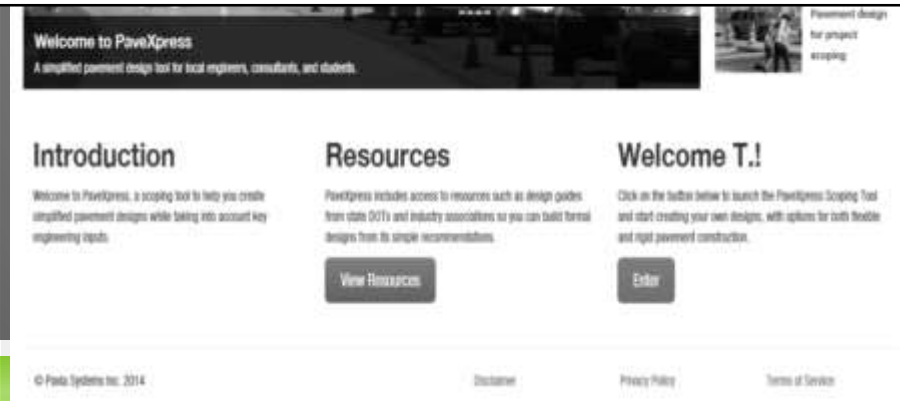
AASHTO has been developing MEPDG for high volume roads, but a gap has developed for local roads and lower volume roads.

# PaveXpress

A SIMPLIFIED PAVEMENT DESIGN TOOL



[www.PaveXpressDesign.com](http://www.PaveXpressDesign.com)

