Pavement Preservation Strategy Selection

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CP2C Background

- Caltrans started Center
  - Jan 2007
- Functions (Tasks)
  - Define and quantify benefits of preservation
  - Training and education
  - Improve PP performance
  - Innovation and tech transfer
  - Technical assistance
  - Promote effective PP
- Treatment Selection is one of the tasks

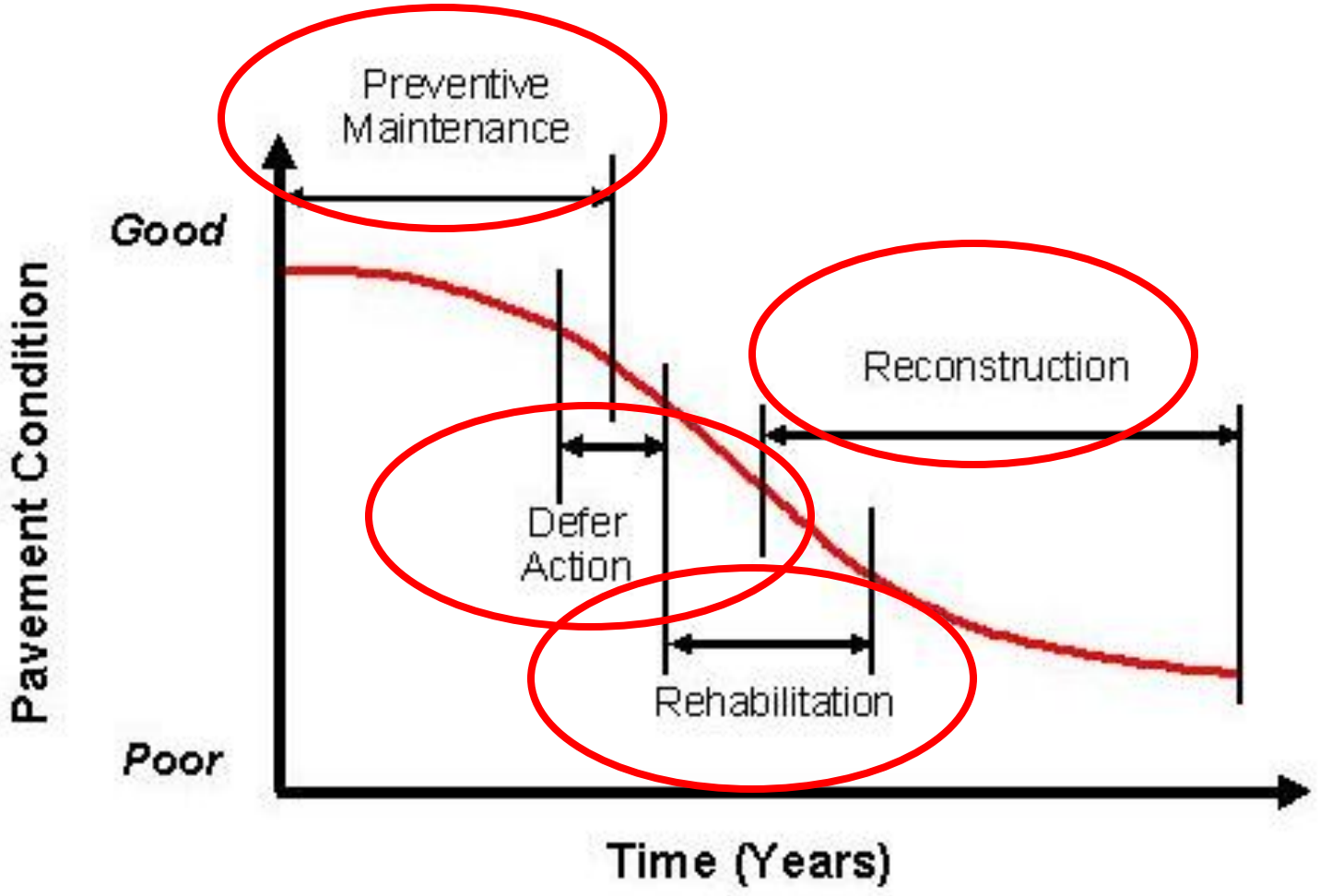
What is Treatment Selection?

A guide to assist maintenance personnel in making better and more informed decisions in selecting and applying maintenance treatments

In other words…

What do we do with this?

Treatment Selection Based on Pavement Condition



Why Pavement Preservation?

- Sustain the built environment
- Conserve natural resources
  - Aggregates
  - Asphalt
  - Cement
- Reduce dependency on petroleum products
- Reduce carbon footprint

Issues Treatment Selection Addresses

- Will the treatment address the distresses present? (i.e., Will it work?)
- Can the required preparation for the treatment be carried out?
- Is the treatment cost effective?
- Will the treatment be performed before the situation being addressed changes?

Selecting Treatment Process

- Assess existing pavement conditions
- Determine the feasible treatment options
- Analyze and compare the feasible options

Assess Conditions

- Assess existing pavement conditions
  - Conduct site inspection either manually or automatically
  - Review project information
  - Perform testing on the existing pavement, as conditions require
- Define the performance requirements for the treatment, such as weather, traffic, treatment life

Fatigue (Alligator) Cracking

LOW

MODERATE

HIGH

Load Related, HMA Thickness

Potholes

Environmental + Load

Rutting and Depressions

Ruts in Wheel Paths

Load + Environmental
Typically Upper 4 in.

