ASSET MANAGEMENT
THE REMAINING SERVICE LIFE

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Remaining Service Life (RSL)

- RSL Is the Estimated Number of Years from Any Given Date to the Time when Pavement Starts to Provide **Substandard Service Quality**
- The RSL Is Calculated Based on Distress Data or Distress Index
- The RSL Has a Self Calibrating Mechanism

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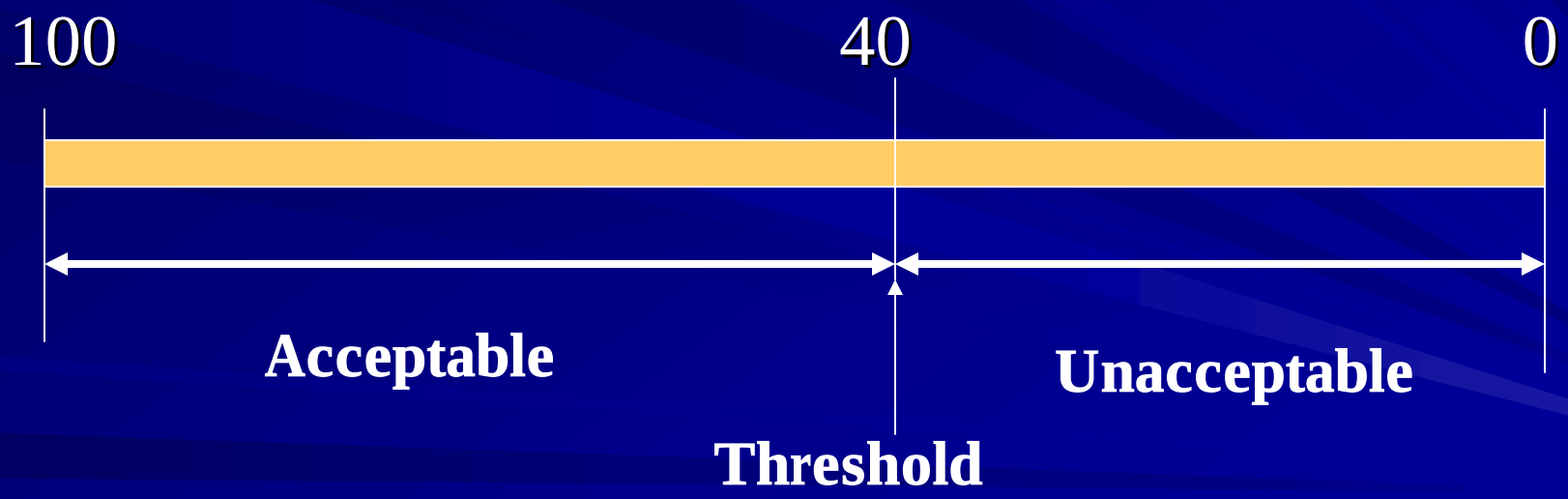
RSL Calculation

The RSL Is Calculated Based on:

- **Types of Pavement Distress and Distress Index**
- **Rating Scale**
- **Distress Point & Distress Point Threshold**



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Distress Index (DI)

Types of DI

- **Itemized** - Such As Rut Index, Roughness Index, Cracking Index, etc.
- **Combined or Composite** - Such As Structural Index, Ride Quality Index, etc.
- **Overall** Pavement Quality Index

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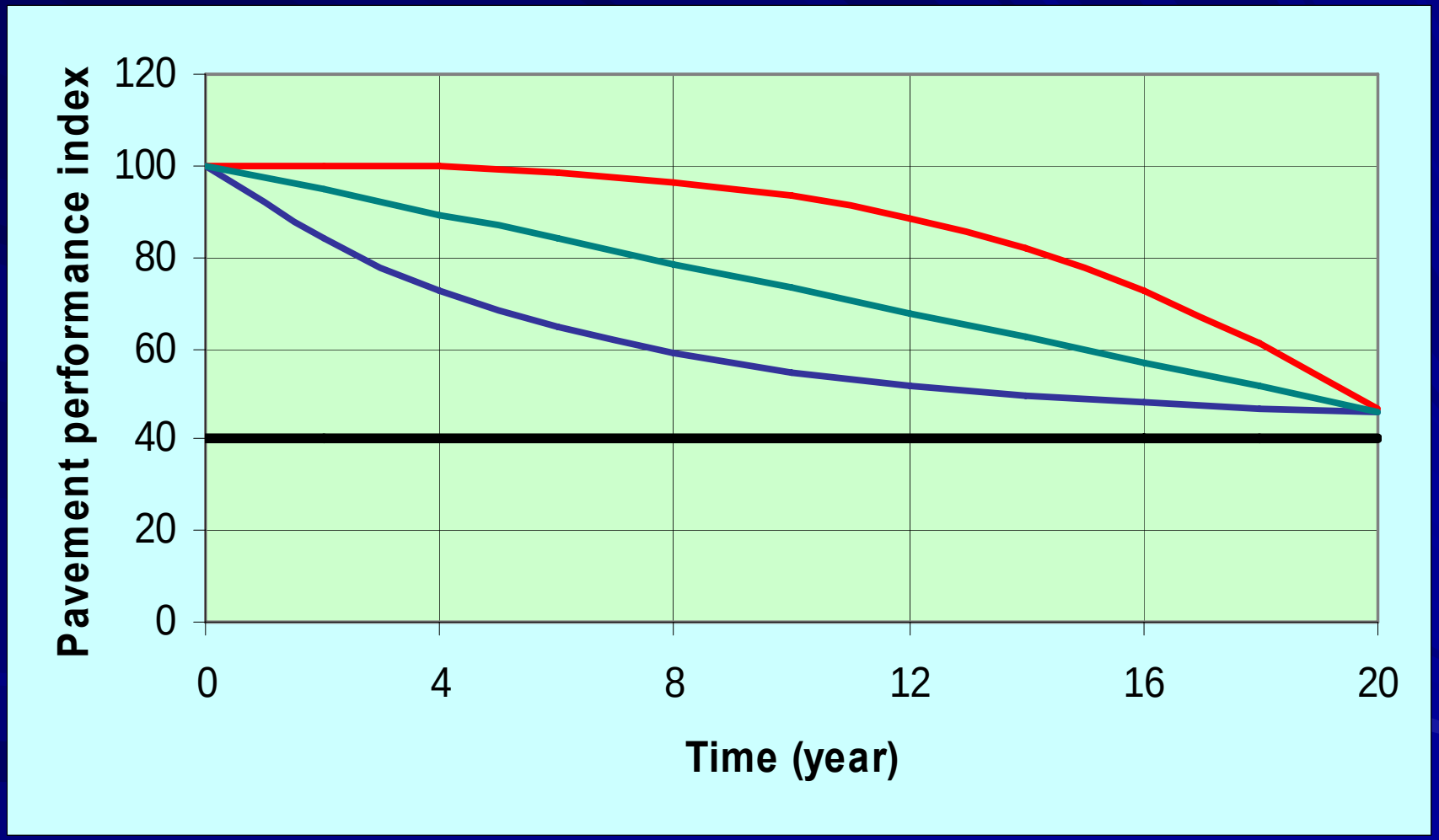
Uses of DI, Performance Curves