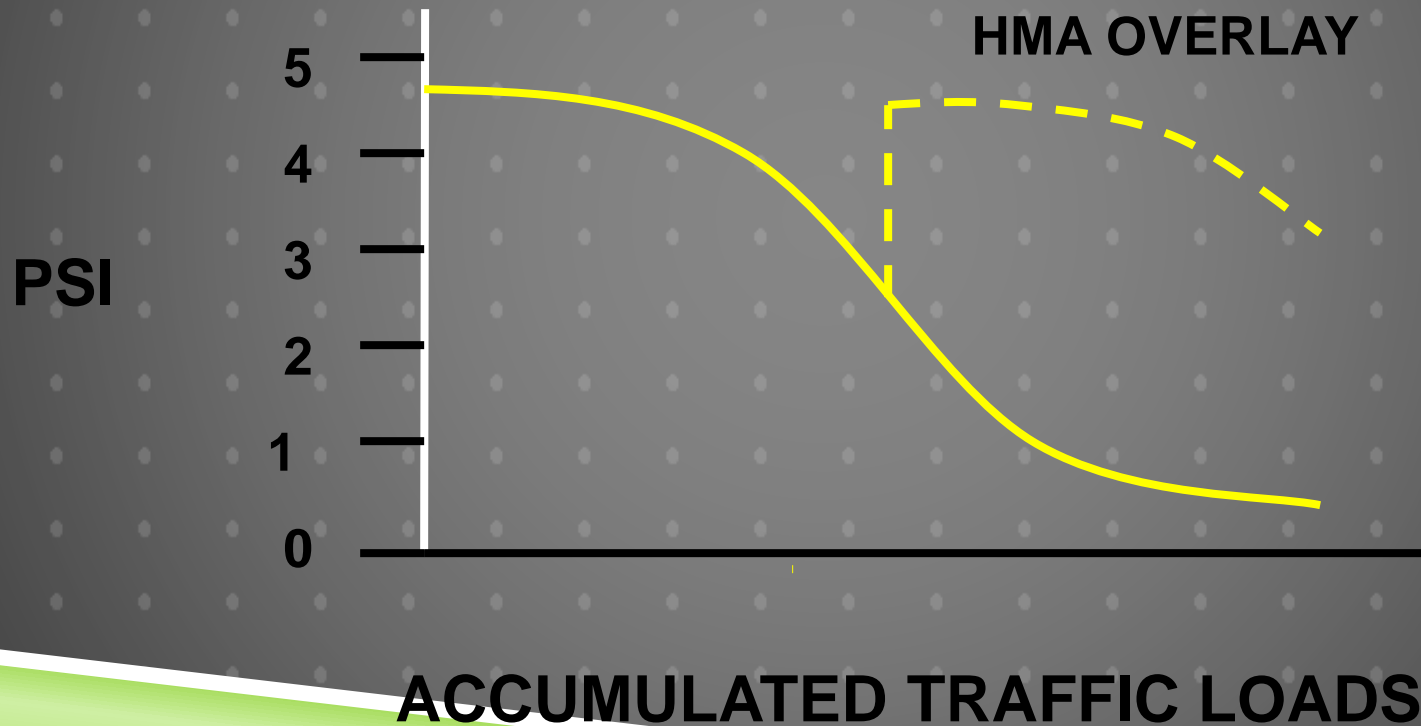




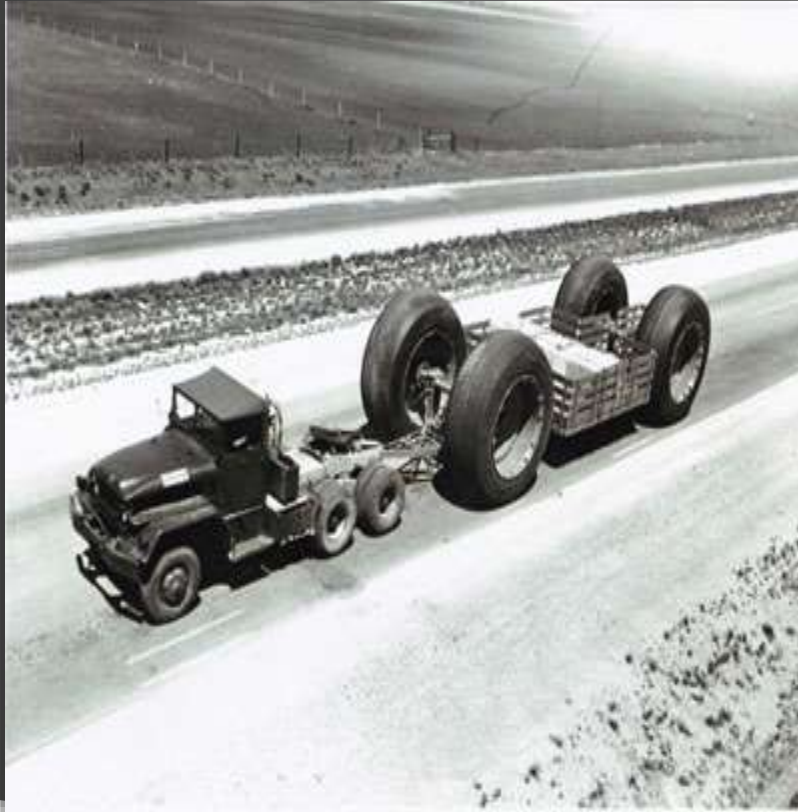
# STRUCTURAL OVERLAYS

- ▶ Needed when traffic loading exceeds the design loading
- ▶ Reduce maintenance costs
- ▶ Increase pavement life
- ▶ Provide a smooth riding surface
- ▶ Improve skid resistance
- ▶ Can be placed with minimal disruption

