Timing of Pavement Preservation Treatments

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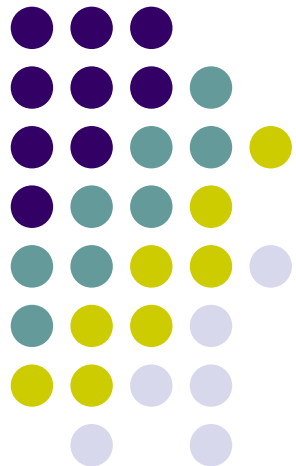

Presentation Topics

- Characteristics of Pavement Preservation Programs
- Applying Treatments at the Right Time
- Treatment Timing Tools

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Pavement Preservation Programs

- Activities undertaken to provide and maintain serviceable roadways using:
  - Corrective maintenance
  - Preventive maintenance
  - Minor rehabilitation
- Cost-effective strategies for maintaining roadways

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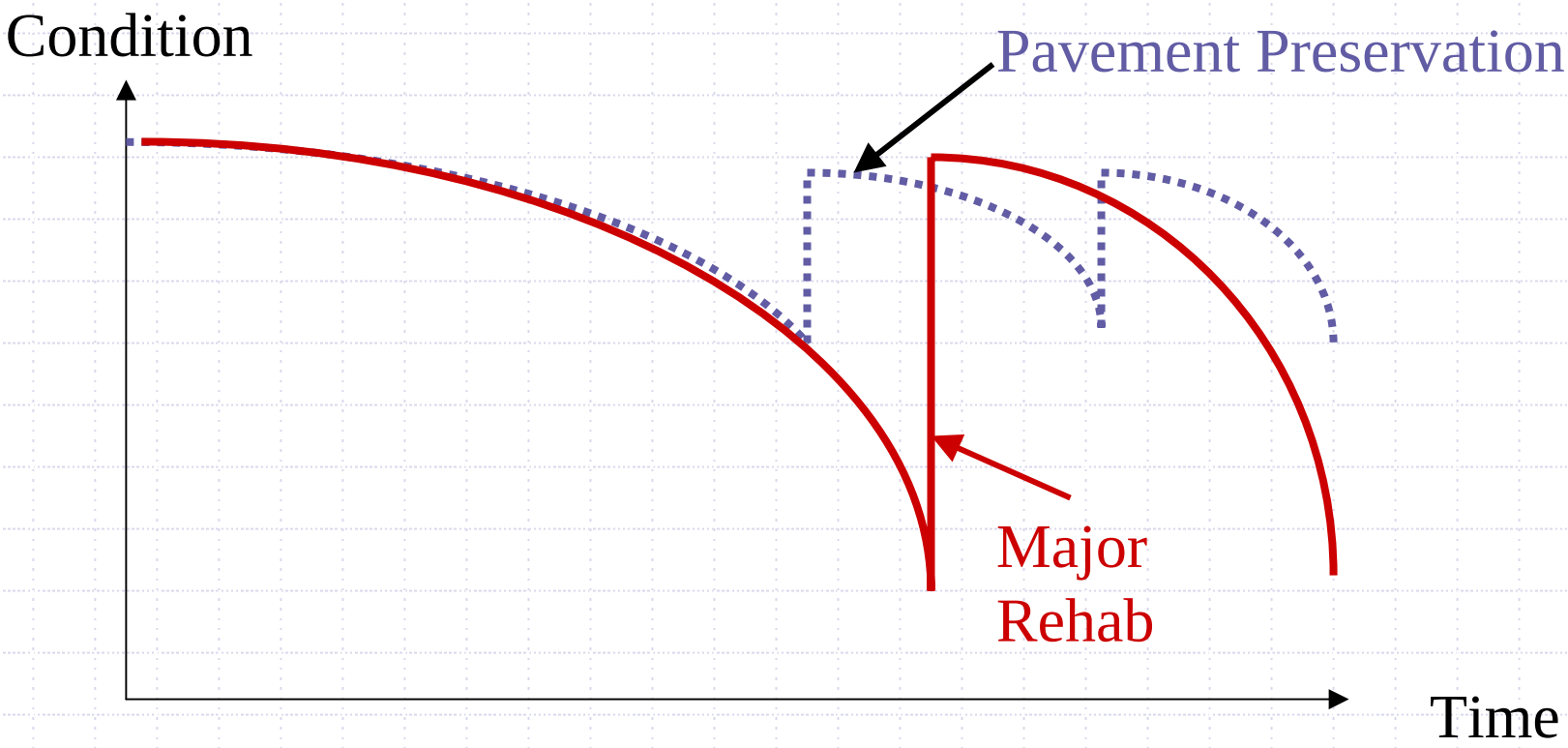
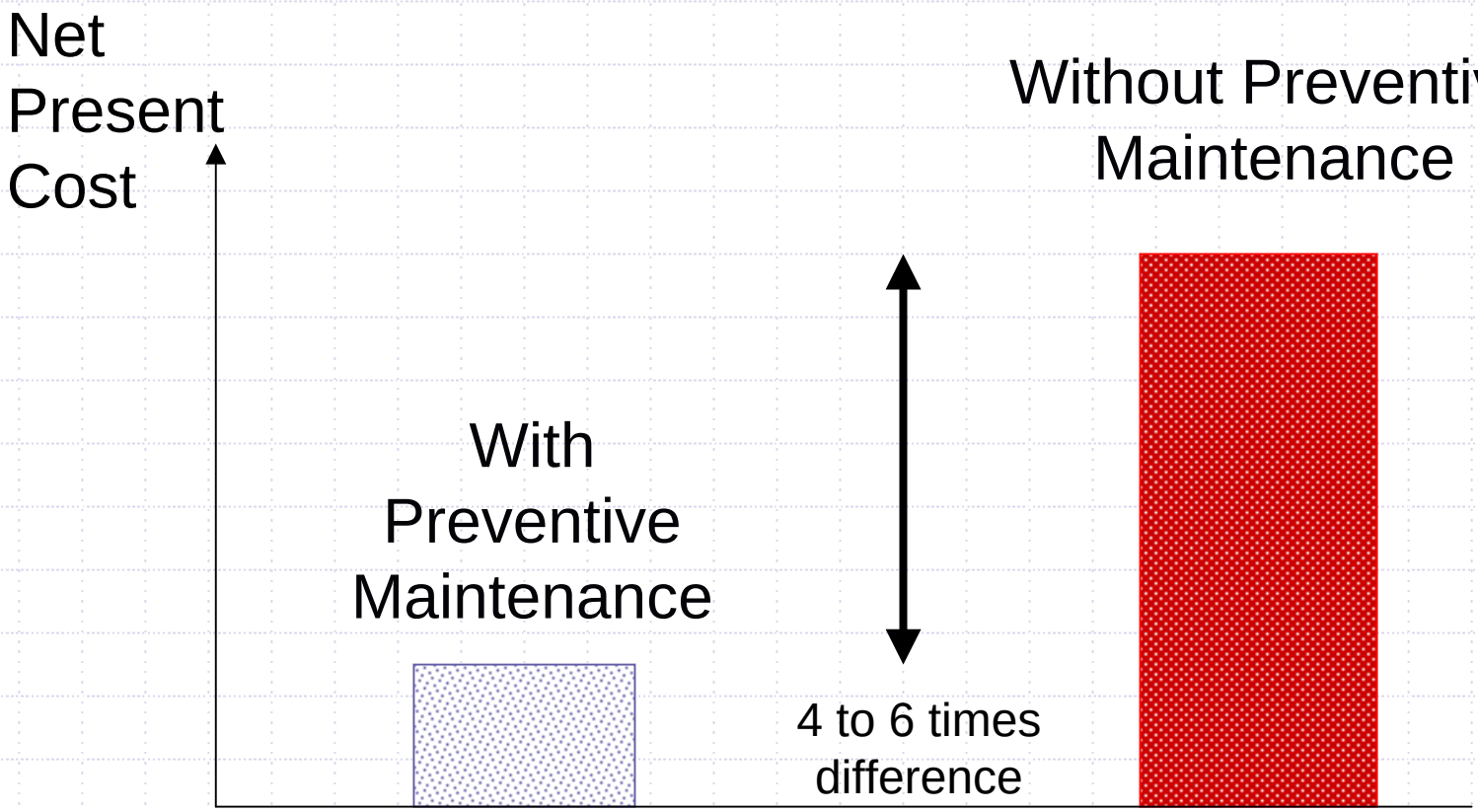
Cost-Effectiveness of Pavement Preservation