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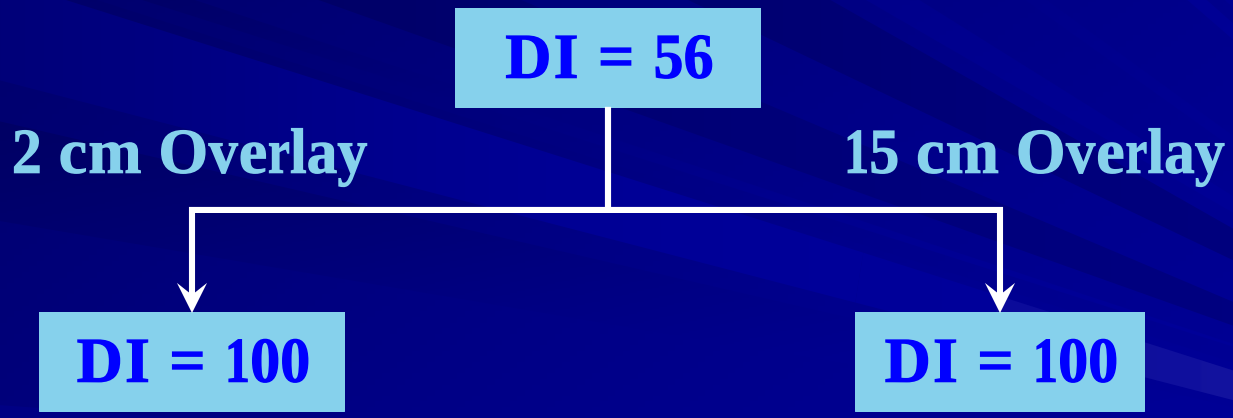
Shortcomings of DI

Inappropriate for Prioritization

Ignores the Pavement Rate of Deterioration

Drives the system to Cheap Fixes



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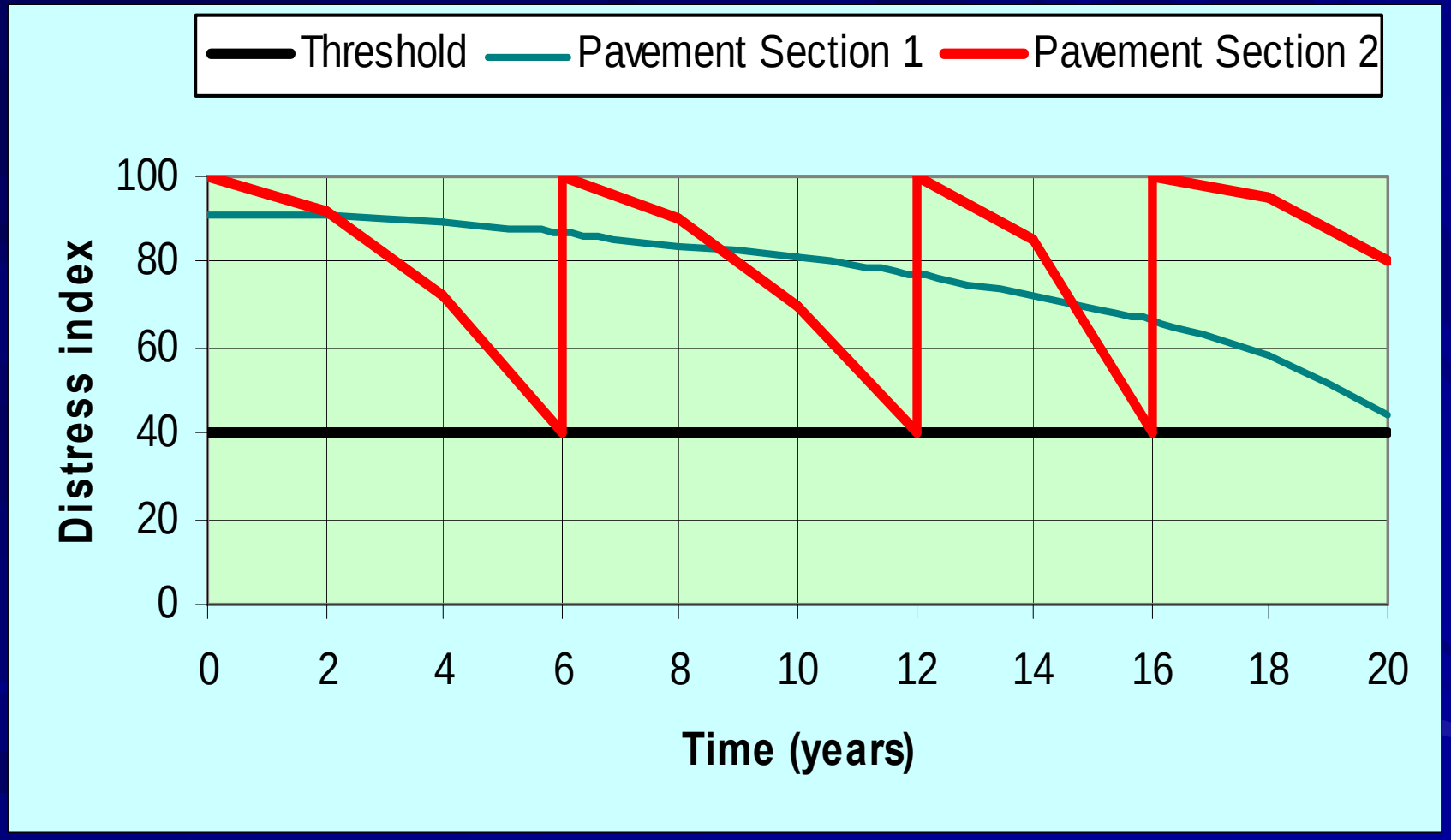
Distress Index vs. Time



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Definitions

Pavement Design Life (DL) - An Estimate of the Number of Years of Service (After Construction/Rehabilitation)

Pavement Service Life (SL) - The Actual Number of Years between Original Construction & Reconstruction/Rehab

Pavement Surface Age (SA) - The Actual Number of Years Since Construction or Last Rehabilitation

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Remaining Service Life

For a Given Pavement Section, the RSL is equal to:

- **The Number of Years between now and the time when the Pavement Distress Points Reaches a Pre-selected Threshold Value**
- **Zero if the Sum of the Distress Points are Equal to or Higher Than the Threshold Value.**
- **The Design Life (DL) if no distress can be found**