Depression

Support Issue
Typically Full Depth

Transverse and Block Cracking

Thermal Cracking

Environmental
Early in Pave. Life

Block Cracking

Environmental + Age

Polishing and Raveling

Polished Aggregate

Raveling

Traffic + Age

Bleeding/Flushing

Materials + Environmental + Traffic

Pumping

Moisture + Traffic Materials?

Construction Issues

Bump

Crack Sealant?

Shoving

Delamination

Loss of Bond (Tack Coat)
Material Issue?

Preservation Treatments Used in CA

- Crack sealing
- Fog/Rejuvenating Seals
- Chip seals
- Slurry seals
- Scrub seals
- Microsurfacing
- Open graded friction course
- RHMA-O, RHMA-O-HB
- PBA-G
- BWC
- BWC-Rubber
- Thin HMA Overlays

Non-Structural Activities

Factors Affecting Treatment Selection

- Pavement age, condition
- Climate
- Traffic levels, expected future plans
- Available funding
- Agency policy

Caltrans Treatment Selection Matrix

- Covers all the major treatment types currently used by Caltrans and allows for use of future strategies
- Treatment selection is a complex, yet important procedure to ensure a optimum pavement treatment
- Affected by pavement conditions, traffic volumes, climate, and more

GENERAL GUIDELINES FOR EFFECTIVE MAINTENANCE TREATMENT SELECTION

Parameters																								Treatment Life Based On Traffic Volumes & Pavement Condition								
Preventive Treatments	Raveling	Oxidation	Bleeding	Rutting		Climate				Traffic Volumes			Night	Cold	Stop Points	urban	Rural	High Snow Plow	Treatment Costs						adt < 5000			adt>5000<30,000			adt >30,000		
																				Cost: $/SQ YD (Treatment Only)						Pavement Condition								
				<1/2"	>1/2"	Desert	Valley	Coastal	Mountains	adt < 5000	adt>5000<30,000	adt >30,000							Cost per lane-mile (Total Project Cost includes traffic control)	Large Projects	Medium Projects	Small Projects	Addtl Premium for night work $/SQ YD	Addtl Premium for Short Work Periods or Work Zones $/SQ YD	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Crack/Joint Seal																																
Emulsion	N	N	N	N	N	G	G	G	G	G	G	G	N	N	G	G	G	G	8,000	0.50-0.65	0.60-0.75	.70-0.8	0.15-0.2	+0.60-1.0(	2 to 8	2 to 6	1 to 4	2 to 7	2 to 5	1 to 4	2 to 6	2 to 4	1 to 4
Modified (Rubber)	N	N	N	N	N	G	G	G	G	G	G	G	G	G	G	G	G	G	8,000	0.55-0.70	0.65-0.80	.75-0.9	0.15-0.2	+0.60-1.0(	5 to 9	3 to 7	N	5 to 8	3 to 6	N	3 to 7	2 to 5	N
Seal Coats																																
Fog Seal (See note 1)	F	G	N	N	N	G	G	G	G	F	F	N	N	P	F	G	G	F	13,000	0.15-0.30	0.15-0.30	.15-0.3(	+0.05	+0.10	1 to 3	N	N	1 to 2	N	N	1 to 2	N	N
Rejuvenator (See note 1)	G	G	N	N	N	G	G	G	G	G	F	N	N	N	N	G	G	F	15,000	0.20-0.50	0.20-0.50	.20-0.5(	+0.10	+0.20	3 to 6	3 to 4	2 to 3	2 to 4	2 to 3	2 to 3	2 to 4	2 to 3	1 to 3
Scrub Seal (See Note 4)	G	G	N	N	N	G	G	G	G	G	F	N	N	G	N	F	G	P	17,000	2.15	2.15	2.15	N/A	N/A	4 to 7	3 to 6	3 to 4	3 to 6	2 to 4	2 to 3	2 to 3	2 to 3	2 to 3
Slurry Seals																																
Type II (See note 1)	F	G	N	N	N	G	G	G	F	G	G	G	N	N	G	G	G	P	23,000	1.60-2.20	1.75-2.40	.90-2.6(	N/A	+0.30	3 to 10	4 to 6	2 to 4	7 to 10	4 to 6	1 to 4	7 to 10	3 to 5	1 to 3
Type III	G	G	N	F	N	G	G	G	F	G	G	G	N	N	G	G	G	P	24,000	1.60-2.20	1.75-2.40	.90-2.6(	N/A	+0.30	3 to 10	4 to 6	2 to 4	7 to 10	4 to 6	1 to 4	7 to 10	3 to 5	1 to 3
REAS	G	G	N	F	N	G	G	G	F	G	G	G	N	N	G	G	G	P		1.20-1.80	1.20-1.80	.20-1.8(	N/A	+0.30	3 to 10	5 to7	N	7 to 10	5 to 7	N	7 to 9	5 to 7	N
Microsurfacing																																