# TYPICAL RELATIONSHIP BETWEEN PSI AND CUMULATIVE TRAFFIC



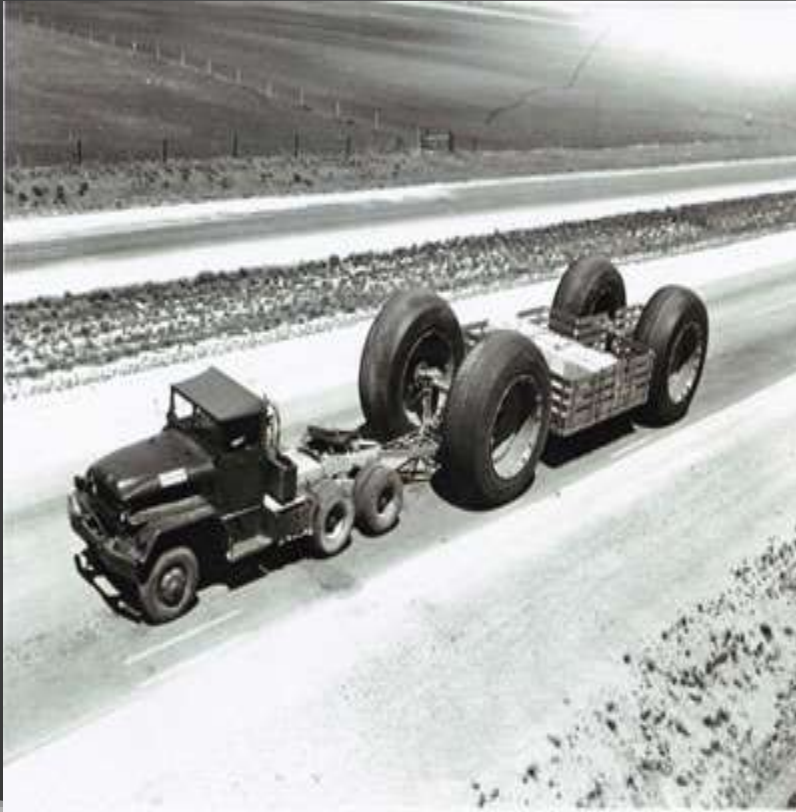
# 1993 AASHTO DESIGN GUIDE EQUATION — BASIC OVERVIEW



The equation was derived from empirical information obtained at the AASHTO Road Test.

The solution represents the average amount of traffic that can be sustained by a roadway before deteriorating to some terminal level of serviceability, according to the supplied inputs.

# 1993 AASHTO DESIGN GUIDE EQUATION — BASIC OVERVIEW (CON'T)



Your design/project should recognize the limitations of the design method, utilize your knowledge of the facility, and satisfy your network objectives.

You need the following:

- 1) **Traffic Data** – Garbage In/ Out
- 2) **Existing Condition** –Distress Survey & Evaluation; Thickness, Materials Verification (e.g. base, subgrade, surfacing); Roadway Evaluation – Drainage, Geometrics & Grade
- 3) **A PLAN** –

***Failure to Plan is Planning to Fail***



# WHERE CAN I FIND TRAFFIC DATA?

- Many DOTs post their traffic count data online
- Contact the Traffic Division of the DOT
- Contact the Traffic Division of the city, if available
- If no official traffic count is available, conduct a short-term count
- Interview local people, farms, commercial operations  
Don't forget your own eyes and "every day"  
observations of your own Maintainers



**Truck count is important, but don't forget agricultural traffic!**

# EXISTING AC PAVEMENT EVALUATION: TWO OPTIONS

The screenshot shows the 'Pavexpress' web application interface for 'Training - AC New Design'. The left sidebar contains a navigation menu with five main steps: 1. Project Information, 2. Pavement Layers, 3. Condition Survey (highlighted in green), 3a. Visual Assessment, 3b. Layer Coefficients, 4. Design Parameters, 5. Traffic & Loading, and Design Guidance. The main content area is titled 'Condition Survey' and includes a 'Save' and 'Next' button. It features three columns for 'Alligator Cracking' and 'Tensile Cracking', each with 'Low', 'Medium', and 'High' options and corresponding images. Below these are 'Cores' and 'Distressed Pavement' sections with dropdown menus and input fields for 'Yes/No' and 'inches'.

Condition Survey

The screenshot shows the 'Pavexpress' web application interface for 'Training - AC Overlay NDT'. The left sidebar contains a navigation menu with five main steps: 1. Project Information, 2. Pavement Layers, 3. Nondestructive Testing (NDT) (highlighted in green), 4. Design Parameters, 5. Traffic & Loading, and Design Guidance. The main content area is titled 'Nondestructive Testing (NDT)' and includes a 'Save' and 'Next' button. It features a 'Backcalculation Results' section with input fields for 'Design Subgrade Modulus (M)' and 'SPUs', each with a 'Calculate' button. Below this are 'Cores' and 'Distressed Pavement' sections with dropdown menus and input fields for 'Yes/No' and 'inches'.