For a Pavement Network, the RSL of the network is equal to the weighted average RSL of all pavement sections

$$RSL_{Network} = \frac{\sum_{i=1}^{n} (RSL_i)(L_i)}{\sum_{i=1}^{n} L_i}$$

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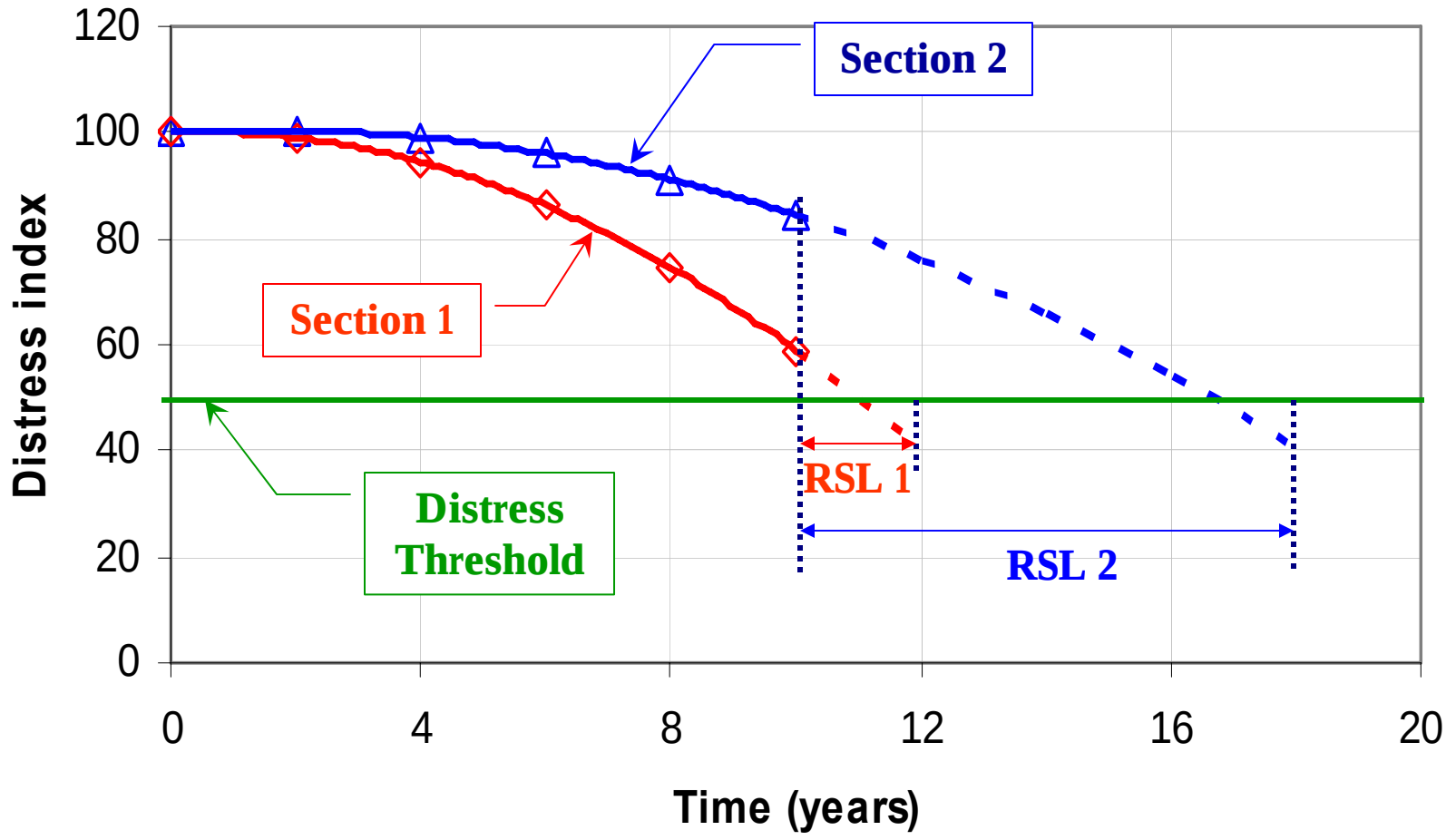
Calculation of RSL



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Calculation of RSL

For a given pavement section/project, an RSL value can be calculated based on each distress type, each distress indices, or each composite distress index.

If $RSL_{RI} < RSL_{IRI} < RSL_{ACI} < RSL_{TCI} < \ldots$, then

$$RSL = RSL_{RI}$$ or

$$RSL = RSL_{RI} - \alpha(DL - RSL_{IRI}) - \beta(DL - RSL_{ACI}) \ldots$$

Where α & β Are Constants

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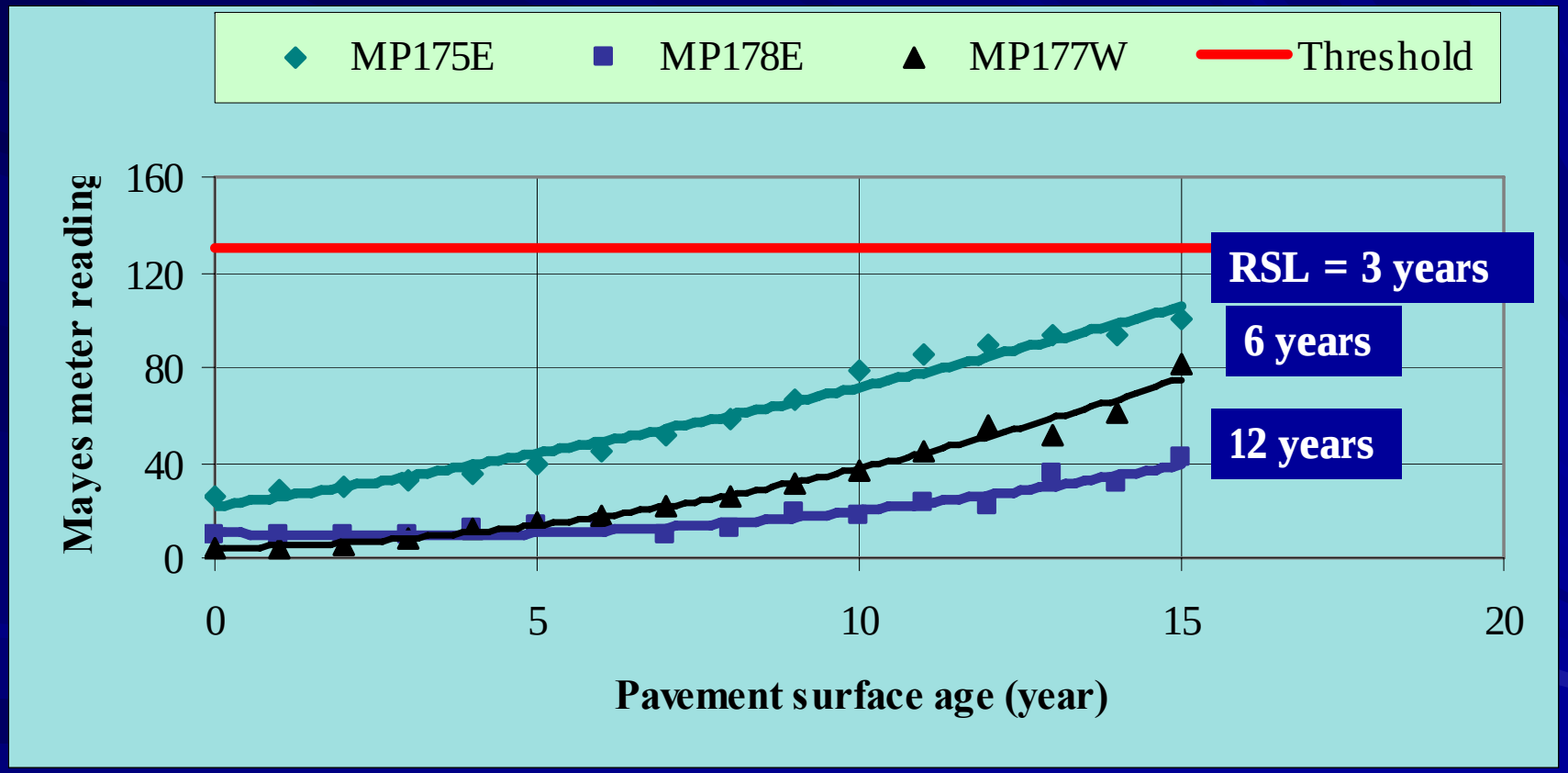
Example - RSL From Mays Meter Data