Type II	G	G	N	G	F	G	G	G	G	G	G	G	G	N	G	G	G	P	31,000	2.00-2.80	2.10-2.90	.25-3.0(	0.10-0.2	N/A	3 to 12	5 to 8	2 to 4	7 to 12	5 to 7	2 to 4	7 to 10	3 to 6	1 to 4
Type III	G	G	N	G	G	G	G	G	G	G	G	G	G	N	G	G	G	P	31,000	2.00-2.80	2.10-2.90	.25-3.0(	0.10-0.2	N/A	3 to 12	5 to 8	2 to 4	7 to 12	5 to 7	2 to 4	7 to 10	3 to 6	1 to 4
Chip Seals																																
PME - Med. Fine (See Note 4)	G	G	N	F	N	G	G	F	F	G	G	N	N	N	P	P	G	P	27,000	1.80-2.00	2.25-2.75	.00-3.5(	N/A	+0.50-1.0(	3 to 12	5 to 8	2 to 4	7 to 12	5 to 7	2 to 4	7 to 10	3 to 6	1 to 4
PME - Medium (See Note 4)	G	G	N	F	N	G	G	F	F	G	N	N	N	N	P	P	G	F	27,000	1.80-2.00	2.25-2.75	.00-3.5(	N/A	+0.50-1.0(	3 to 12	5 to 8	2 to 4	7 to 12	5 to 7	2 to 4	7 to 10	3 to 6	1 to 4
PMA - Medium (See Note 3.)	G	G	N	F	N	G	G	G	G	G	G	N	N	G	P	P	G	F	24,000				N/A		3 to 12	6 to 9	4 to 6	7 to 12	5 to 7	4 to 6	7 to 10	4 to 6	3 to 5
PMA - Coarse (See Note 3.)	G	G	N	F	N	G	G	G	G	G	N	N	N	G	P	P	G	G	24,000				N/A		3 to 12	6 to 9	4 to 6	7 to 12	5 to 7	4 to 6	7 to 10	4 to 6	3 to 5
AR - Medium	G	G	N	F	N	G	G	G	G	G	G	N	G	G	P	P	G	F	65,000	3.75-4.55	4.00-4.75	.25-5.0(	N/A	+0.50-1.0(	3 to 12	6 to 9	4 to 6	7 to 12	5 to 7	4 to 6	7 to 10	4 to 6	3 to 5
AR - Coarse	G	G	N	F	N	G	G	G	G	G	N	N	G	G	P	P	G	G	65,000	3.75-4.55	4.00-4.75	.25-5.0(	N/A	+0.50-1.0(	3 to 12	6 to 9	4 to 6	7 to 12	5 to 7	4 to 6	7 to 10	4 to 6	3 to 5
Cape Seals																																
Slurry	G	G	N	F	N	G	G	G	G	G	G	G	N	N	G	G	G	P							9 to 14	7 to 10	5 to 7	8 to 12	6 to 8	5 to 7	8 to 10	5 to 7	4 to 6
Micro	G	G	N	G	F	G	G	G	G	G	G	G	N	N	G	G	G	P							10 to 1	8 to 10	5 to 8	8 to 12	6 to 8	5 to 8	8 to 10	5 to 7	4 to 6
PM Alternative to a Seal Coat > 30,000 ADT																																
PBA-O	G	G	P	F	N	G	G	G	G	G	G	G	F	F	G	G	G	P	65,000	8-12	8-14	10-16		+1.20-4.0(	3 to 14	6 to 12	4 to 7	8 to 12	6 to 10	4 to 5	8 to 10	5 to 7	3 to 5
RAC-O	G	G	P	F	N	G	G	G	G	G	G	G	F	P	G	G	G	P	60,000	10-14	10-14			+1.50-3.5(	3 to 14	5 to 12	4 to 7	8 to 12	5 to 10	4 to 5	8 to 10	5 to 9	3 to 5
RAC-O High Binder (HB)	G	G	P	F	N	G	G	G	G	G	G	G	F	P	G	G	G	P	65,000	10-14	10-14			+1.50-3.5(	3 to 15	6 to 12	4 to 8	10 to 12	6 to 12	4 to 6	8 to 12	5 to 10	4 to 5
RAC-G	G	G	P	G	F	G	G	G	G	G	G	G	F	F	G	G	G	G	65,000	10-14	10-14			+1.50-3.5(	3 to 14	6 to 10	4 to 6	8 to 12	5 to 9	4 to 5	8 to 10	5 to 7	3 to 5
PBA-G	G	G	P	P	N	G	G	G	G	G	G	G	F	F	G	G	G	G	60,000	8-12	8-14	10-16		+1.20-4.0(	3 to 14	6 to 12	4 to 7	8 to 12	6 to 10	4 to 5	8 to 10	5 to 7	3 to 5
Thin Bonded Wearing Course (BWC)	G	G	P	F	N	G	G	G	G	G	G	G	F	F	G	G	G	G	85,000	10-14	10-14			+1.50-3.5(	3 to 12	5 to 10	4 to 6	8 to 10	5 to 9	4 to 5	8 to 10	5 to 9	3 to 4
Thin Bonded Wearing Course Rubber (BWC-RAC O/C	G	G	P	F	N	G	G	G	G	G	G	G	F	F	G	G	G	G	85,000	10-14	10-14			+1.50-3.5(	3 to 12	5 to 10	4 to 6	8 to 10	5 to 9	4 to 5	8 to 10	5 to 9	3 to 4
Maintenance Treatments																																
Thin Lifts Overlays																																
Conventional	G	G	P	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	45,000	8-12	8-14	10-16		+1.20-4.0(	3 to 12	5 to 10	4 to 6	8 to 10	6 to 9	3 to 6	6 to 8	4 to 6	1 to 3
PBA	G	G	P	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	60,000	8-12	8-14	10-16		+1.20-4.0(	3 to 14	6 to 12	4 to 7	8 to 12	6 to 10	4 to 5	8 to 10	5 to 7	3 to 5
RAC	G	G	P	G	F	G	G	G	G	G	G	G	F	F	G	G	G	G	65,000	10-14	10-14			+1.50-3.5(	3 to 14	5 to 12	4 to 7	8 to 12	5 to 10	4 to 5	8 to 10	5 to 9	3 to 5
Digouts	P	P	G	N	G	G	G	G	G	G	G	G	G	G	G	G	G	G	125,000														

Where is the magnifying glass?