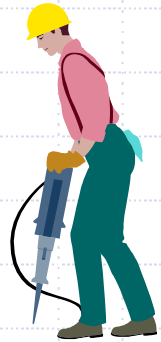


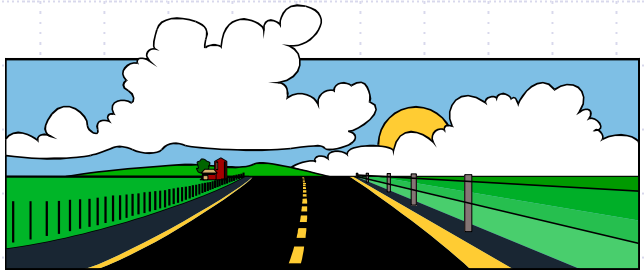
Total Life Cycle Cost



Pavement Preservation Slogan

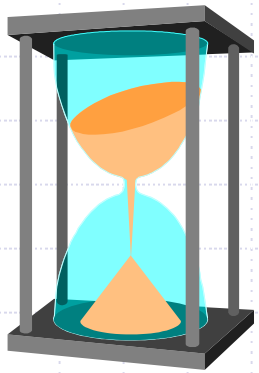
Applying the right treatment





. . . To the right road

. . . At the right time



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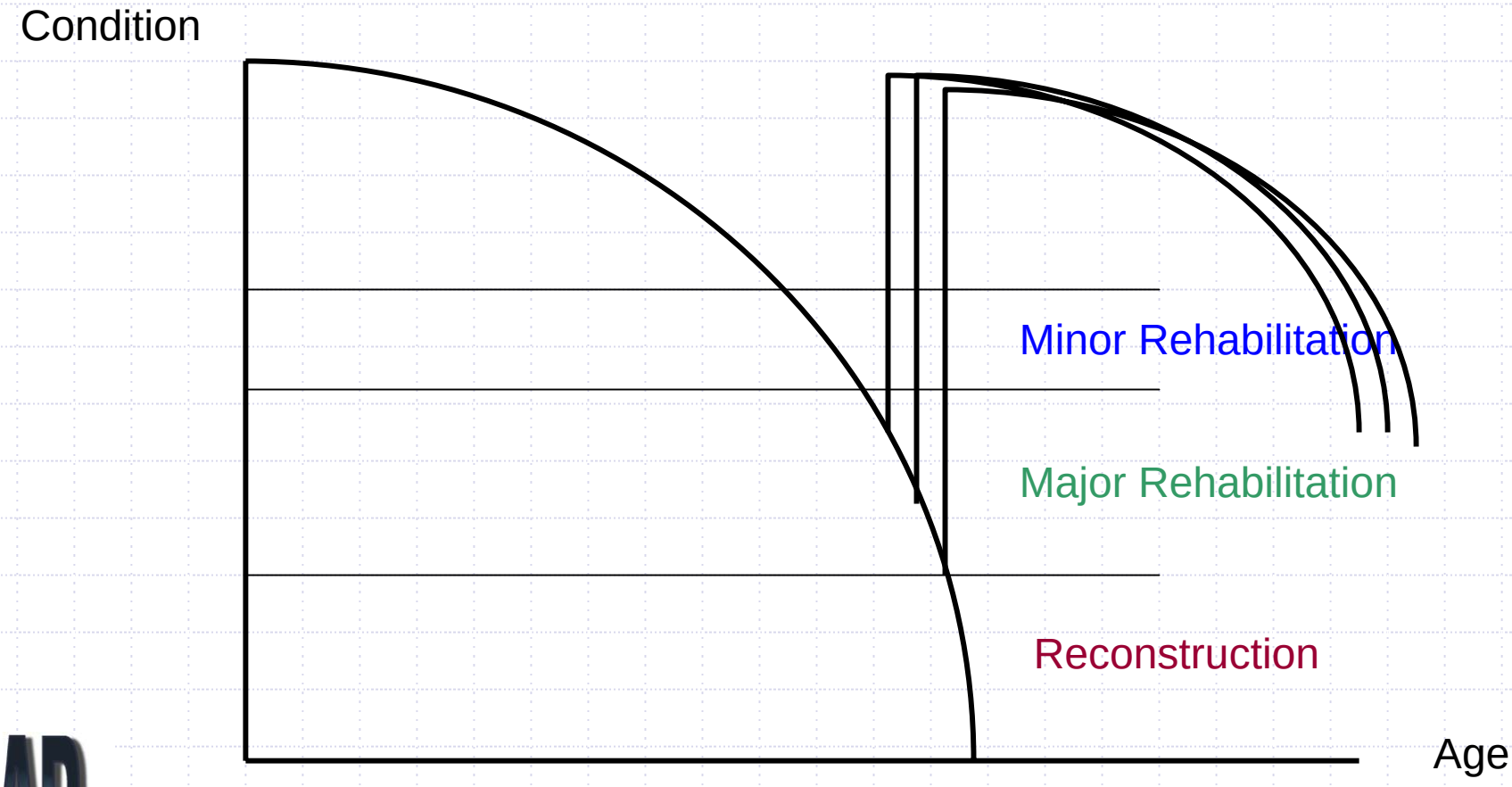
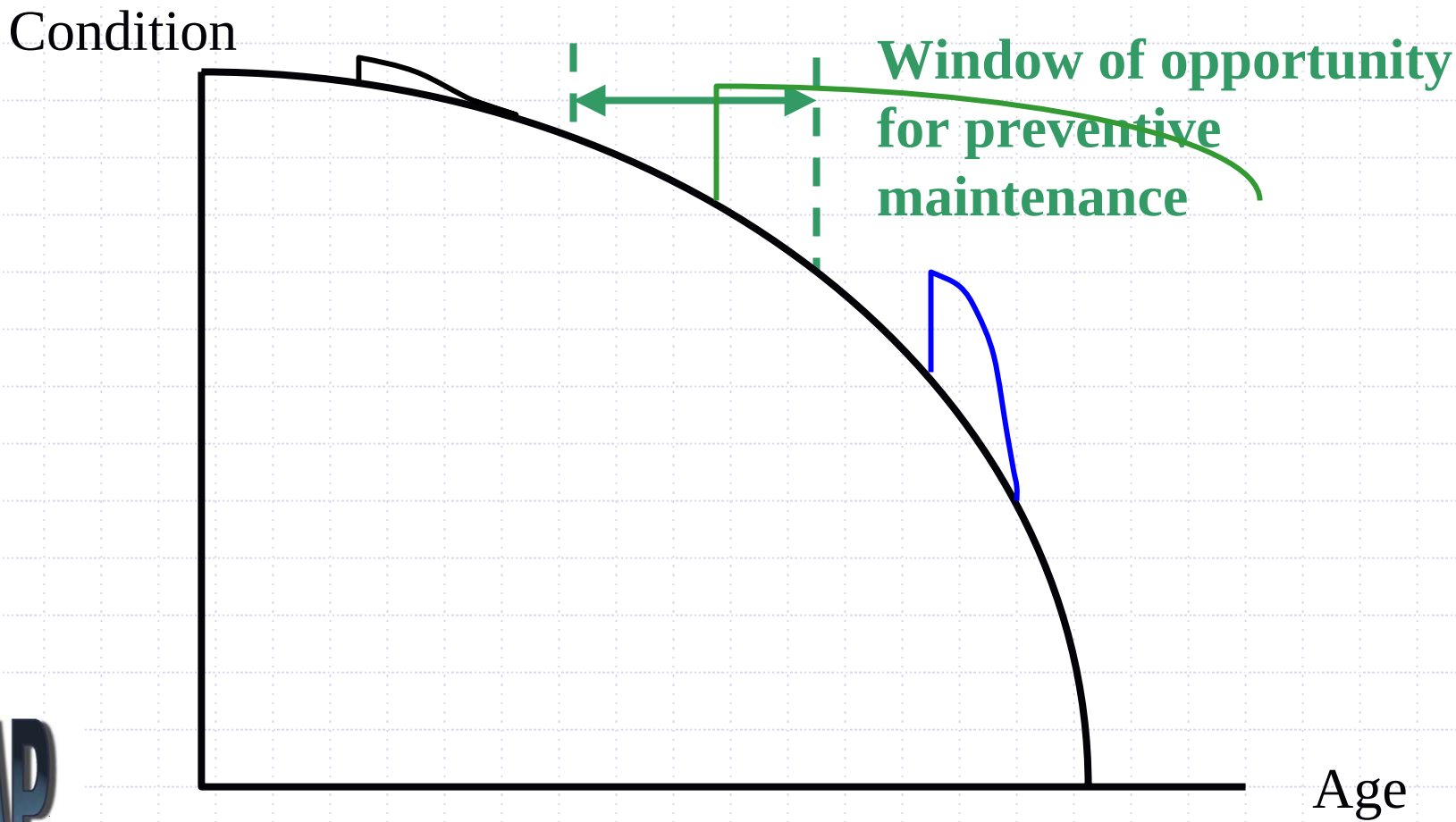
Rehabilitation Treatment Timing



Window of Opportunity



“Good Candidates” for Preventive Maintenance

- No structural failures
- Minimal distress (extent and severity)
- Relatively young in age
- Few historical problems with similar projects
- Treatment can be constructed before distress becomes too extensive (considers rate of deterioration and contracting period)