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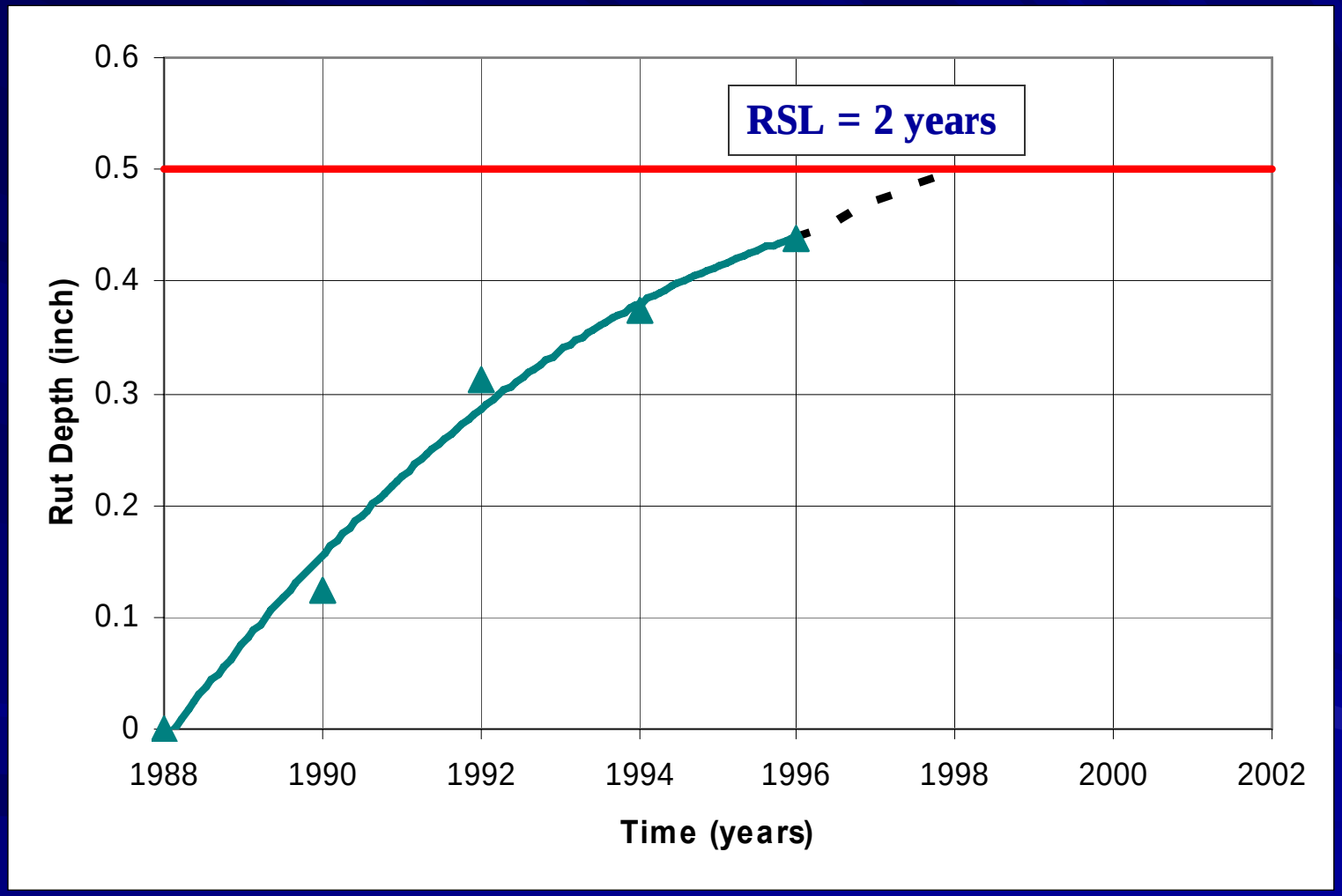
Example - RSL From Rut Depth Data