Nondestructive Testing

## Training - AC New Design

Save Print

- 1 Project Information  
*Location, Roadway Classification and Pavement Type*
- 2 Pavement Layers  
*Pavement Layer(s) Information*
- 3<sub>a</sub> Condition Survey  
*Visual Assessment***
- 3<sub>b</sub> Layer Coefficients  
*Structural Parameters information*
- 4 Design Parameters  
*Specific Design Variables*
- 5 Traffic & Loading  
*Traffic and Loading Data*
- Design Guidance

### Condition Survey

#### Alligator Cracking

Low	Medium	High
		
0 %	0 %	0 %



#### Transverse Cracking

Low	Medium	High
		
0 %	0 %	0 %



### Cores

Were cores taken on the roadway?  

Were cores of cracks taken?  

### Distressed Pavement

Mill/Remove Distressed Asphalt?  

Depth to remove  inches 

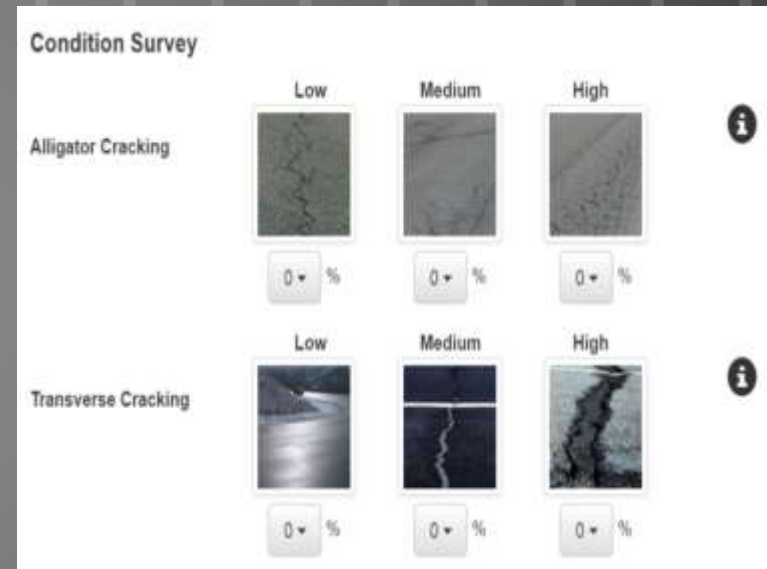
Previous Next

# Condition Survey

# 3<sub>a</sub> Condition Survey

## Visual Assessment

**Condition Survey:** This approach to assessing the existing pavement's structural capacity relies on a visual condition survey. Two distress types —Alligator Cracking and Transverse Cracking — are evaluated and used in Pavexpress. For each distress type, a percentage by condition type (Low, Medium, or High) is recorded.



*While rutting is considered in Chapter 5 of the 1993 Guide, it is highly recommended to mill surfaces that experience rutting.*

ASPHALT PAVEMENT RATING FORM

REVIEWER

DATE

ROUTE

PAVEMENT TYPE

WIDTH

DEFECTS

RATING

Transverse Cracks

0-5

Longitudinal Cracks

0-5

Alligator Cracks

0-10

Shrinkage Cracks

0-5

Rutting

0-10

Corrugations

0-5

Raveling

0-5

Shoving or Pushing

0-10

Pot Holes

0-10

Excess Asphalt (Bleeding)

0-10

Polished Aggregate

0-5

Deficient Drainage (Profile)

0-10

Overall Ride Quality (0=Excellent, 10=very poor)

0-10

Sum of Defects

0.00

Condition Rating = 100 - Sum of Defects

Condition Rating = 100 - 0.00

Condition Rating =

100.00

# 3<sub>a</sub> Condition Survey

## Visual Assessment

**Cores:** In addition to a visual assessment of the pavement, coring is critical. Coring will aid in confirming the existing pavement structure and retrieving material for lab testing. Just as importantly, cores can be used to determine the direction of cracking, along with the presence of delamination or stripping. The depth of cracks and location of delamination/stripping is used by PaveXpress to guide the user in determining depth of milling needed.