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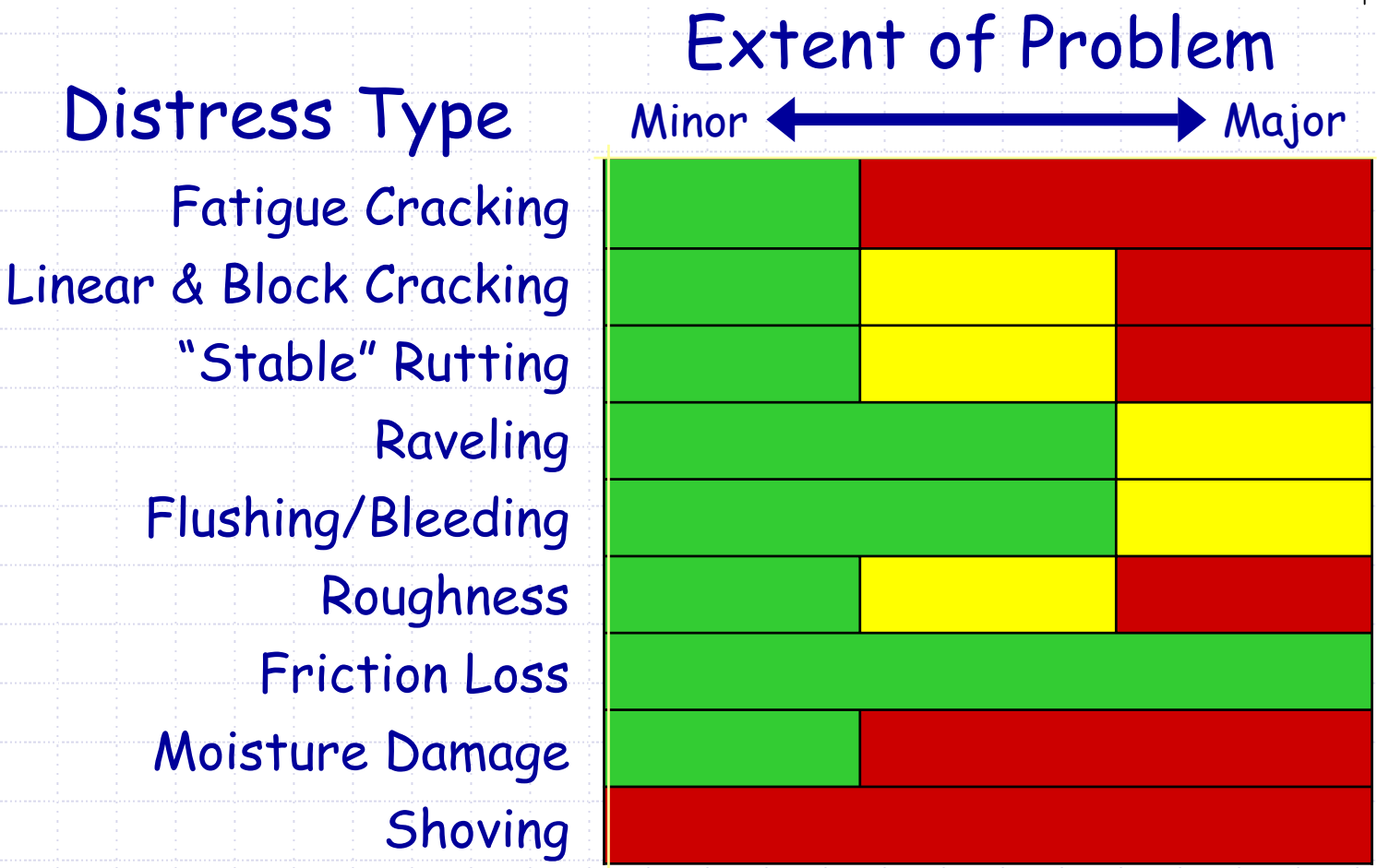
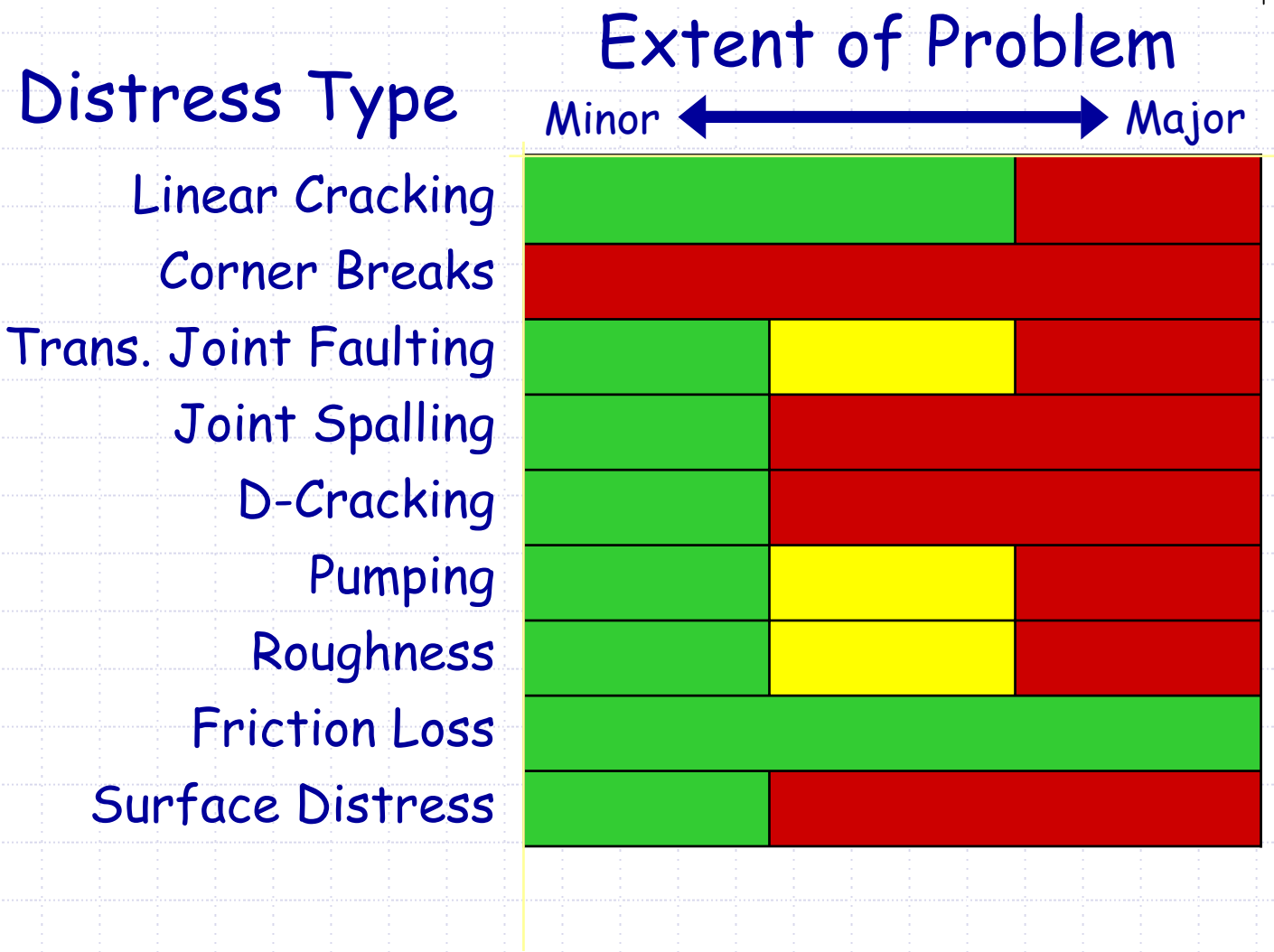
Maximum Allowable Distresses

HMA Pavements



Maximum Allowable Distresses

PCC Pavements



Sample Treatment Guidelines

HMA Distresses	Low		Moderate		High	
	Occasional	Frequent	Occasional	Frequent	Occasional	Frequent
Fatigue Cracking	Fog Seal, Do Nothing	Fog Seal, Chip Seal	Chip Seal, Fog Seal, Thin HMA Overlay	Chip Seal, Slurry Seal	Patching, Chip Seal, Thin HMA Overlay	Recon, Patching
Edge Cracking	Do Nothing, Crack Seal or Fill	Crack Seal or Fill, Do Nothing	Crack Seal, Patching	Crack Seal, Patching	Patching	Patching
Longitudinal Cracking	Crack Seal, Do Nothing	Crack Seal, Chip Seal, Do Nothing	Crack Seal, Chip Seal	Crack Seal, Chip Seal	Patching, Crack Seal, Chip Seal	Chip Seal, Crack Seal, Patching
Bleeding	Do Nothing	Do Nothing, Chip Seal	Chip Seal, Do Nothing, Mill	Chip Seal, Mill	Mill + Chip Seal	Mill + Chip Seal, Thin HMA Overlay