Maintenance Selection on Cracks - Overview

GENERAL GUIDELINES FOR EFFECTIVE MAINTENANCE TREATMENTS ON CRACKS

	Type of Cracking														
	Alligator "A"			Alligator "B"			Alligator "C"			Longitudinal/Transverse			Edge		
Criteria	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Width	<1/4"	>1/4", <1/2"	>1/2"	<1/4"	>1/4", <1/2"	>1/2"	<1/4"	>1/4", <1/2"	>1/2"	<1/4"	>1/4", <1/2"	>1/2"	No	>0%, <10%	>10%
	or	or	or	or	or	or	or	or	or				Material	Material	Material
Area	<10%	>10%, <20%	>20%, <30%	<10%	>10%, <20%	>20%, <30%	<10%	>10%, <20%	>20%, <30%				Loss	Loss	Loss
Preventive Treatment															
Crack/Joint Seal (See Note 5)															
Emulsion	N	F	N	N	P	N	N	N	N	G	F	N	G	P	P
Modified (Rubber)	N	G	P	N	P	N	N	P	N	P	G	F	P	P	P
Fog Seal (See note 1)	G	P	N	G	N	N	F	N	N	F	N	N	F	P	P
Rejuvenator (See note 1)	G	N	N	G	N	N	F	N	N	F	N	N	F	P	P
Scrub Seals	G	F	N	G	F (See Note 4)	N	G	P (See Note 4)	N	F	P	P	F	P	P
Slurry Seals															
Type II (See note 1)	F	N	N	F	N	N	F	N	N	F	N	N	F	P	P
Type III	F	P	N	F	P	N	F	P	N	F	P	N	F	P	P
Microsurfacing															
Type II (See note 2)	G	N	N	F	P	N	F	P	N	F	N	N	P	P	P
Type III	G	P	N	F	P	N	F	P	N	F	N	N	P	P	P
Chip Seal															
PME - Med. Fine	G	P	N	G	F (See Note 4)	N	G	P (See Note 4)	N	P	P	N	P	P	P
PME - Medium	G	P	N	G	F (See Note 4)	N	G	P (See Note 4)	N	P	P	N	P	P	P
PMA - Medium (See Note 3.)	G	P	P	G	F (See Note 4)	P	G	P (See Note 4)	P	P	P	N	P	P	P
PMA - Coarse (See Note 3.)	G	P	P	G	F (See Note 4)	P	G	P (See Note 4)	P	P	P	N	P	P	P
AR - Medium	G	G	F	G	G	F	G	F (See Note 4)	F	P	F	F	P	P	P
AR - Coarse	G	G	F	G	G	F	G	F (See Note 4)	F	P	F	F	P	P	P
PM Alternative > 30,000 ADT															
PBA OGAC	G	F	N	G	F (See Note 4)	N	G	F (See Note 4)	N	G	F	P	P	P	P
RAC-O	G	G	F	G	G	F (See Note 4)	G	G	F	G	F	P	P	P	P
RAC-O High Binder (HB)	G	G	F	G	G	F (See Note 4)	G	G	F	G	F	P	F	F	F
RAC-G	G	G	G	G	G	F (See Note 4)	G	G	G	G	F	P	G	G	G
Thin Bonded Wearing Course Rubber (BWCR)	G												P	P	P
Maintenance Treatments															
Conventional	G												N	F	F
PBA	G												N	F	F
RAC	G												N	F	F
BWC															
Digouts	N	N	F	N	N	G	N	N	G	N	F	F	N	F	G

Not again

Analyze and Compare

- Analyze and Compare the Feasible Options
  - Several treatments may be feasible
  - Cost and life of the treatments vary
  - Effect of the treatment on the life extension of the existing pavement
  - Other factors to consider: cost effectiveness, treatment timing, traffic level, and constructability

Estimated Life of Treatments

Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Fog Seal	3 - 5	1 - 3	1 - 2
Chip Seal	7 - 10	3 - 5	1 - 3
Slurry Seal	7 - 10	3 - 5	1 - 3
Micro-surfacing	8 - 12	5 - 7	2 - 4
Thin HMA	10 - 12	5 - 7	2 - 4

Select Best Treatment

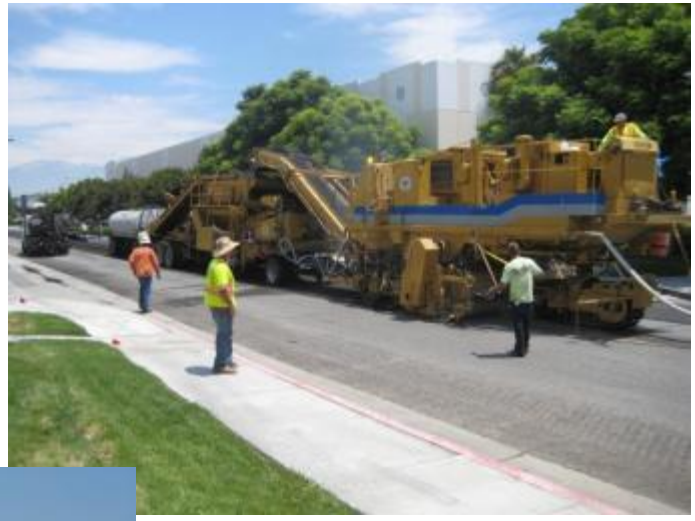
- Cost Effectiveness
  - Equivalent Annual Cost
  - Life Cycle Cost Analysis
- Selection of Maintenance Treatments
  - Performance and constructability
  - Customer satisfaction
  - Ranking of selected treatments by rating overall importance