**Cores**

Were cores taken on the roadway?	Yes ▾	<b>i</b>
Were cores of cracks taken?	Yes ▾	<b>i</b>
Crack Type	Top-Down Only ▾	<b>i</b>
Depth of cracks (max)	2 inches	<b>i</b>
Delamination/Stripping?	Yes ▾	<b>i</b>
Depth of distress (max)	2 inches	<b>i</b>

# 3<sub>a</sub> Condition Survey

## Visual Assessment

**Distressed Pavement:** In many cases, the existing pavement surface is distressed and should be removed prior to placement of a new AC overlay. The designer must define the depth of existing pavement to be removed. This material that is removed will impact the existing structural capacity.



**Distressed Pavement**

Mill/Remove Distressed Asphalt?  ⓘ

Depth to remove   ⓘ















# TRADITIONAL MAINTENANCE DEFINITIONS

- ✓ Preventative
- ✓ Corrective

I would add a third level: Preparatory Maintenance

Maintenance identified in your three or five year plan in preparation of resurfacing or overlay work consisting of crack sealing/filling, pothole repairs, blade patching, drainage improvements, shoulder “stiffening”, and approach work.



Shoulder Stiffening Req'd.



Grade In-slopes for positive drainage to shed water away from pavement structure





**Stabilize approaches, so they're not launching pads onto your pavement edge. Positive drainage and cross slope keep water from ponding and weakening pavement edge as well.**

Pay attention to the flow line of borrows, it could save you isolated pavement repairs and extend pavement life