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Combination of Distress

Distress	Combination of Distress (Read Vertically) *From Haas, Hudson, Zaniewski*	
PSI<4.0	N	N
Major Cracking	N	N
Rutting > 30%	Y	N
Raveling > 30%		Y
Feasible Options	3 in O/L, Mill + chip, Recycle + O/L, Reconstruct	1 in O/L, Recycle + O/L, Mill + O/L, Chip Seal

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Time-Based Schedule Example

New York State Initial Guidelines for Treatment Application Cycles

Treatment Type	Appl. Cycle, yrs
• PCC pavement joint and crack sealing	8
• HMA pavement crack sealing	4
• Thin HMA overlays (38 mm [1.5 in])	12
• Surface treatments of HMA pavements	4
• Surface treatments of shoulders	4
• Clean drainage	10

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Timing for First Application

- South Dakota
  - Crack sealing: 1 to 2 years
  - Chip seal: 3 years
- Montana
  - Chip seal: 6 to 8 years
  - Thin overlay: 10 to 12 years

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Analytical Tool to Determine Optimal Timing - OPTime

- Developed during NCHRP 14-14, Optimal Timing for Preventive Maintenance
- Macro-driven Excel workbook
- Evaluates benefits and costs associated with a preventive maintenance treatment
- Benefits can be evaluated in terms of more than one condition index
- Detailed or simple analyses available

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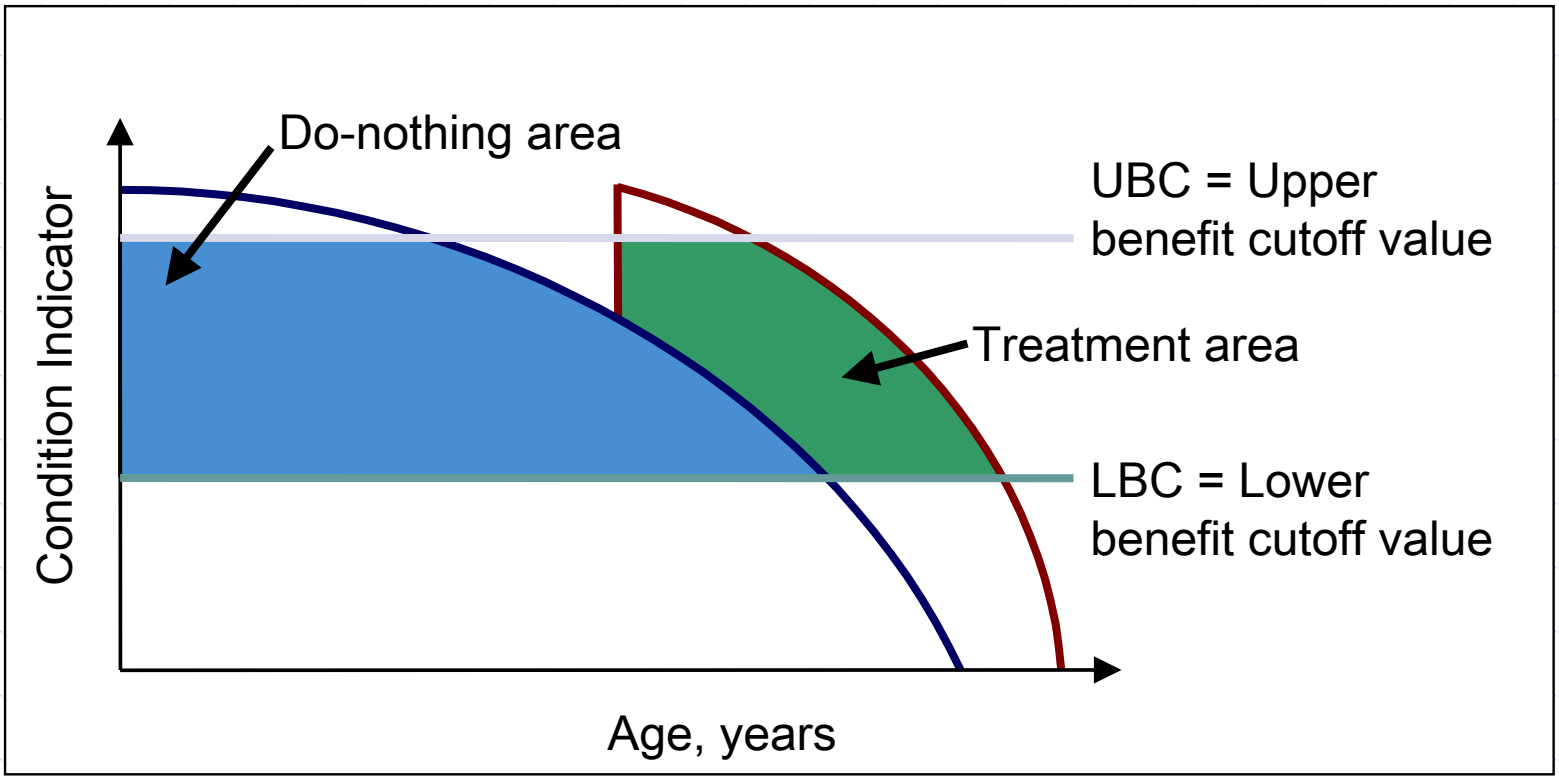
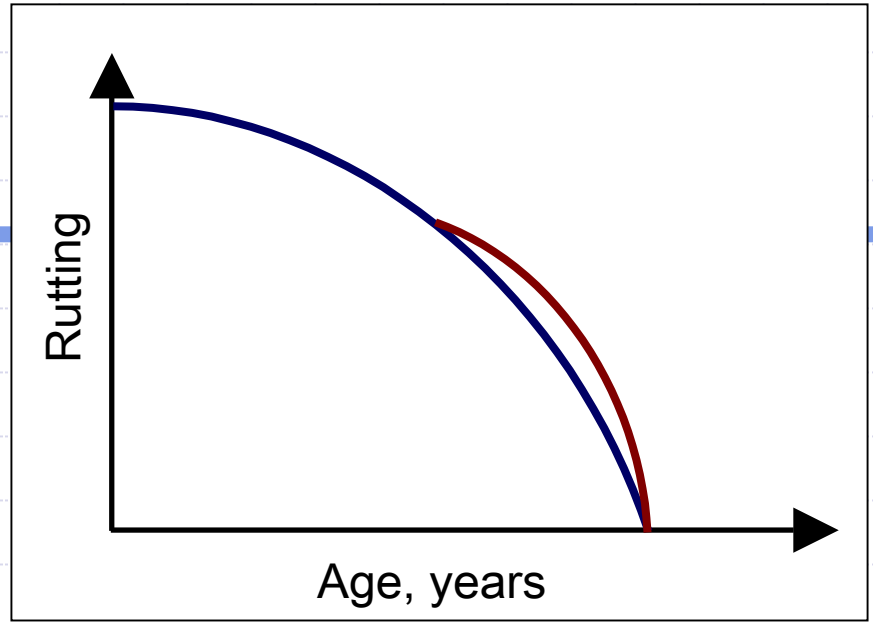
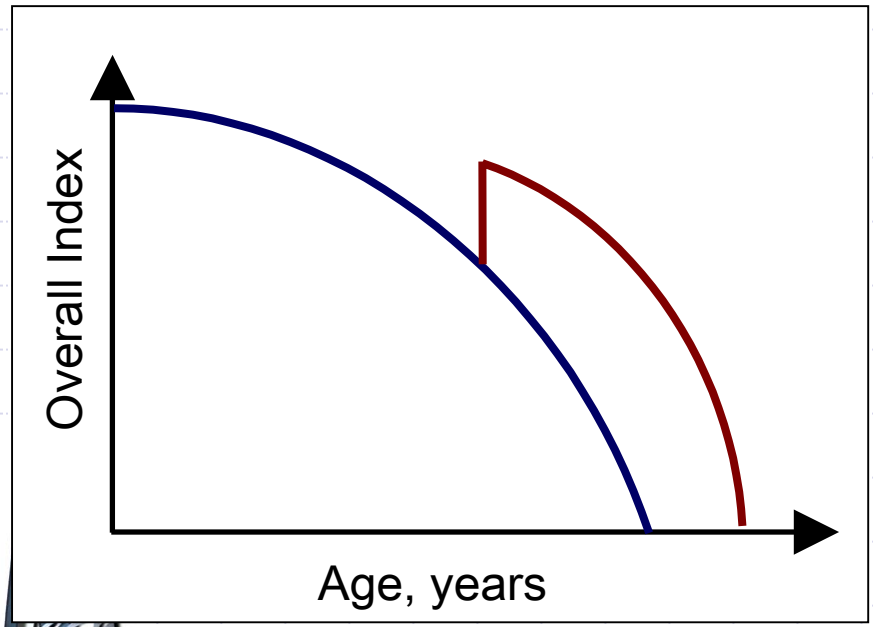
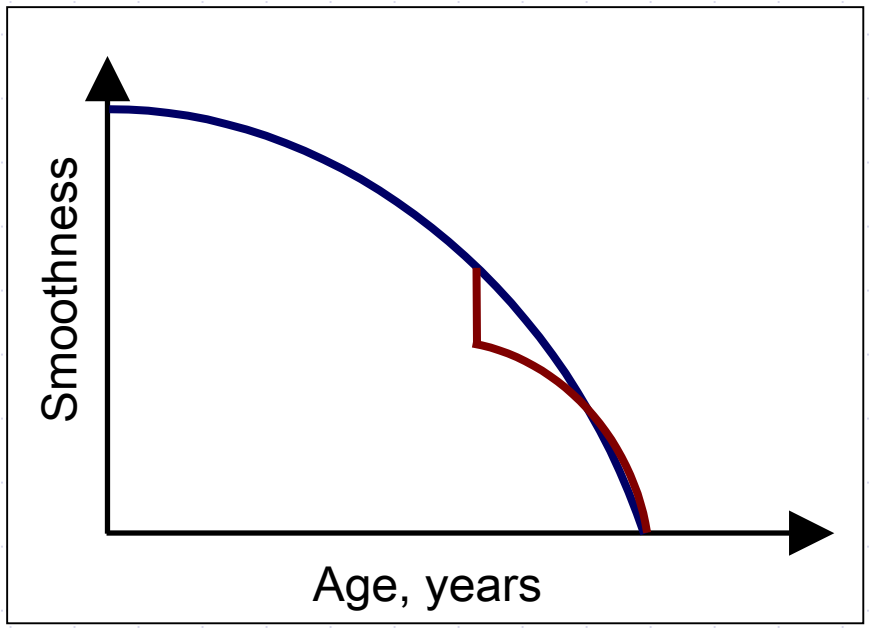
Benefit