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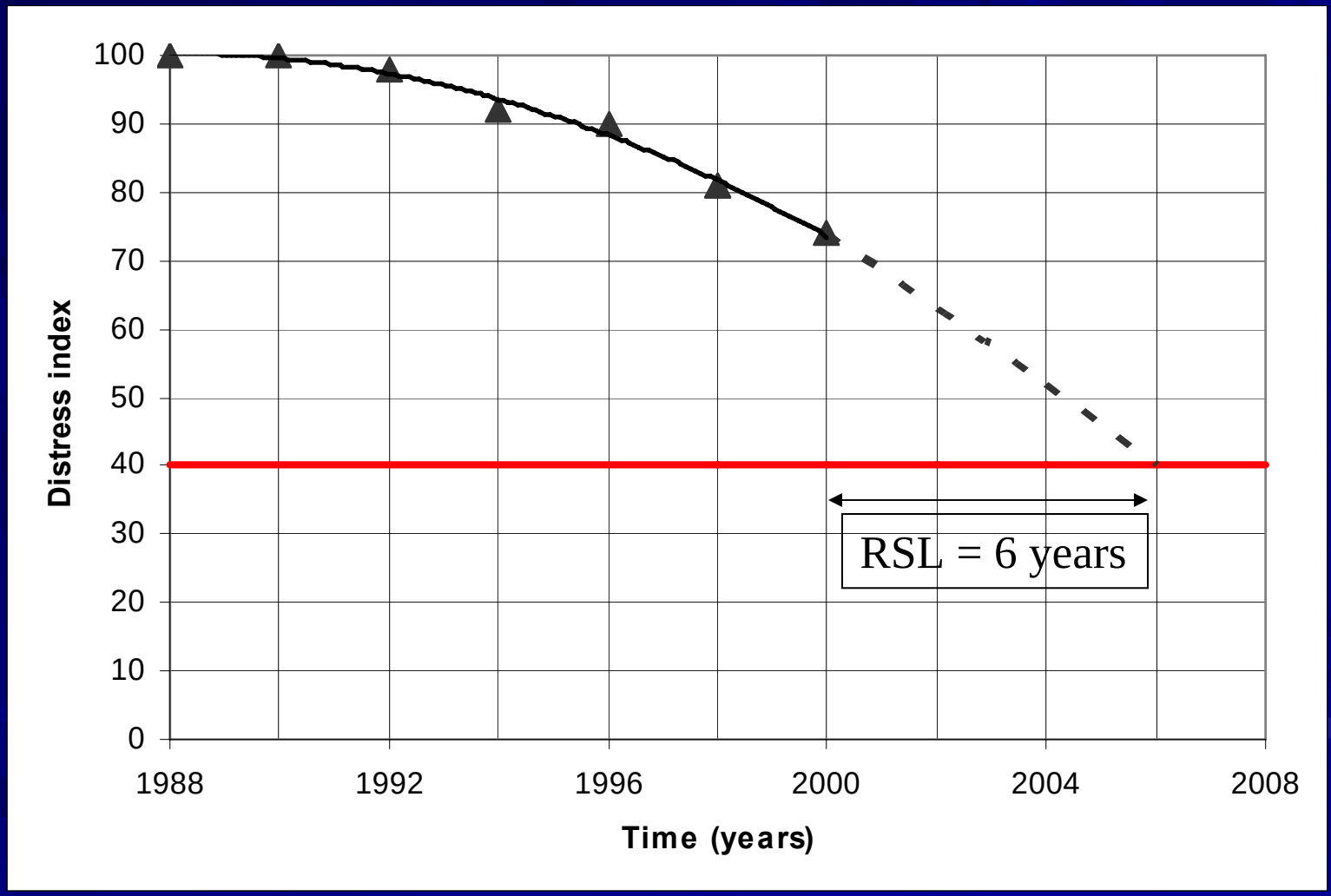
Example - RSL From Distress Index



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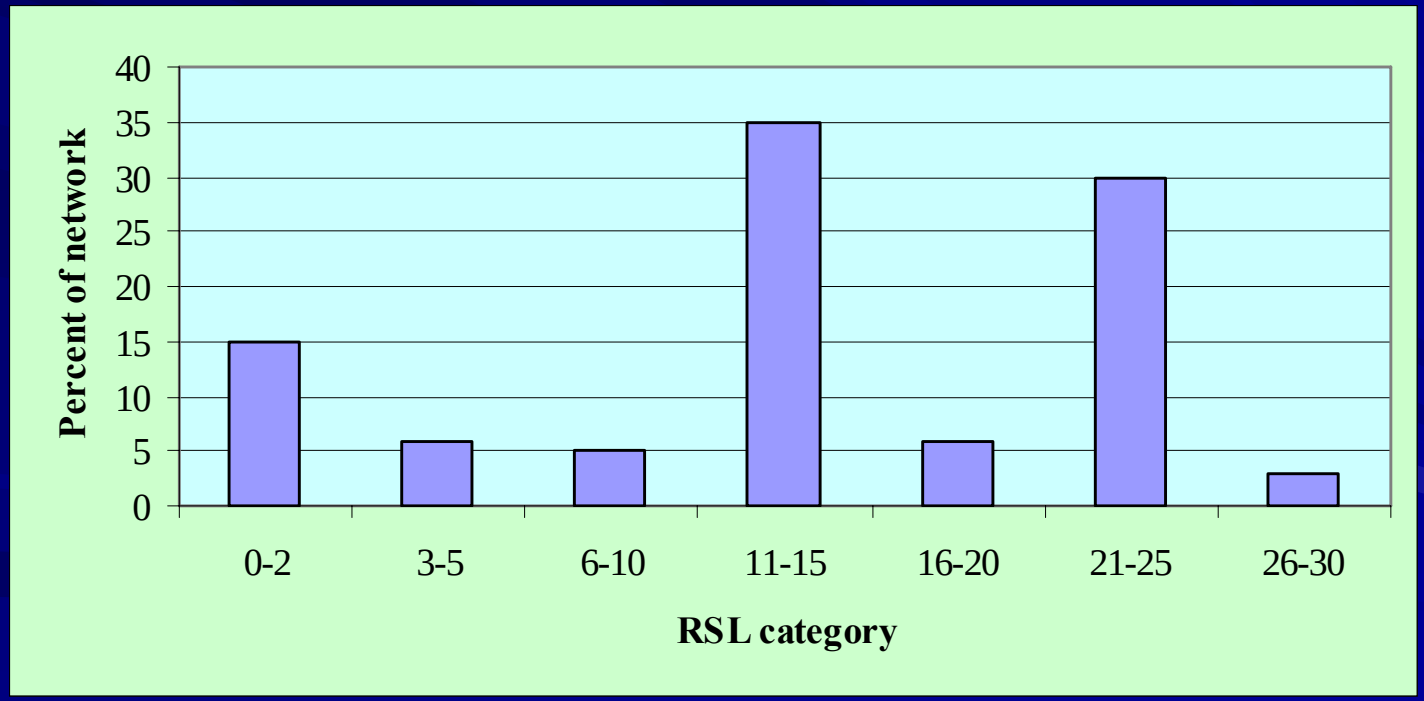
Uses of RSL

- Estimate the RSL of the various pavement sections & the pavement network
- Detect uneven distribution of RSL (uneven workload, preventive maintenance)



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Uses of RSL

The RSL can be used to calibrate the assigned distress points (deduct values) of the various distresses and their severity and extent.