Economics of Preservation

- Project Size
  - Small
    - 1 to 2 days of work
  - Medium
    - 3 to 5 days of work
  - Large
    - + 1 week

Other Options

- Other preservation treatments
  - Recycling
    - Cold in-place
    - Hot in-place
    - Full depth recycling

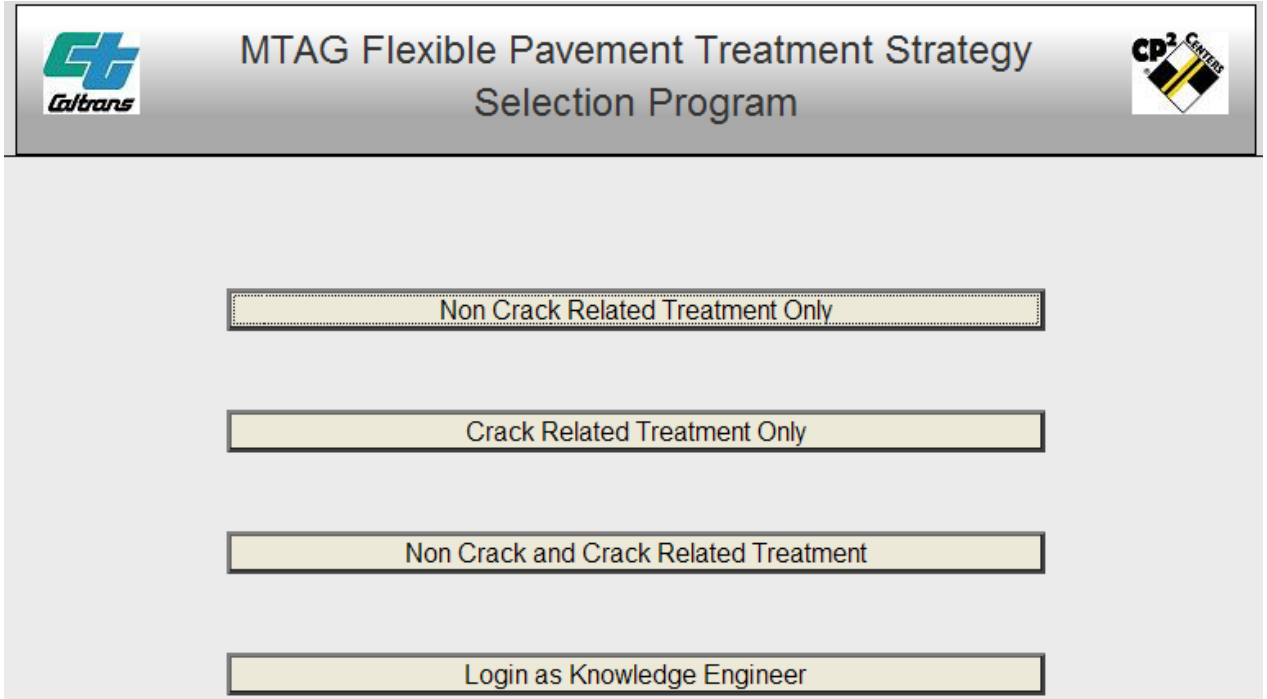


Interlayers

- Interlayers
  - Overlays
  - Chip over fabric

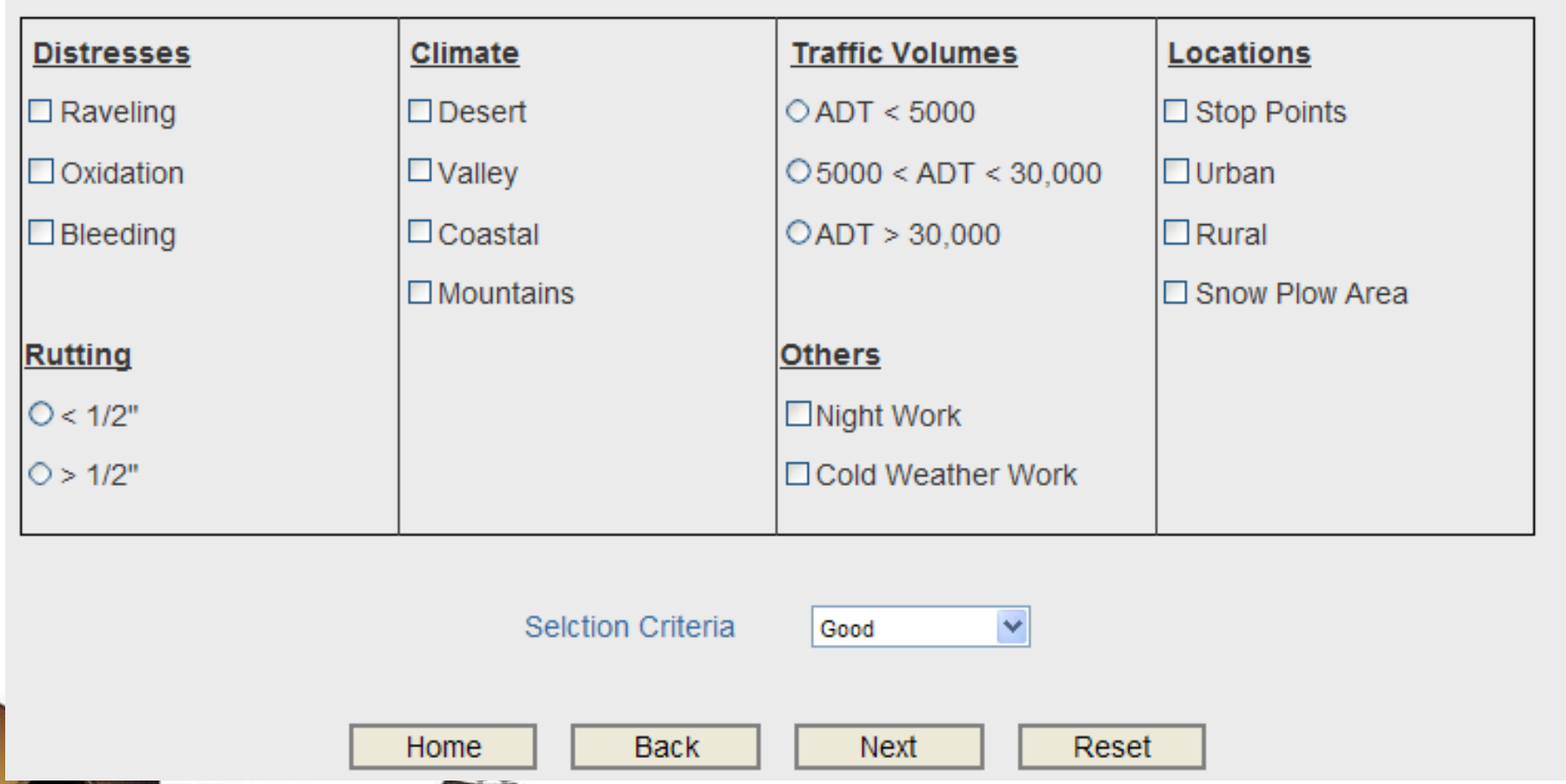
MTAG Flexible Pavement Treatment Selection Software Is Now Online