$$\text{Benefit Value} = \frac{\text{Treatment Area}}{\text{Do-Nothing Area}}$$


Rutting
Age, years


Overall Index
Age, years


Smoothness
Age, years

Combining Multiple "Benefits"

- Calculate benefit area for each condition measure
- Normalize benefit as percent of do-nothing area
- Assign "benefit weighting factors" to different condition measures
- Compute and sum

Condition Indicator	Benefit Value (% of do nothing)	Benefit Weighting Factor	Benefit WF Percentage	Overall Benefit Contribution (%)
Rutting	27	60	0.6	16.2
Cracking	12	30	0.3	3.6
Friction	47	10	0.1	4.7
TOTAL	**-**	**100**	**1.0**	**24.5**

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Costs

- Treatment construction
- Rehabilitation
- Work zone delays
- Additional routine maintenance

After benefits and costs have been defined, a benefit/cost (B/C) ratio is determined for each possible application timing

APPLIED PAVEMENT TECHNOLOGY

Effectiveness Index (EI)

$$EI_i = \left[\frac{(B/C)_i}{(B/C)_{max}} \right] \times 100$$

i = Index associated with current timing scenario

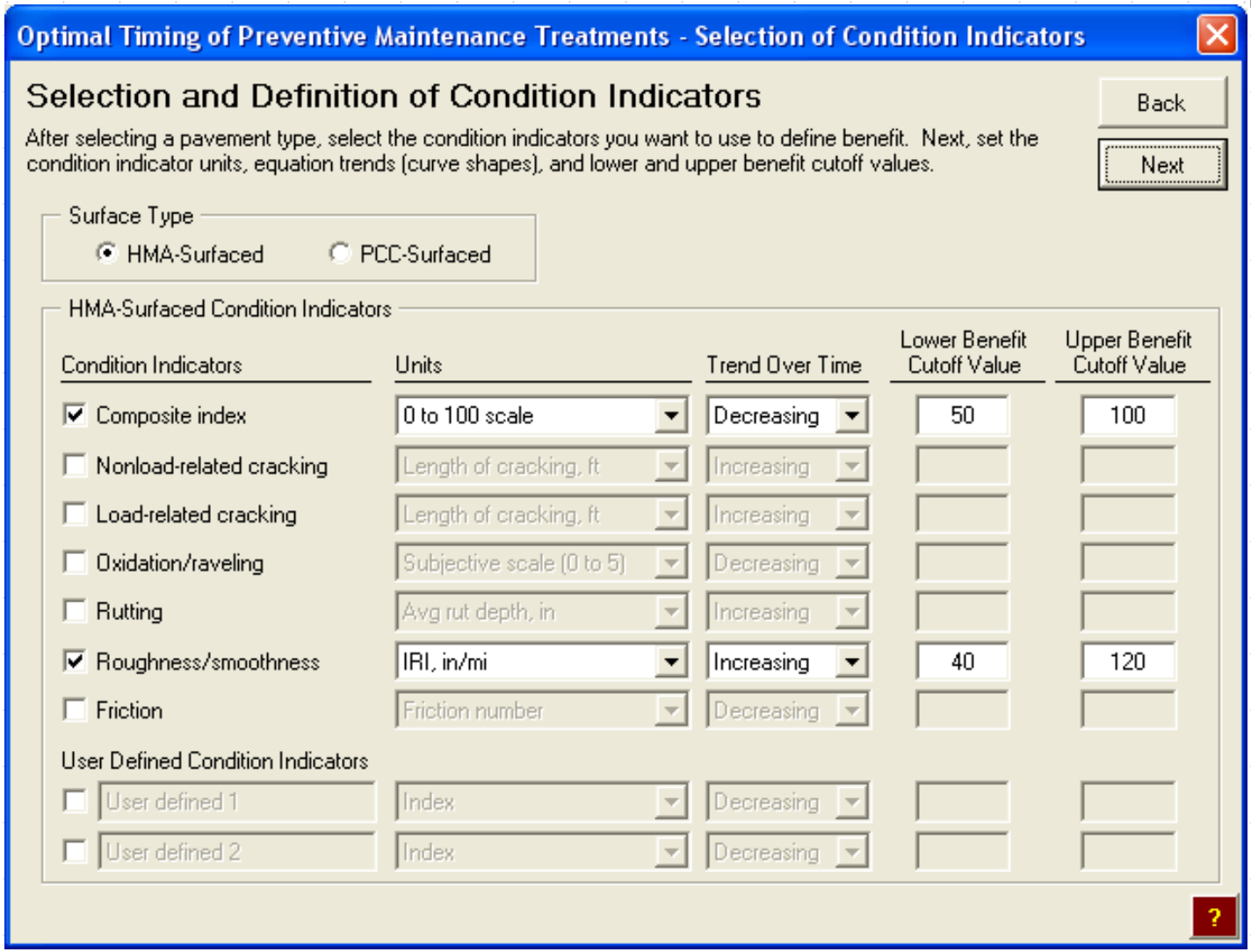
B/C = Benefit / cost ratio

The most cost-effective timing always has an EI = 100

APPLIED PAVEMENT TECHNOLOGY

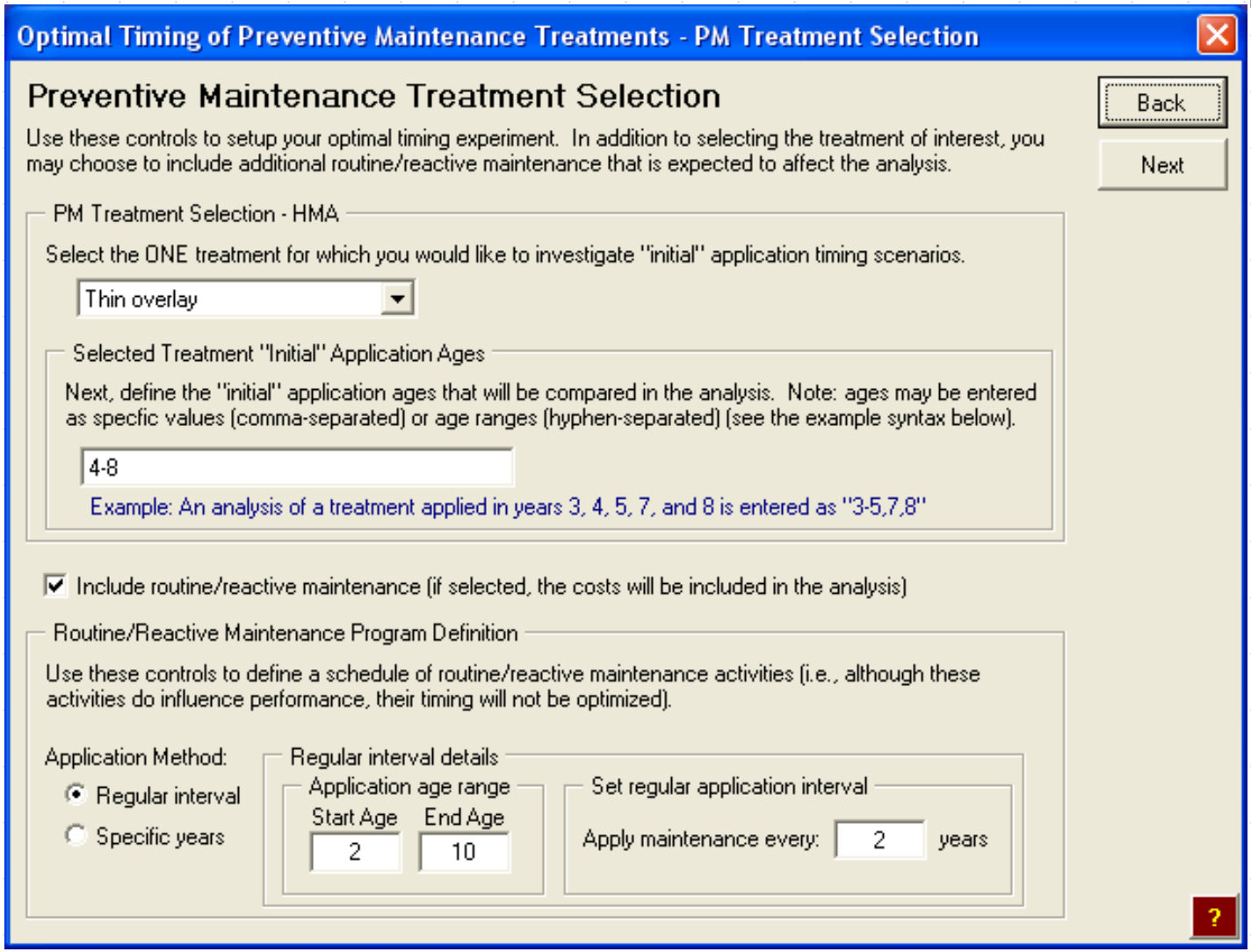
Example Analysis Session

Condition Indicators



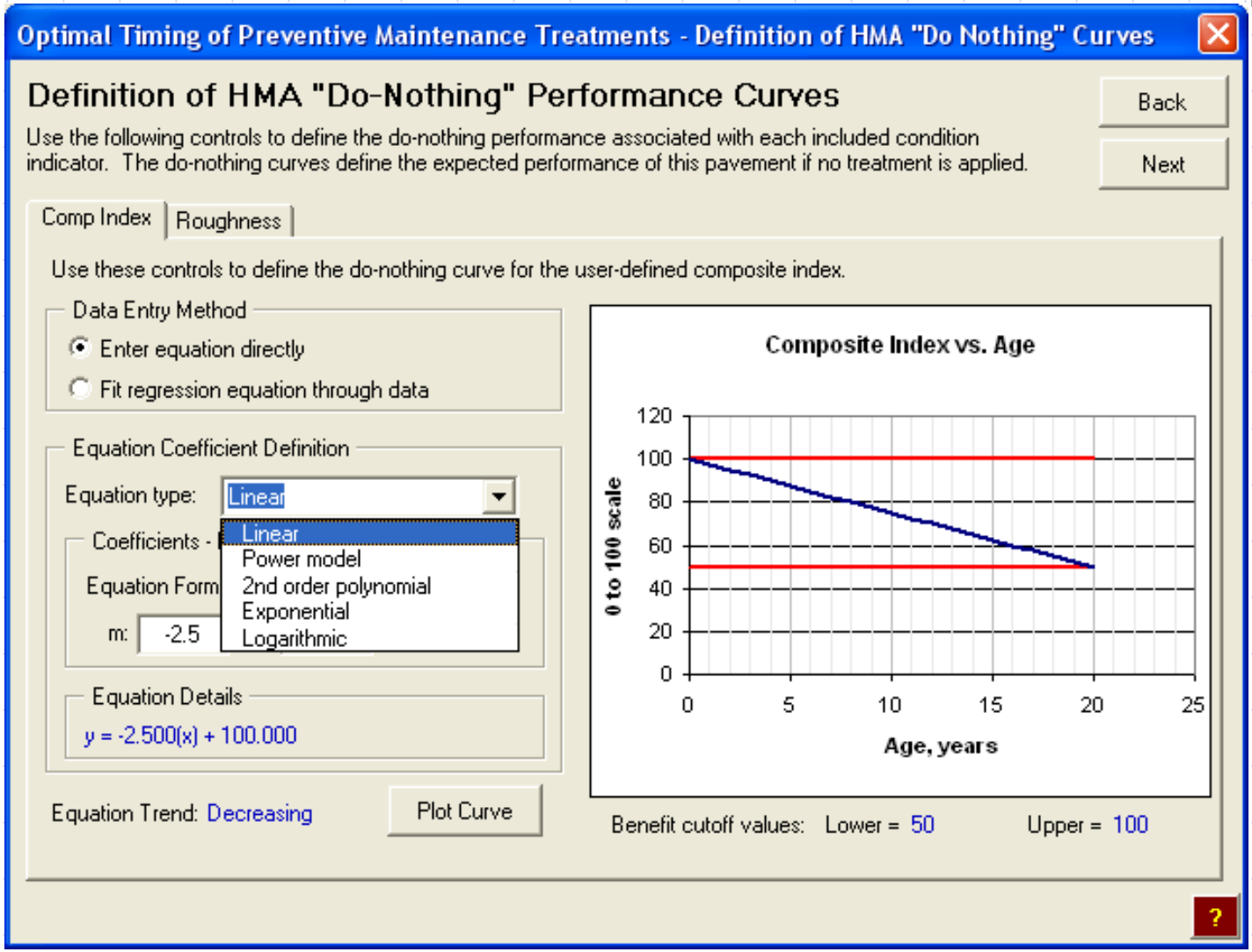
Example Analysis Session

Treatment Selection



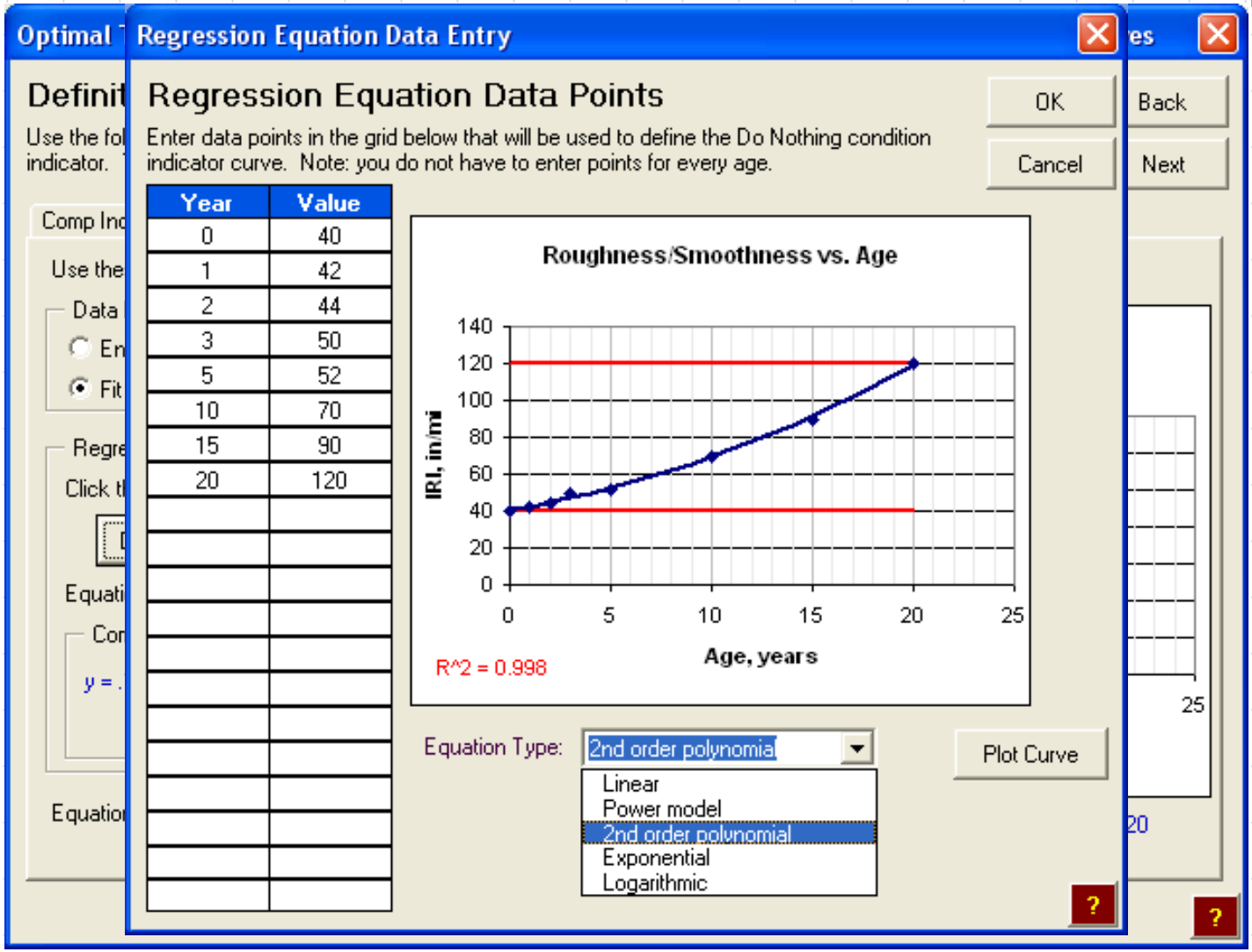
Example Analysis Session

Do-Nothing Curves: Direct Equation



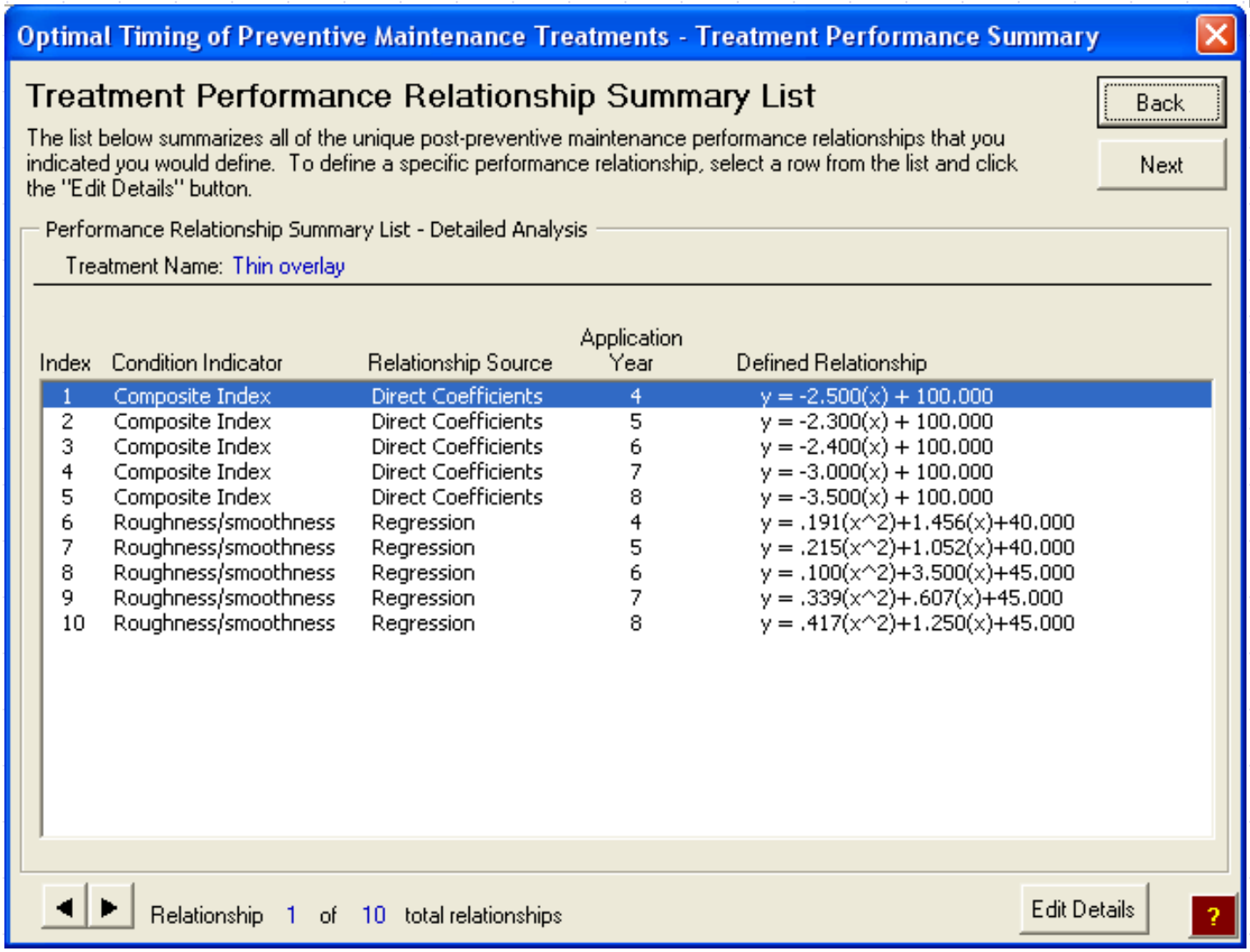