THE DO-NOTHING PAVEMENT SECTIONS

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Uses of RSL

The RSL can be used to determine budgetary needs

A Pavement Network Consists of 12,000 Lane-Miles, Its Weighted RSL = 6 Years

Investment Level:
12,000 * 6 = 72,000 Lane-Mile-Year

The Minimum Yearly Budget:
12,000 Lane-Mile-Year

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Uses of RSL (Cont'd)

- Optimization of Rehabilitation Strategy
- One- & Multi-Year Rehabilitation Programs
- Impact of Various Budget Levels on the Health of the Pavement Network
- Control Future Conditions of the Network
- Percent Users on Substandard Roads
- Planning of Yearly Balanced Program
- Quality Control Checks - Feedback

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Example – Rehabilitation Strategy

- For a 12,000 Lane-Mile-Network, 12,000 Lane-Mile-Year Is Lost Each Year
- For the Status Quo, Add 12,000 Lane-Mile-Year
- Analyze Different Strategies:

Rehab500 LM by Adding 12 Years of SL – Gain of	6,000 LMY
Rehab 400 LM by Adding 8 Years of SL – Gain of	3,200 LMY
Maintain 200 LM by Adding 4 Years of SL – Gain of	800 LMY
Reconstruct 100 LM Using 20 Years DL – Gain of	2,000 LMY
Total	12,000 LMY

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Uses of RSL

Estimate the pavement asset value, the rate of depreciation & the benefits of rehabilitation in lane-mile-year

TO DO THAT

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DISTRESS INDEX AND ASSET VALUE

The upper and lower limits of the distress index must correspond to the asset value.

- For the distress index value of 100, the dollar value of the pavement is almost equal to the design and construction cost ($DCC).
- For the distress index value of 0.0 (reconstruction), the dollar value of the pavement must equal to zero ($ZDV).

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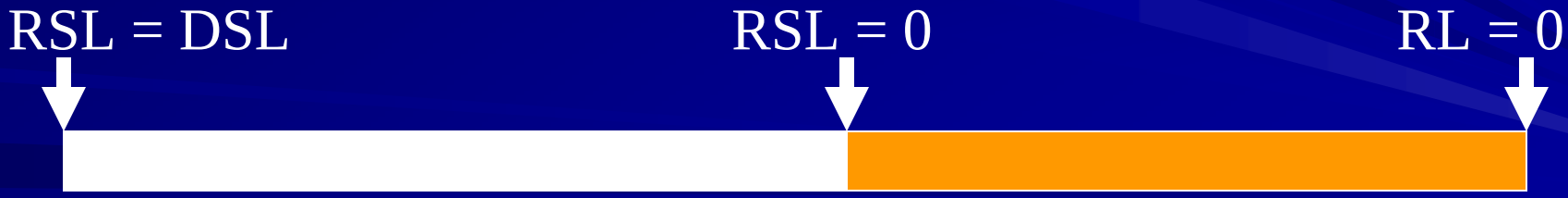
Relationships Between DI, Asset Value, RSL and RL of a Pavement Structure

Distress index

Asset value



Remaining service life (RSL), remaining life (RL)

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DISTRESS POINTS CALIBRATION

The calibration of the distress points must be based on at least three values of the distress index (DI); one hundred, the threshold value and zero.

- A DI value of 100 implies no surface defects.
- A DI = the threshold implies major rehabilitation (e.g., surface replacement, rubblization, crush and shape, etc.) to restore the bulk of the original DSL
- A DI value of zero implies reconstruction from the roadbed soil and up

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DISTRESS POINTS CALIBRATION

Cost data obtained from several State Highway Agencies indicate that the average cost of major rehabilitation to restore the bulk of the original design service life (DSL) is about 63 percent of the $DCC.

Hence, the asset value of that section when the DI = the threshold value is about 37 percent of the $DCC.

This information would yield 3 points on the asset value curve as shown in the figure.

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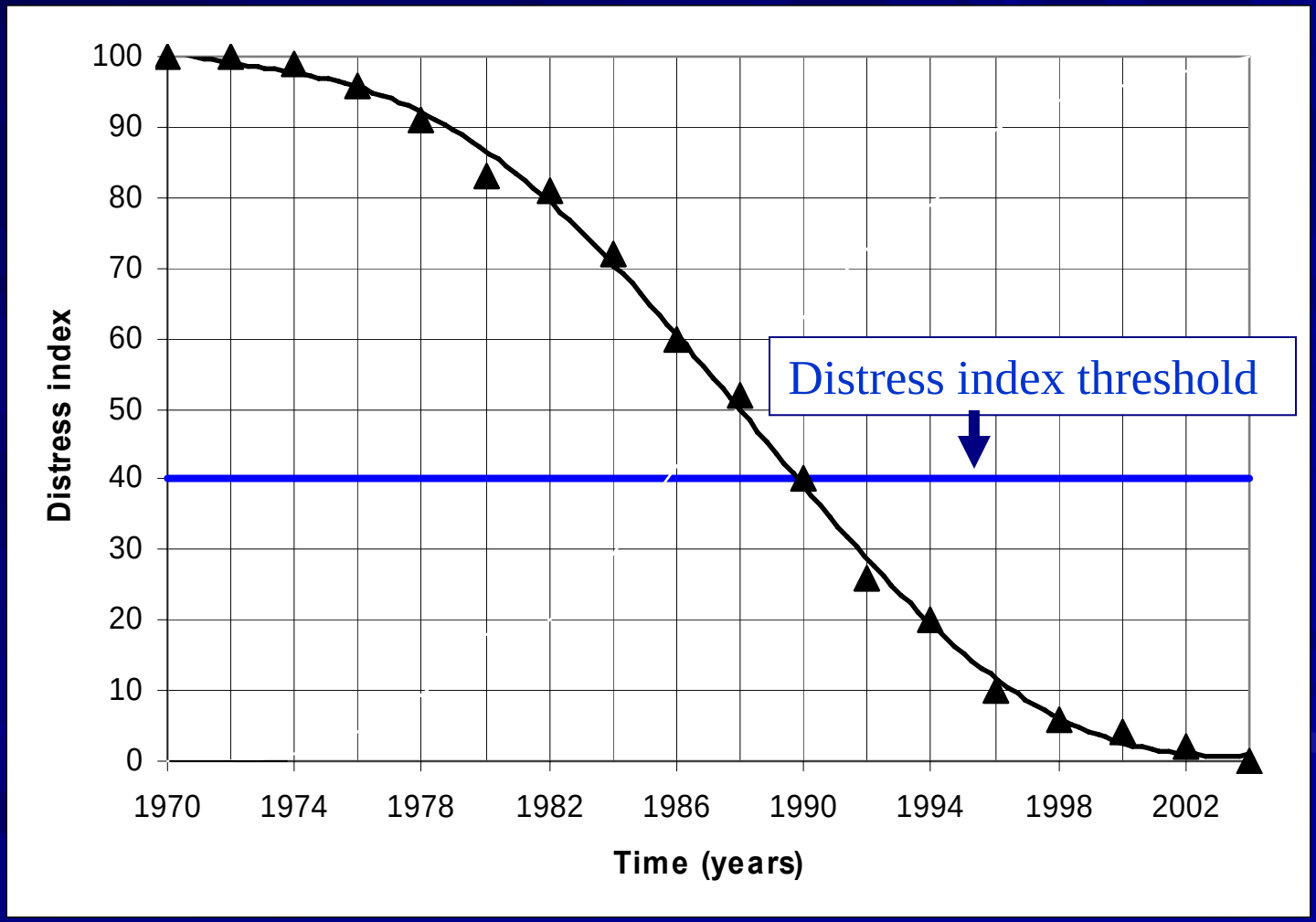
DISTRESS INDEX AND ASSET VALUE



