Remaining Service Life
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**Remaining Service Life**

- **Distress Index (DI)**
- **Time (Years)**

**Terminal Threshold**

- **RSL = 4 years**
- **RSL = 2 years**
- **RSL = 9 years**
- **RSL = 12 years**

**Treatment A:** 5 year life extension

**Treatment B:** 10 year life extension

**Road A**

- 15 yrs
- 30 yrs
Definitions

**Service Life:**
The period over which a pavement section adequately performs its desired function or performs to a desired level of service.

**Remaining Service Life (RSL):**
The amount of service life left.
Impassible Condition

- Impassible
- Acceptable
- Unacceptable Needs Repair
Terminal Threshold Value

- Threshold
- Acceptable
- Unacceptable
  Needs Repair
• Only remaining cost-effective option is Reconstruction or Rehabilitation
• Agency begins receiving user complaints
• Pavement has zero service life: \( RSL = 0 \)
<table>
<thead>
<tr>
<th>Engineering Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ensuing Decisions - Main Driving Mechanism</td>
</tr>
<tr>
<td>• Addressing Distress Points To Be Assigned</td>
</tr>
<tr>
<td>• Assessing Weight Factors - Maximum Extent of Distress</td>
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</tbody>
</table>
Friction

POLISHED AGGREGATE
Faulting
DISTRESS

BLOCK CRACKING
Distress

ALLIGATOR CRACKING
Distress

TRANSVERSE CRACKING
Distress Points Example (Transverse Cracking)

- Maximum Allowable Number of TC = 20
- Distress Points per Crack = ?

Perfect = 100
Threshold = 60

\[
100 - 60 = 40
\]

\[
40/20 = 2 \text{ Distress Points per Crack}
\]
**Distress Points Example**  
(Alligator Cracking)

- Rating Scale: 0 to 100 (100 = Perfect)
- Threshold Value = 60
- Max. Allowable Extents for AC
  - Low Severity = 100 %
  - Medium Severity = 50 %
  - High Severity = 10 %
- Alligator Cracking Index (ACI) = ?
Distress Points Example (Alligator Cracking)

Perfect = 100

Threshold = 60

Poor = 0

100 – 60 = 40

Weight Factors:

\[
\frac{40}{100} = 0.4 \text{ for L.S. AC}
\]

\[
\frac{40}{50} = 0.8 \text{ for M.S. AC}
\]

\[
\frac{40}{10} = 4.0 \text{ for H.S. AC}
\]

\[
ACI = 100 - (4 \times \text{H.S.} + 0.8 \times \text{M.S.} + 0.4 \times \text{L.S.})\] AC
ACI = 100 - (4 * H.S. + 0.8 * M.S. + 0.4 * L.S.)AC

- Calculate ACI for a Section with
  - 20% L.S. AC
  - 10% M.S. AC
  - 5% H.S. AC
Distress Points Example (Alligator Cracking)

$$ACI = 100 - (4 \times H.S. + 0.8 \times M.S. + 0.4 \times L.S.)_{AC}$$

$$= 100 - (4 \times 5 + 0.8 \times 10 + 0.4 \times 20)$$

$$= 64$$

The Pavement Section is Still Acceptable!
Advantages of Distress Index

• Improved Communication
• Standard Critical Threshold
• Ranks Roads/Highways
• Effects Various Design Decisions
Shortcomings of Distress Index

• Only Indicates Condition at Survey
• Does Not Account for Design Life Nor Rate of Deterioration
• Does Not Capture Long-Term Behavior
Shortcomings of Distress Index

Distress Index vs Year

- Pavement Section 1
- Pavement Section 2
- Threshold Value


Distress Index: 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100
Remaining Service Life (RSL)

- Overcome Shortcomings of Distress Index
- Examines Distress Index Over Time → Rate of Deterioration
- Assign Initial Distress Index Value as Function of Design Life
Remaining Service Life Example (Transverse Cracking)

- Rating Scale: 0 to 100 (Perfect)
- Threshold = 60
- Built in 1990
- DI in 1999 = 75
- Estimate RSL & SL
Remaining Service Life Example
(One Data Point)

\[
\begin{align*}
\text{DE} & = \text{CD} \\
\text{BC} & = \frac{\text{AB}}{}
\end{align*}
\]

Diagram showing the relationship between distress index and time, with points A, B, C, D, and E marked.
Remaining Service Life Example (One Data Point)

\[
RSL = 9 \times \left( \frac{15}{25} \right) = 5.4 \text{ years}
\]

\[
SL = RSL + SA = 14.4 \text{ years}
\]
Remaining Service Life Example  
(Multiple Data Points)

\[ DI = 100 - 0.25T^2 - 1.1T \]

Threshold = 60

\[ \text{SA} = 6 \quad \text{RSL} = ? \]

Service Life = ?
From Best-Fit Equation of DI;

\[ DI = 100 - 0.25 \times T^2 - 1.1 \times T \]

Where \( T \) = Time in Years

Remember that when \( DI = 60 \), \( T = \) Service Life

\[ 60 = 100 - 0.25 \times T^2 - 1.1 \times T \]

\[ T = SL = 10.6 \text{ Years} \]

\[ RSL = SL - SA = 10.6 - 6 = 4.6 \text{ years} \]
### Which Remaining Service Life should be used?

<table>
<thead>
<tr>
<th>Index</th>
<th>RSL (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse Cracking</td>
<td>11</td>
</tr>
<tr>
<td>Longitudinal Cracking</td>
<td>14</td>
</tr>
<tr>
<td>Alligator Cracking</td>
<td>7</td>
</tr>
<tr>
<td>Block Cracking</td>
<td>18</td>
</tr>
<tr>
<td>Rutting</td>
<td>6</td>
</tr>
</tbody>
</table>
Uses of Remaining Service Life

- Average Remaining Service Life of Pavement Network (Network Health)
- Enhances Communication
- Forecasts Future Condition of Network
- True Benefits: RSL Gain
- Used to Determine Asset Values
Limitations of Remaining Service Life

• Not Applicable to Some Distress Types (Such as Potholes & Blowup)
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