Example Analysis Session

Do-Nothing Curves: Regression



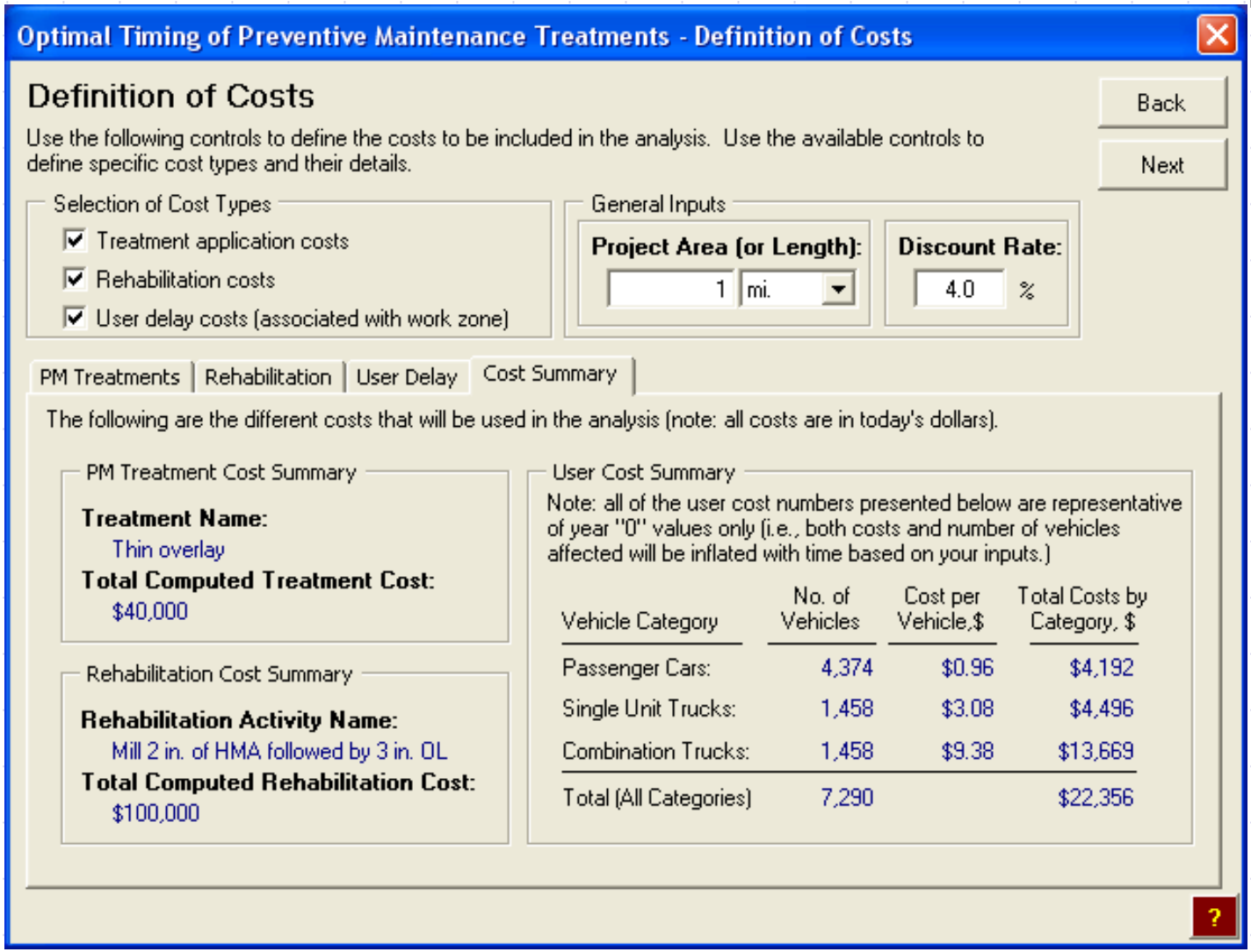
Example Analysis Session

Treatment Performance Summary List



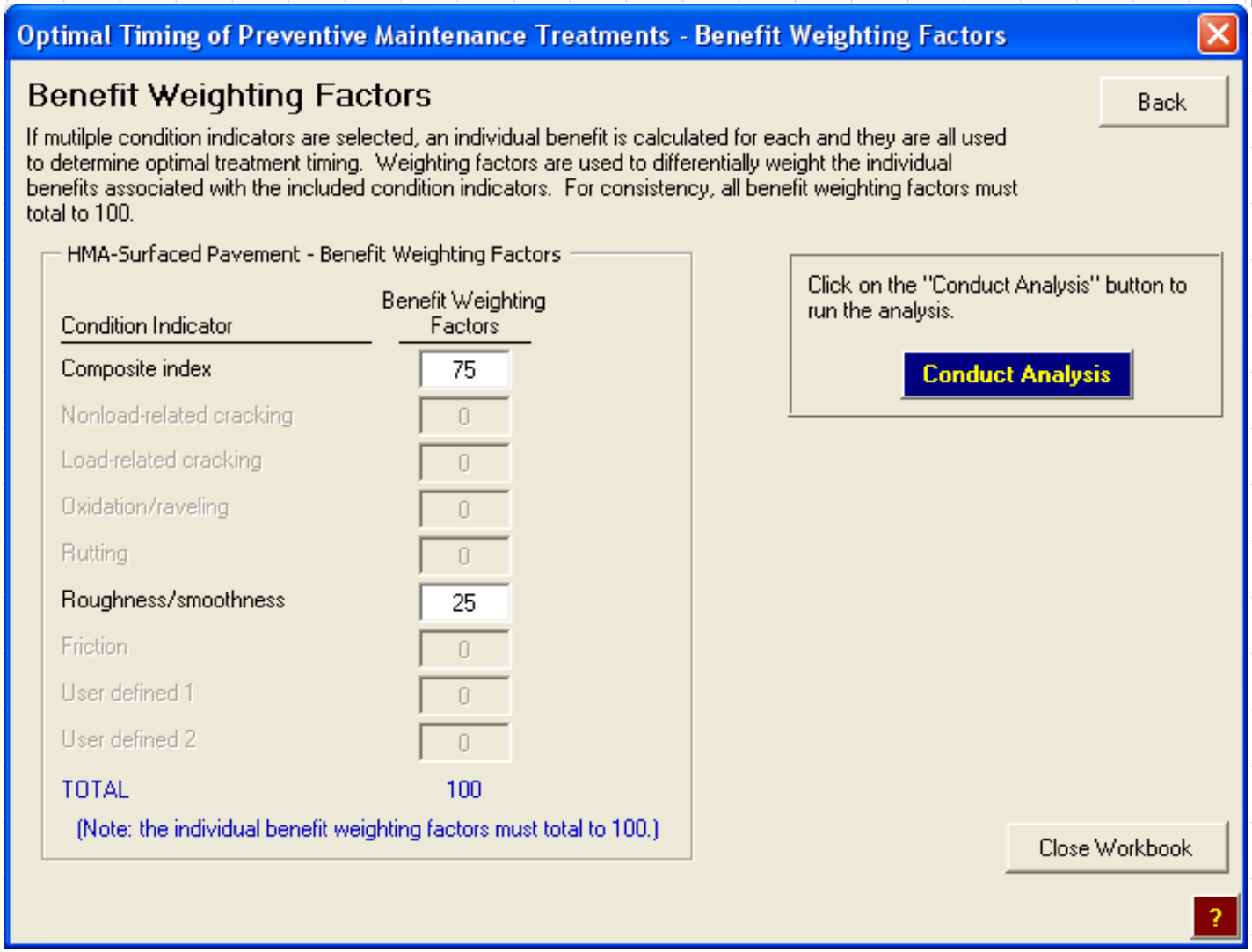
Example Analysis Session

Cost Summary



Example Analysis Session

Benefit Weighting Factors



Tabular Output

Output Data

Pavement Surface Type:	HMA
Treatment Type:	Thin overlay
Application Years:	4, 5, 6, 7, 8
Expected Do-Nothing Service Life (yrs):	20.0

Benefit Summary

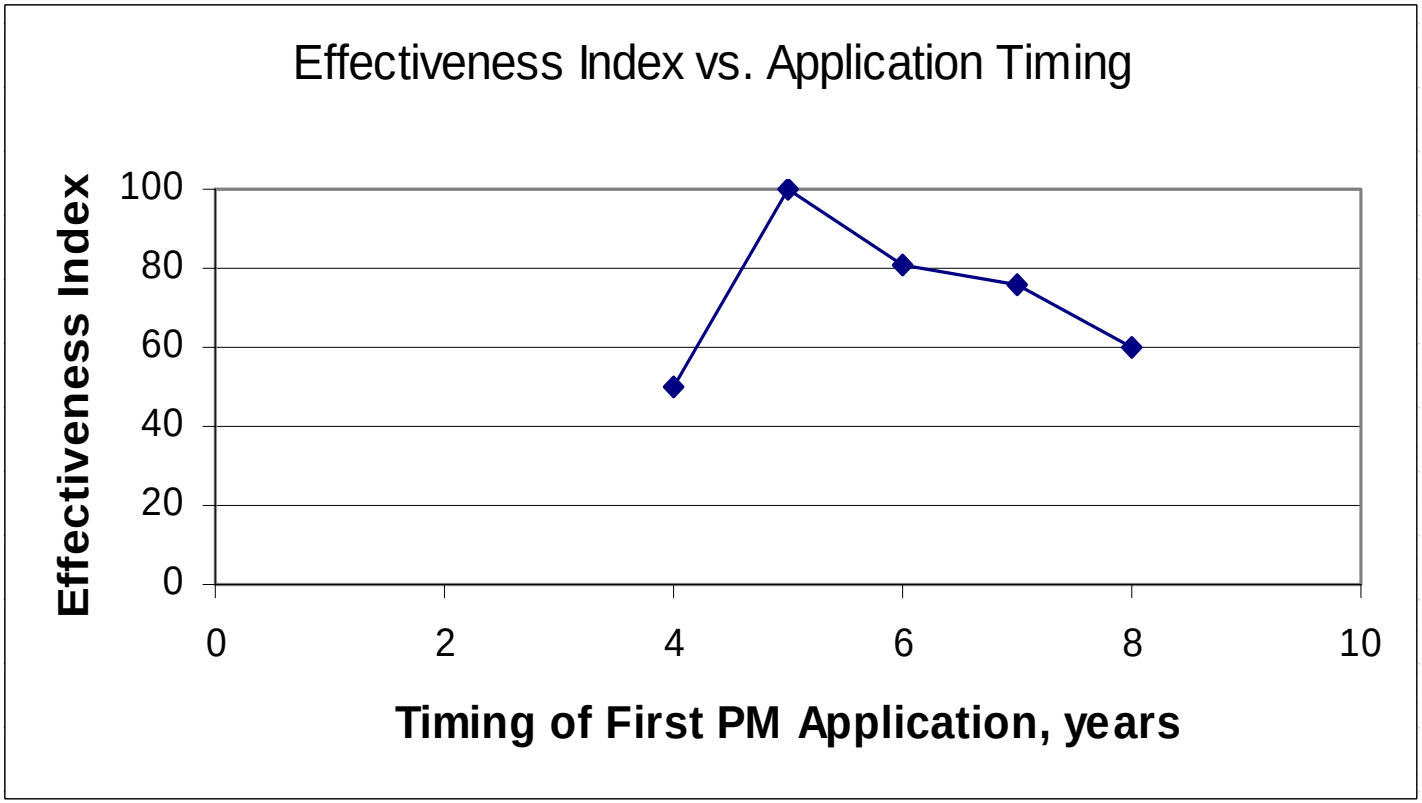
		Individual Benefit Summary	
Benefit Ranking Factors =>		75	25
Application Age, yrs	Total Benefit	Composite Index	Roughness/ Smoothness
4	0.11	0.08	0.22
5	0.22	0.20	0.31
6	0.19	0.21	0.12
7	0.18	0.16	0.25
8	0.15	0.13	0.20

Cost Summary

Effectiveness Summary

Application Age, yrs	Effectiveness Index	Total Benefit	EUAC, $	Expected Life, yrs	Expected Extension of Life, yrs
4	50.40	0.11	$7,366	21.0	1.0
5	100.00	0.22	$7,269	22.0	2.0
6	80.50	0.19	$7,487	21.0	1.0
7	76.07	0.18	$7,765	21.0	1.0
8	60.00	0.15	$8,028	20.0	0.0

Graphical Output



Wrap-Up

- Pavement preservation programs can be very cost-effective when treatments are used at the right time
- Determining the right time to apply preventive maintenance treatments is a challenge
  - Construct test sections
  - Monitor pavement conditions
  - Update agency guidelines
- Be sure preventive maintenance treatments are used in a preventive manner
- OPTime can be used to assist

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