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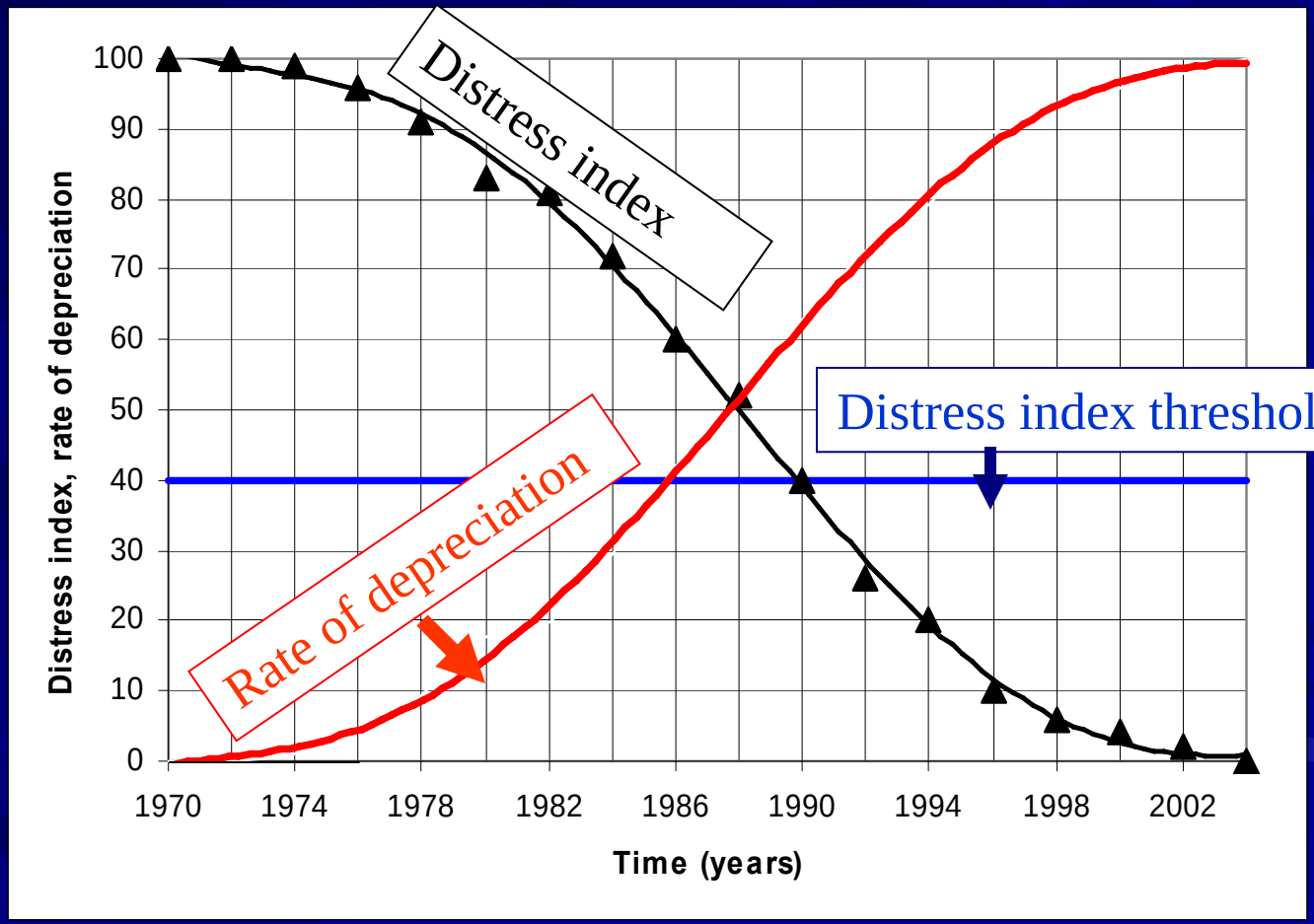
DISTRESS INDEX AND ASSET DEPRECIATION



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DISTRESS POINTS CALIBRATION continued

The other points along the asset value curve can be calibrated based on the cost of the preventive maintenance actions that are typically taken at an early stage of pavement deterioration (high DI value) to restore the bulk of the pavement original DSL. Hence the asset value ($AV) at any time (t) can be calculated as follows:

$ AV(t) = {$ DCC - $cost of repair to restore the bulk of the original DSL of the pavement}{DSL(new)/DSL (original)}

