MODULE 6

PAVEMENT CONDITION INDICES

6

Instructional Objectives

- **Historic development of pavement condition indices**
- **The basic functions of condition indices in PMS**
- **Different types of condition indices**
- **Development of a pavement condition index**

6

Present Serviceability Rating

PSR	Description
5.0 to 4.0	Very Good
3.9 to 3.0	Good
2.9 to 2.0	Fair
1.9 to 1.0	Poor
0.9 to 0.0	Very Poor

6

Present Serviceability Index

$$PSI = 5.02 - \log(1+SV) - 1.38(RD)^2 - 0.01(C+P)^{1/2}$$

Where:

- **PSI** = Statistical estimate of the Mean PSR
- **SV** = Slope variance (roughness)
- **RD** = Rut Depth
- **C** = Cracking (ft^2 / 1000 ft^2)
- **P** = Patching (ft^2 / 1000 ft^2)

6

Need for Pavement Distress Indices

- **Trigger treatments**
- **Calculating life-cycle costs**
- **Evaluate network conditions**
- **Compare roads with different distress**

6

Pavement Condition Indices Development

Computed using a very simple deduct based formula:

- **PCI = PCI_{max} - Deduct Value**
- ***Example***

100 - 40 = 60

6

Pavement Condition Indices Development (cont'd)

- Transform pavement condition data into pavement condition indices
- Deduct values developed for various levels of distress severity and extent
- Two basic approaches
  - Expert opinion
  - Engineering criteria

6

Deduct Value Table

From Expert Opinion

Severity	Extent (%)				
	None	1 – 10	10 - 25	25 - 50	> 50
Low	0	20	30	40	50
Medium	0	35	40	60	75
High	0	50	60	80	100

6

Example: Pavement Distress Trend

Severity	Extent (%)				
	None	1 – 10	10 - 25	25 - 50	> 50
Low	~ 2	~ 4	~ 6 ~ 8		
Medium			~ 10	~ 12 ~ 14	
High				~ 16	

6

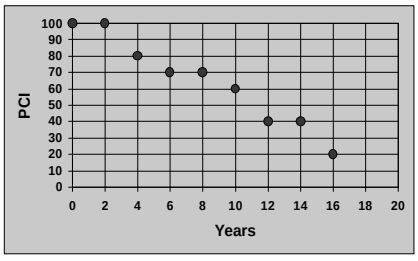
Pavement Distress Curve

- Plot condition index versus age
- Produces a pavement performance curve
- Shape and trend of resulting curve is dependent on deduct value developed

6

Pavement Performance

(Using deducts from Expert Opinion)



6

Engineering Criteria Approach: Index Scale

- Scale used for condition index
- Scale chosen to meet agency needs and perceptions
- Typical scales are 0-100, 0-10, 0-5

6

Engineering Criteria Approach: Threshold Value

- Index value representing unacceptable pavement condition
- Typically taken as middle of an index scale, such as 50 (0-100 scale) or 2.5 (0-5 scale)
- May be set to represent a range such as 40 to 60 (0-100 scale) or 2 to 3 (0-5 scale)

6

Engineering Criteria Approach: Engineering Criteria

- Pavement distress level (severity, extent), considered unacceptable
- Amount of distress for each severity level where action should be taken to correct distress
- May be numerically different for various types of distress

6

Engineering Criteria Example

- Use a 100 to 0 Scale
- Set Threshold Condition Value at 50
- Set Engineering Criteria
  - 90% Low Severity Cracking
  - 25% Medium Severity Cracking
  - 15% High Severity Cracking

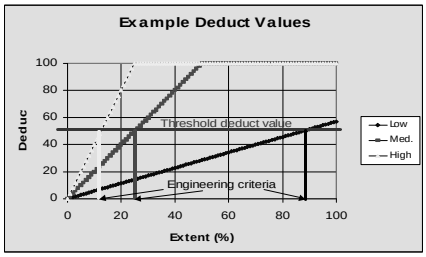
6

Engineering Criteria Example

- Develop Plot of Deduct Values
  - All three severities start at 0 and pass through the threshold value of 50 at the engineering criteria selected
  - In this example they pass through the threshold value of 50 at 15%, 25%, and 90% for low, medium and high severity cracking