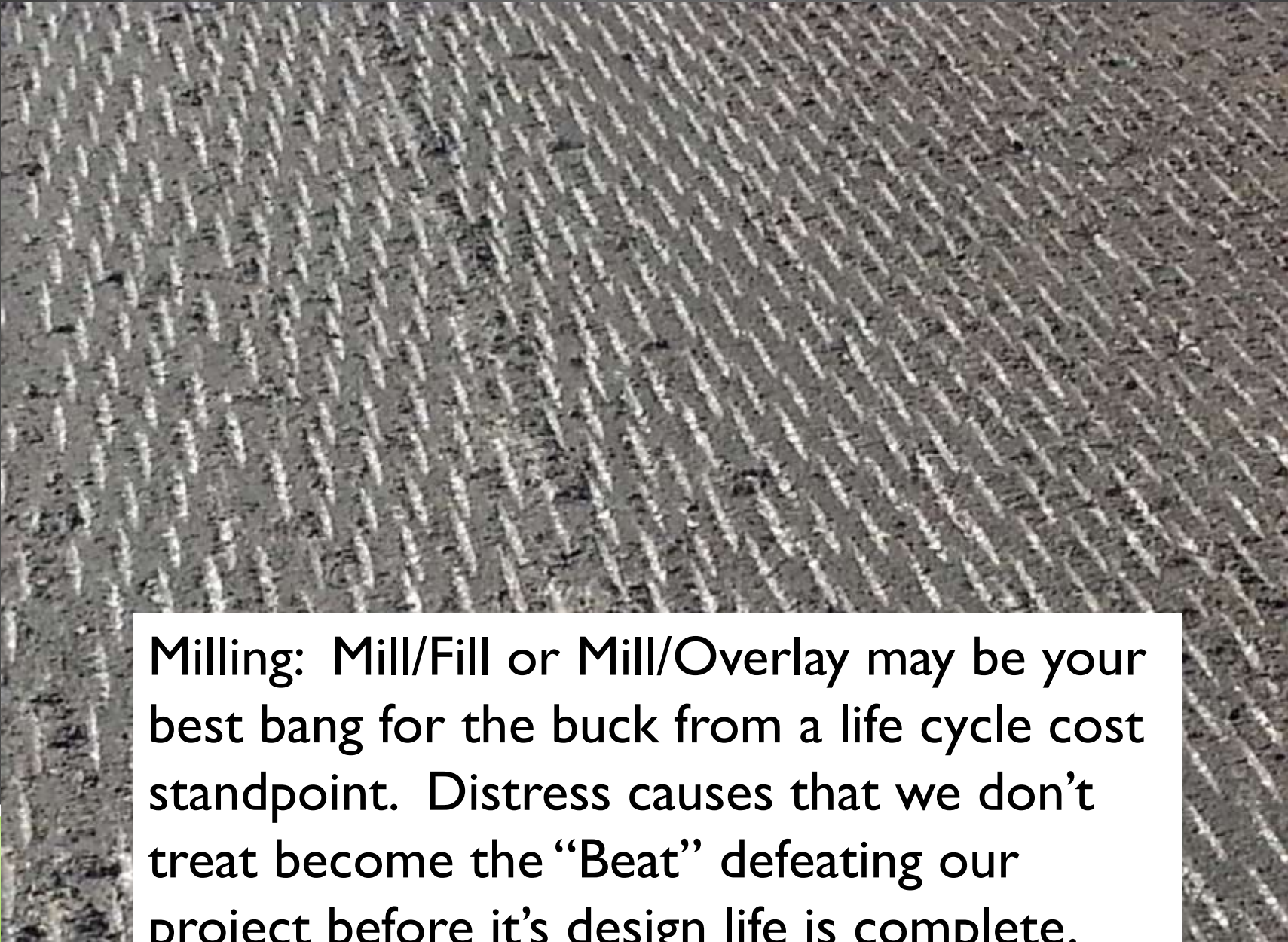


Blade time providing clean and positive drainage to your in-slopes is investing pennies to save \$Dollars\$

# COLD MILLING ASPHALT







Milling: Mill/Fill or Mill/Overlay may be your best bang for the buck from a life cycle cost standpoint. Distress causes that we don't treat become the "Beat" defeating our project before it's design life is complete.



And it's not as expensive as your think.....



# LAYER COEFFICIENT CONSIDERATIONS

Average values of layer coefficients for materials used in the AASHO Road Test were as follows:

**Asphalt Surface Course 0.44**  
**Crushed Stone Base Course 0.14**  
**Sandy Gravel Subbase 0.11**

*Keep in mind that these values were empirically derived from a road test with one climate, one soil type, and one asphalt mix type.*

The asphalt layer coefficient used for the Road Test was actually a weighted average of values ranging from 0.33 to 0.83.

More recent studies at the NCAT Test Track found that for Alabama, an asphalt layer coefficient of 0.54 better reflected actual performance.







Moisture susceptible fine grained soils have to be addressed on two fronts.....notice the contamination of the base layer

# DRAINAGE COEFFICIENT CONSIDERATIONS

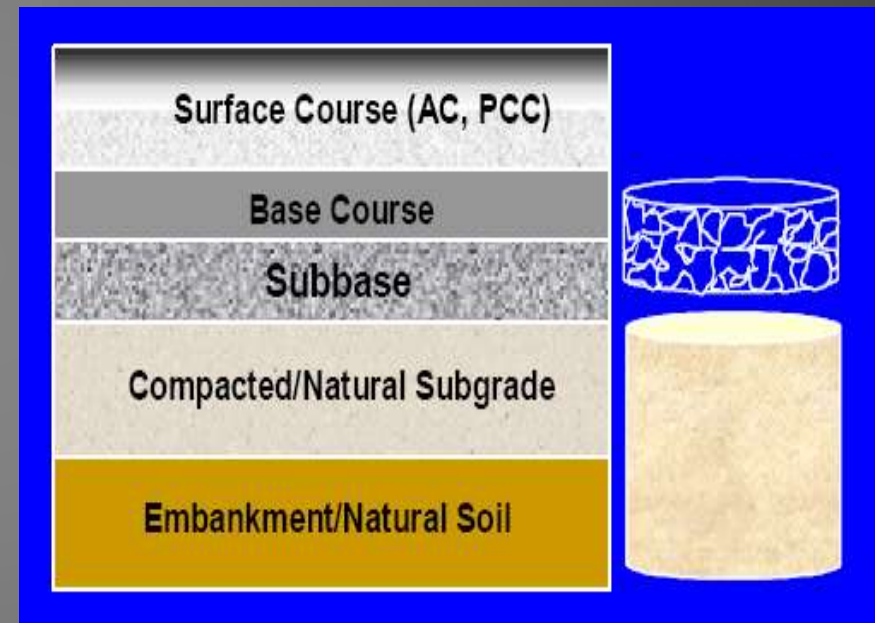
1993 Design Guide Table 2.4 — Recommended  $m_i$  Values for Modifying Structural Layer Coefficients of Untreated Base and Subbase Materials in Flexible Pavements