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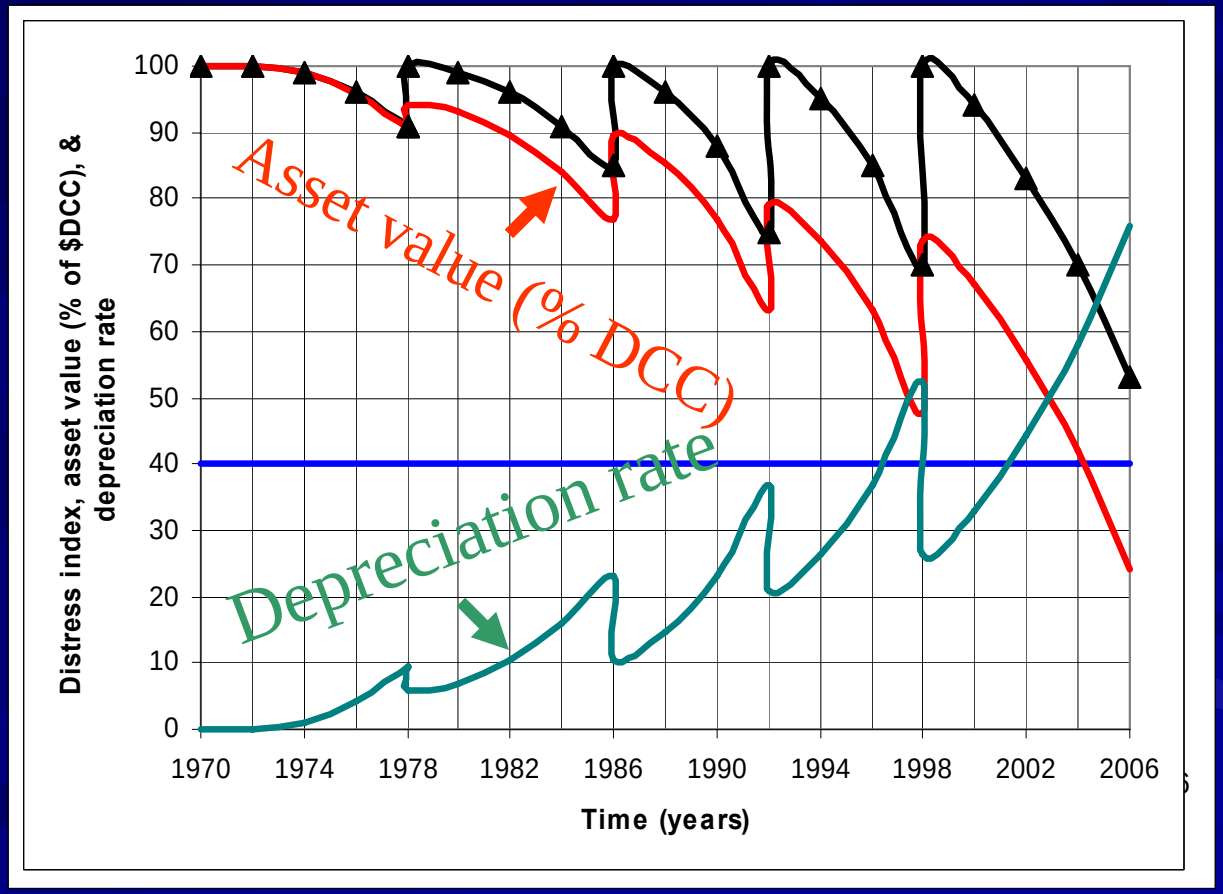
Distress Index, Asset Value (%DCC), and Depreciation Rate



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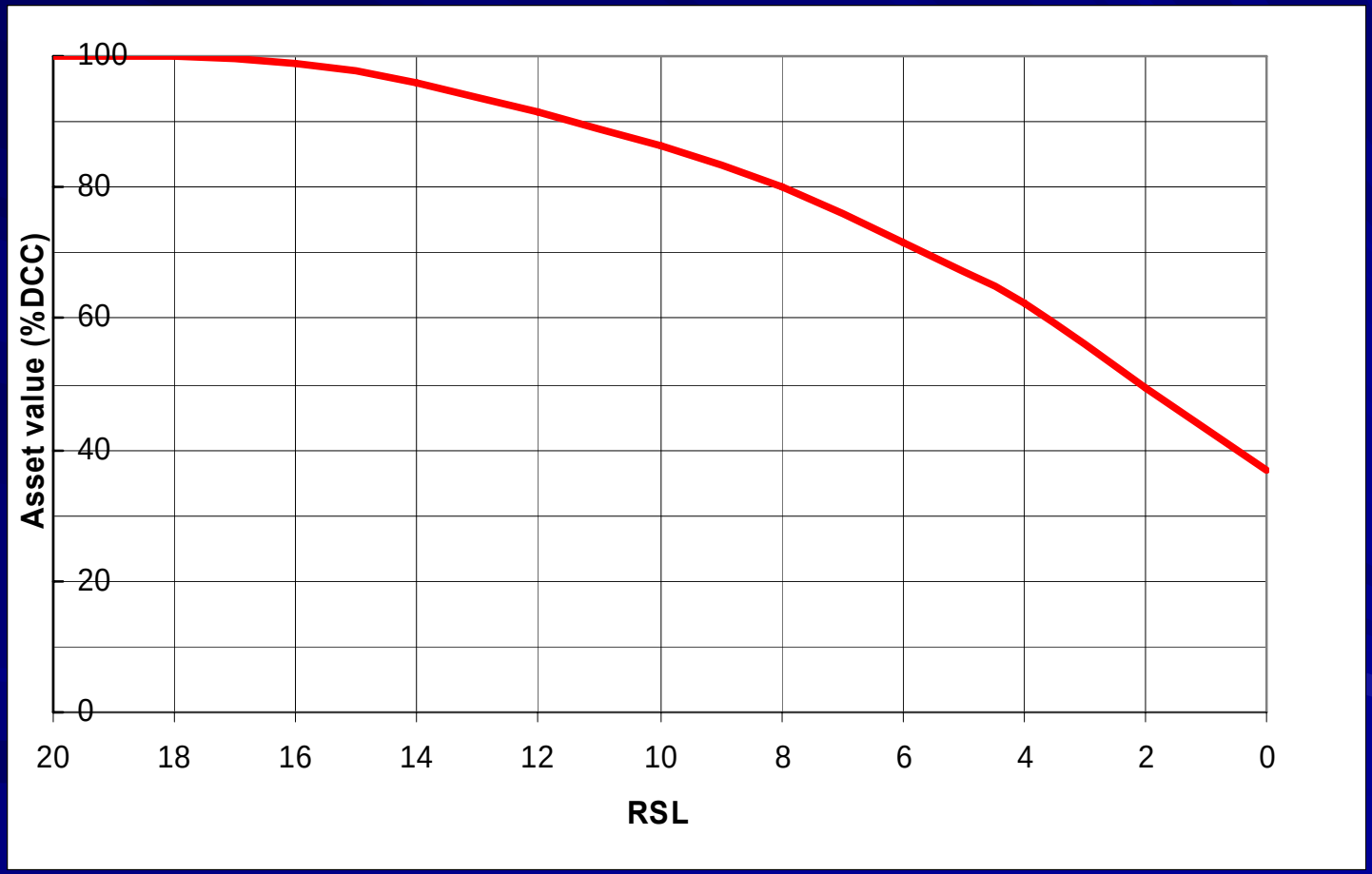
RSL & Asset Value (%DCC)



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KEY POINTS

The key points in the calibration include:

- A DI = the threshold value corresponds to major rehabilitation as to restore the pavement to its original DSL.
- A DI value of zero corresponds to no pavement (zero asset value) - reconstruction from the roadbed soil and up

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KEY POINTS

The key points in the calibration include:

- The $ asset value of a pavement section at any time is proportional to the $DCC & the cost of repair to restore the pavement to its original DSL.
- The time rate of asset depreciation is not linear relative to the time rate of DI.
- For a given pavement section or network, the time dependent RSL, the pavement asset value, and the pavement depreciation rate are related

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Conclusions on RSL

- The RSL is a powerful & simple concept
- The RSA can be calculated directly from the distress data or from the distress indices
- The RSL expresses the severity & extent and the rate of deterioration of the pavement
- At any time, the RSL is related to the asset value of the pavement structure and the rate of depreciation

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THANK YOU

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