6

Development of Deduct Values



6

Engineering Criteria Example

- Develop Final Deduct Values from relationships shown on plot
- The Deduct Values may be developed as set of continuous functions which may be shown:
  - as a plot of a chart
  - as a formula
  - as a set of deduct tables

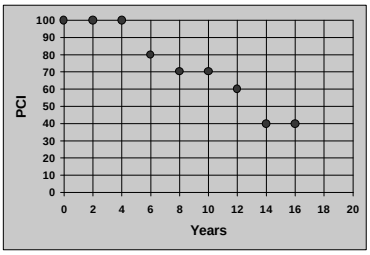
Example Deduct Value Table

(Straight Line approach)

Severity	Extent (%)				
	None	1 – 10	10 - 25	25 - 50	> 50
Low	0	3	10	21	43
Medium	0	10	35	75	-
High	0	20	70	-	-

Pavement Performance

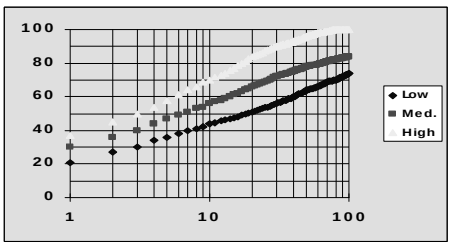
Using deducts from Engineering Criteria



Pavement Deduct Values

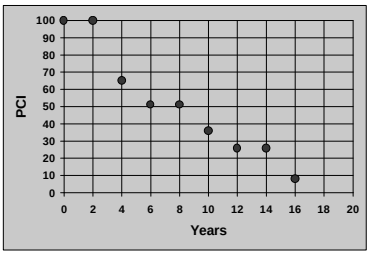
ASTM D5340 "Paver"

"Based on Engineering Experience"



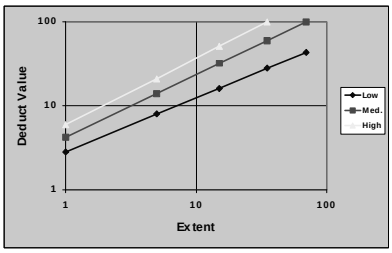
Pavement Performance

Using deducts from ASTM D5340



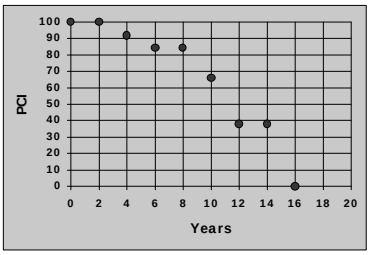
Pavement Deduct Values

Using Log-Log Chart



Pavement Performance

Using deducts from Log - Log approach



6

Distress Index Development Basic Criteria

- **Scaled deduct values so resulting condition index threshold value occurs near middle of scale**
- **Transition of deduct values should produce reasonable smooth performance curve matching trends of distress observed in field**

6

Current Practices

- **1994 - NCHRP Synthesis 203 survey**
- **50 states / 9 provinces**
- **Roughness (IRI) use increased sharply**
- **Structural capacity - vary widely**
- **Friction / skid testing - not common at network level**

6

Current Practices

- **Distress info - most variation**
  - field procedure
  - distress definitions
- **Little opportunity to exchange information**
- **Approximately. 80% of agencies use**
  - distress index
  - serviceability index/rating
  - priority rating
- **No evident trends in development**
- **67% use composite indices (roughness)**

6

Instructional Objectives

- **Historic development of pavement condition indices**
- **The basic functions of condition indices in PMS**
- **Different types of condition indices**
- **Development of a pavement condition index**