Quality of Drainage	Percentage of Time Pavement Structure is Exposed to Moisture Levels Approaching Saturation			
	< 1%	1–5%	5–25%	> 25%
Excellent	1.40–1.35	1.35–1.30	1.30–1.20	1.20
Good	1.35–1.25	1.25–1.15	1.15–1.00	1.00
Fair	1.25–1.15	1.15–1.05	1.00–0.80	0.80
Poor	1.15–1.05	1.05–0.80	0.80–0.60	0.60
Very Poor	1.05–0.95	0.95–0.75	0.75–0.40	0.40

# SUBGRADE CONSIDERATIONS

The most common methods of classifying the subgrade for pavement design are:

- California Bearing Ratio (CBR)
- Resistance Value ( $R$ )
- Resilient Modulus ( $M_R$ )



# CALIFORNIA BEARING RATIO (CBR)

The CBR Test can be performed either in the lab(AASHTO T 193,ASTM D 1883) or in the field in situ (ASTM D4429).

The CBR is a simple test that compares the bearing capacity of a material with a standard well-graded crushed stone, which has a reference CBR value of 100%.

Fine-grained soils typically have values less than 20.



# USING THE DYNAMIC CONE PENETROMETER TO ESTIMATE CBR

The Dynamic Cone Penetrometer (DCP) Test can be performed in the field in situ (ASTM D6951) and used to estimate CBR values.

The U.S. Army Engineers Waterways Experiment Station has developed the following relationship between Dynamic Penetration Index (DPI) and CBR:

$$\log_{10}(\text{CBR}) = 2.46 - 1.12 \log_{10}(\text{DPI})$$

*\*Other correlations have been developed also.*



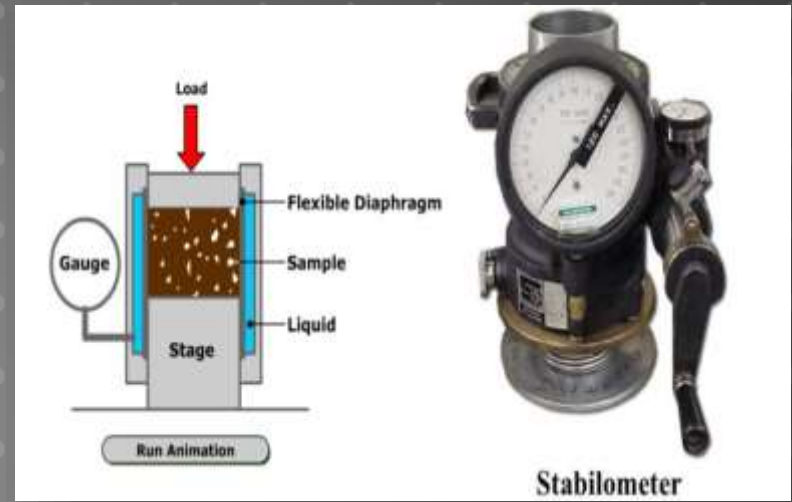
# RESISTANCE VALUE (R)

The Resistance Test is performed in the lab (AASHTO T 190, ASTM D 2844).

It tests both treated and untreated laboratory compacted soils or aggregates with a stabilometer and expansion pressure devices. It tests the ability of the

material to resist lateral spreading due to an applied vertical load.

A range of values are established from 0 to 100, where 0 is the resistance of water and 100 is the resistance of steel.



# SUBGRADE CONSIDERATIONS

The Asphalt Institute publication IS-91 gives the following test values for various subgrade qualities:

Relative Quality	R-Value	California Bearing Ratio	Resilient Modulus (psi)
Good to Excellent	43	17	25,000
Medium	20	8	12,000
Poor	6	3	4,500

*Note that different design guides will show different ranges for the various subgrade qualities — use engineering judgment when evaluating subgrade design inputs.*

Design to lowest common denominator of our project section, average roadway conditions, majority rules, dry cycles/wet cycles??? The decision we make can affect \$\$ and the traveling public.





Should we design both areas circled the same?  
Mother nature and time certainly didn't treat  
them the same.....



# Conclusions:

- 1) Plan ahead
- 2) Read the road
- 3) A few dollars up front, a few dollars during construction can make or break a million dollar investment!

Thank you!!!