- MTAG Method
  - Non-Crack Related
  - Crack Related

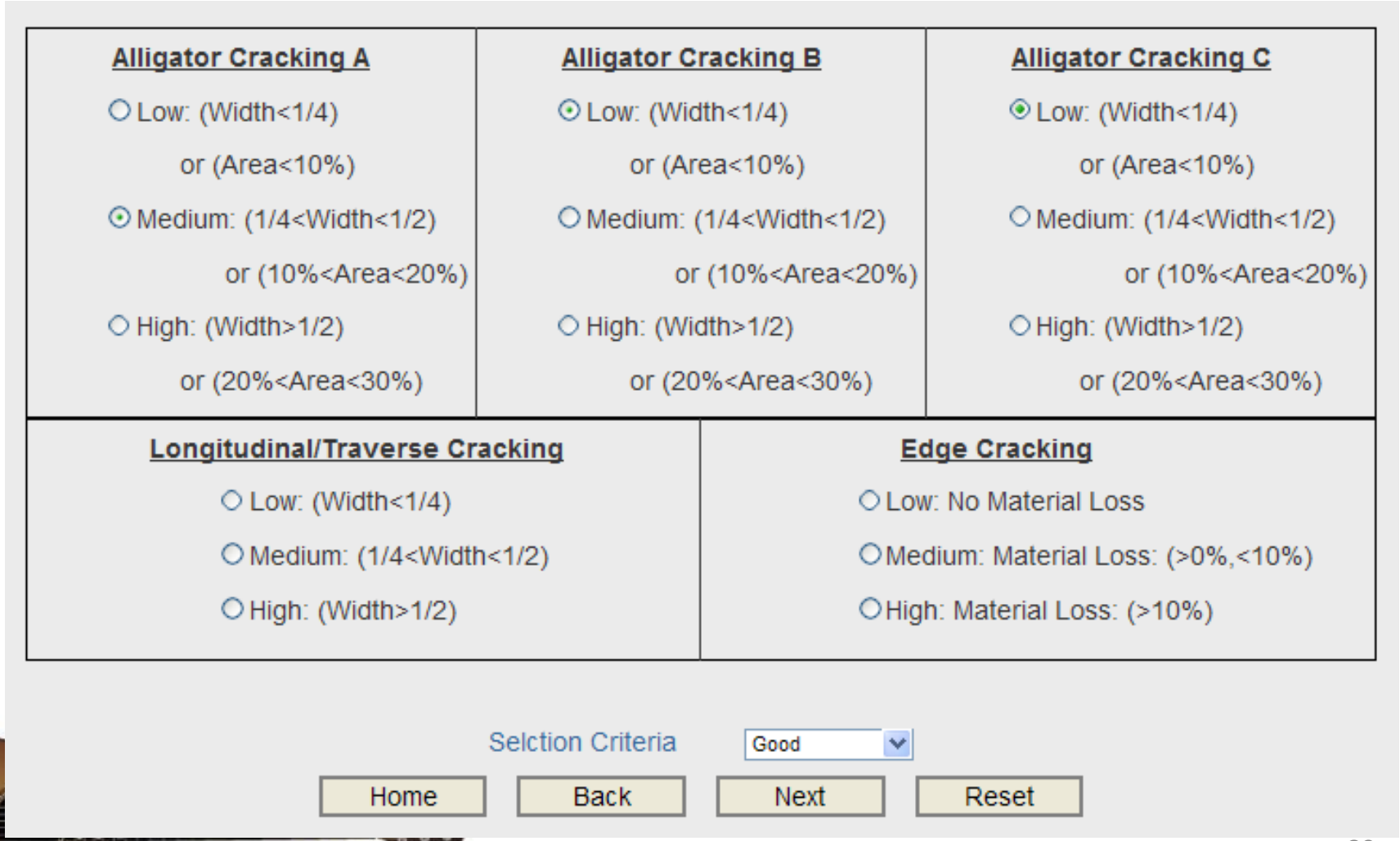


http://www.cp2info.org/TreatmentSelection2.0/

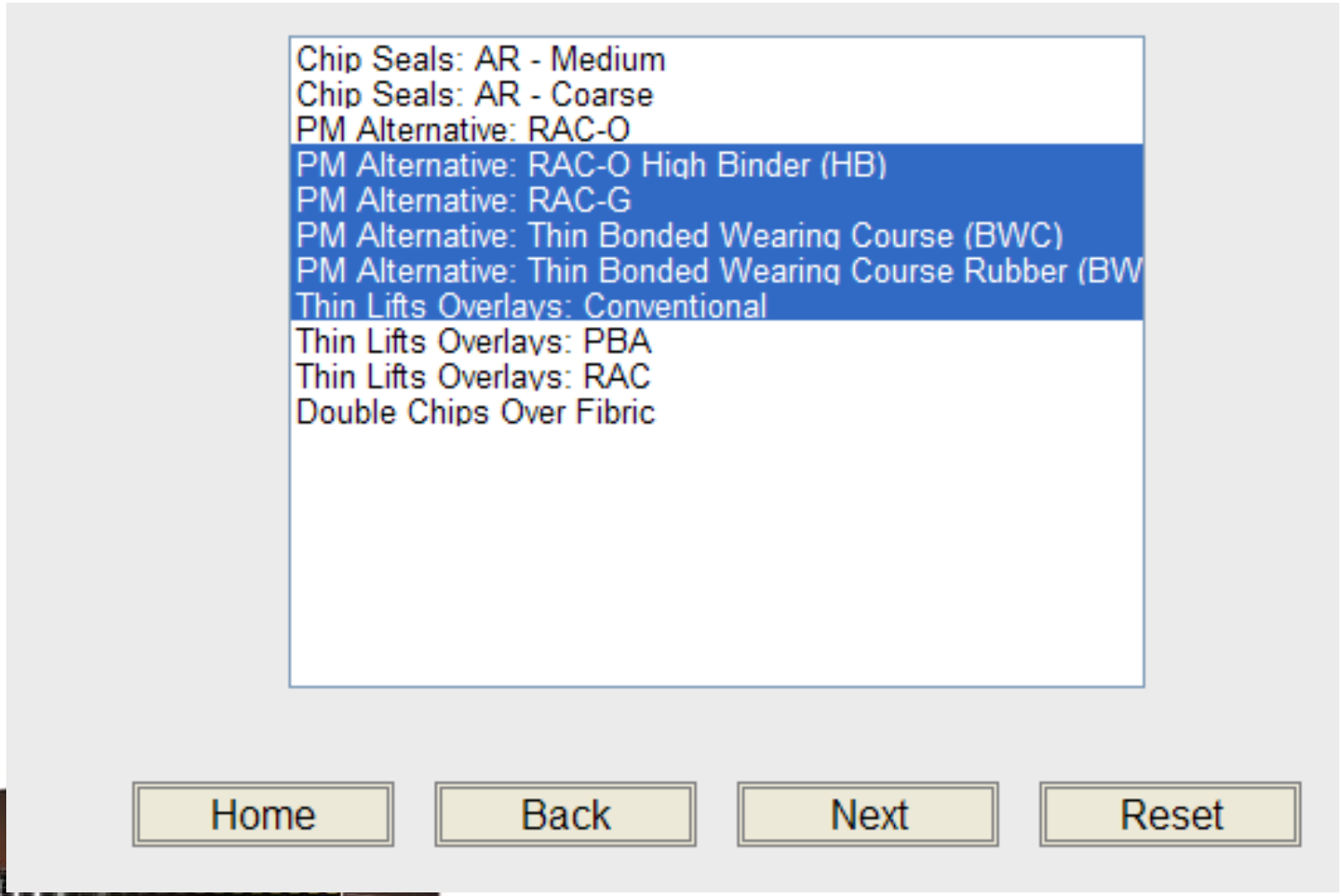
MTAG – Identify Non-crack Related Distresses and Conditions



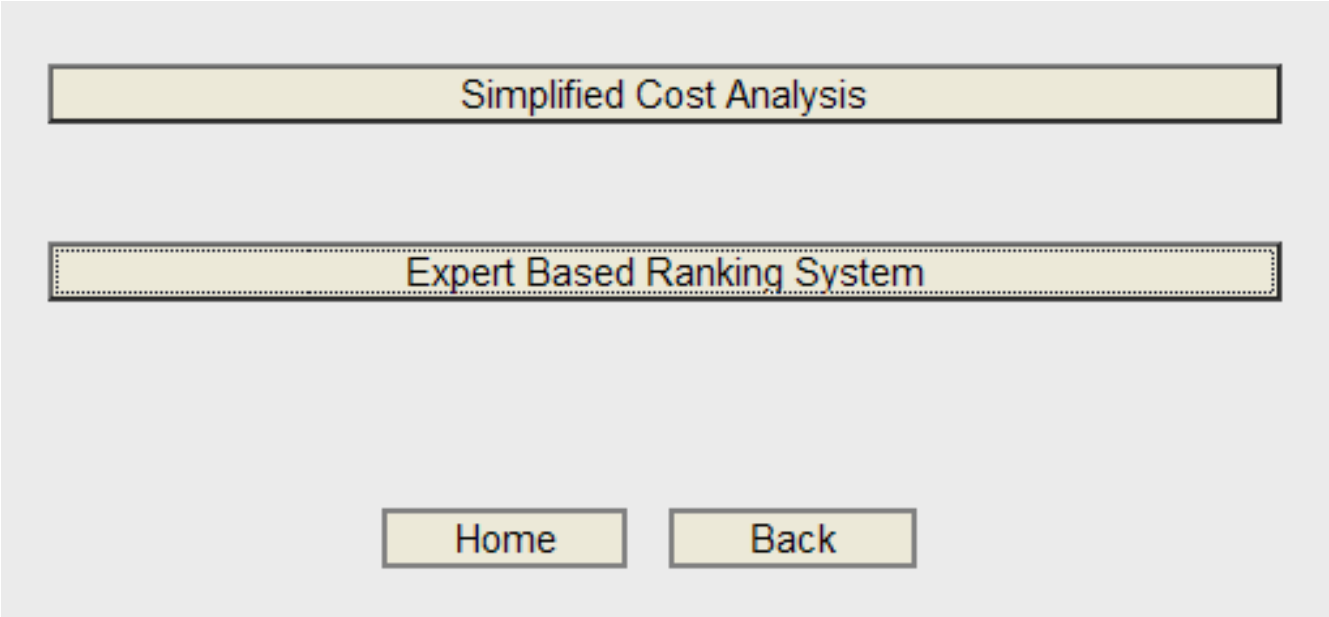
MTAG – Identify Crack Related Distresses



Generate Preliminarily Selected Treatment List



Further Detailed Comparison Methods



- The framework of Cost Analysis and Expert System have been developed.
- Knowledge and data will be input into the system so that ranking of alternatives can be derived.

Alaska Treatment Selection Program

- Integrated with Alaska DOT&PF Pavement Preservation Database, which shows project location with Google Map.
- Developed strategy selection matrixes includes common pavement distresses as well as cold region special conditions.
- Contained treatments not only preservation but also rehabilitation.

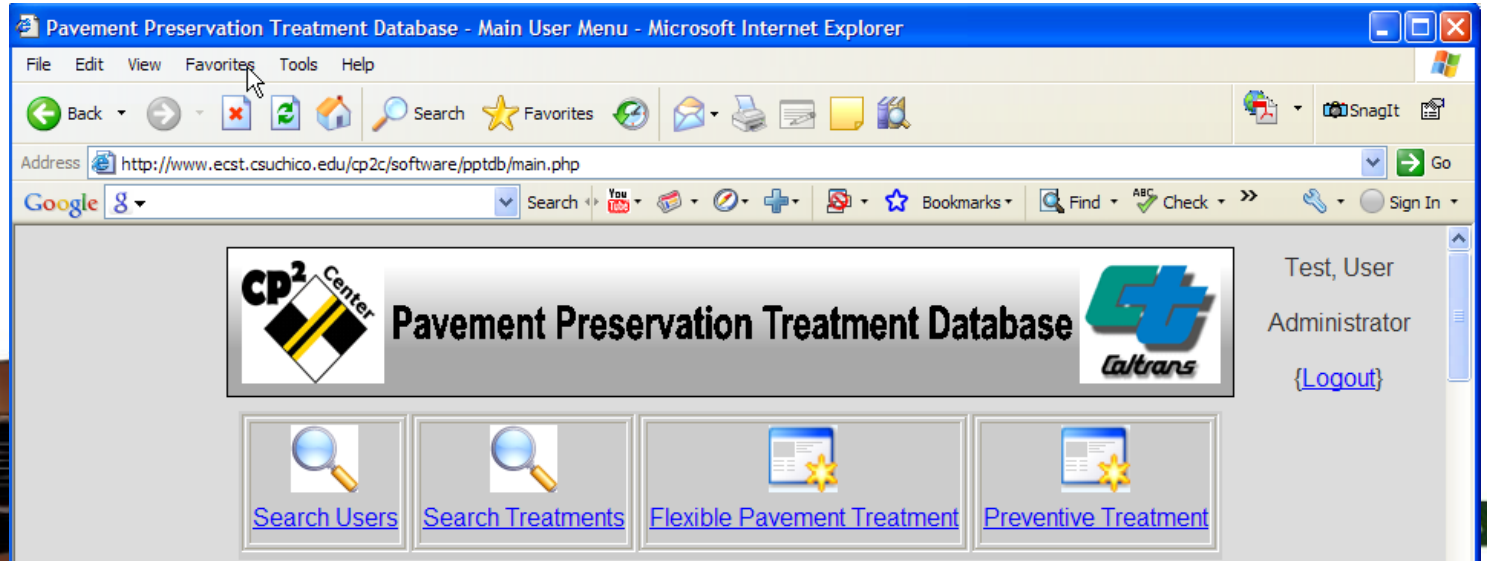
Alaska DOT&PF Treatment Selection Online Program

- Long term performance tracking
- Ranking treatment based on life cycle cost analysis
- Website:

  http://sites.google.com/site/alaskap2/

Future Plans

- Enhance Pavement Preservation Treatment Database
- Improve Estimates of Treatment Life and Life Extension
- Improve Strategy Selection Process using Expert Systems



Summary

- Right treatment at the right time on the right pavement
- Treatments have different service lives
  - Better life when used earlier
  - Little life extension when used with 25% cracking
- Cost savings with increasing size of project
- Future plans

QUESTIONS?

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