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# Seven Steps of Implementing In-Place Recycling by Public Agencies

Midwestern States Regional In-Place Recycling Conference

Schaumburg, IL

**Presented by:**


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**Federal Highway Administration**


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# Our Visit

1. Designate a Point of Contact
2. Assess the Situation
3. Formulate a Plan
4. Develop Tools
5. Train Staff and Take Action
6. Track and Evaluate Progress
7. Communicate Results

# Designate a Point of Contact

- Provide focus
- Comfortable with technical information and communication
- Obtain full support from top managers
- Partner with industry
- Lead training

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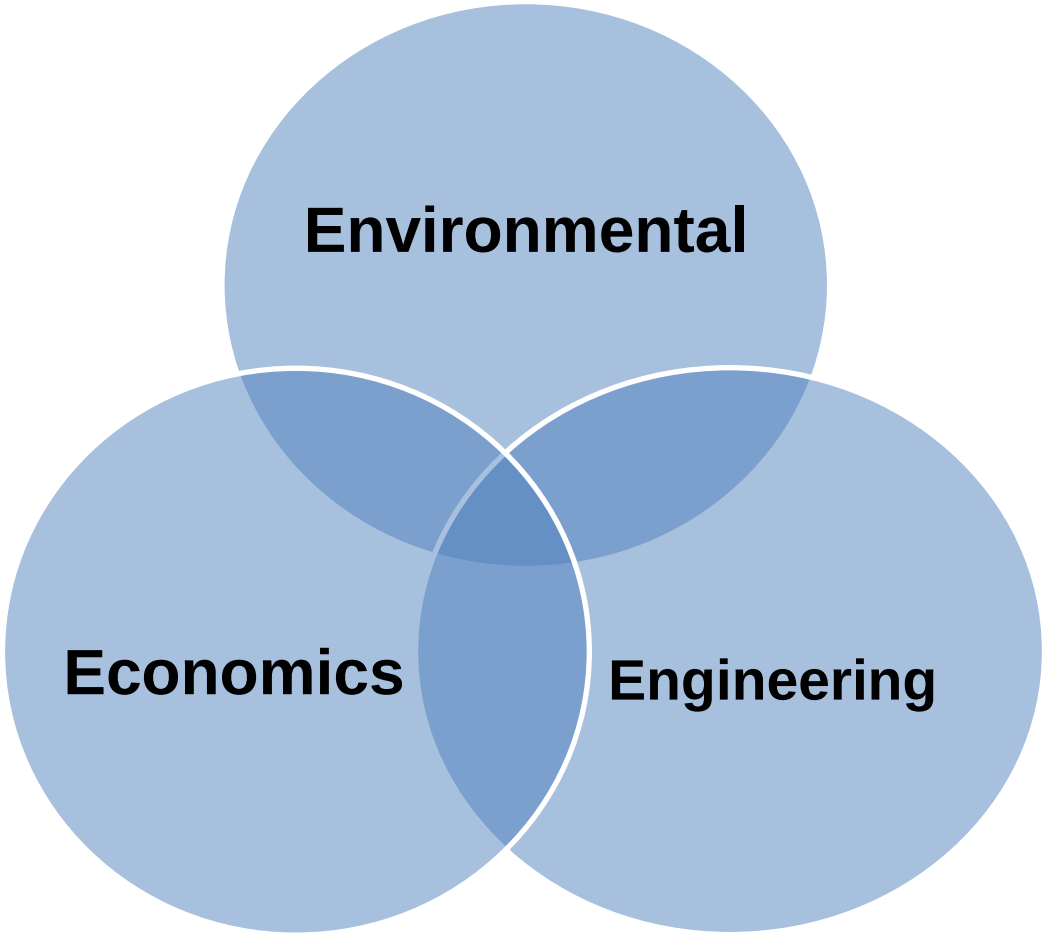
# Assess the Situation Nationally



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# Mill & Overlay vs. CIR & Overlay

## 3” Mill & 3” HMA

- Existing HMA (SN-0.2/inch)
- New HMA (SN-0.42/inch)

- Total SN-
- (3”*0.42)-3*0.2=0.66

## 3” CIR & 1.5” HMA

- 0.3-CIR (SN-0.3/inch)
- 0.42 New ACP (SN-0.42/inch)

- Total SN-
- (3*(0.3-0.2)+0.42*1.5=0.93

40% Increase in SN value

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# Cost Comparison

**3” Mill & 3” overlay**

- 3” Milling-$1.5/ Sq. Yd.
- 3” HMA- $18/ Sq.Yd.

- Total cost for one mile (32’ wide )= $370 K

**3” CIR & 1.5” overlay**

- 3” CIR-$4.5
- 1.5” HMA- $9/ Sq.Yd.

- Total cost for one mile (32’ wide)= $253K

30% Cost decrease

# Long-Term Performance

## 9-year Performance

### CIR and 2” Overlay Section, Reno, Nevada

# Long-Term Performance

## 20-year Performance - US-95 Nevada

# Colorado DOT, Region 2
# I-25 south of Pueblo

- Life Cycle Cost Analysis
  - 6-inch CIR and 4-inch overlay ($24.7M)
  - 4-inch mill and 5.5-inch overlay ($28.9M)
- **"Go Green" Calculations**
  - Save 17,000 tons of aggregate
  - Save 1,200 tons of binder
  - Recycle 85,000 tons of material

# Assess the Situation Locally

**Type of in-place recycling that offers biggest competitive advantage**

- Geographic locations for aggregates hauled
- Type of traffic
- Type of pavement distresses
- Type of in-place recycling that offers most promise

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# Formulate a


- Goals
  - Try in-place recycling for the first time
  - Try a different type of in-place recycling technique for the first time
  - Expand current number of projects by a certain number or percentage

# Formulate a PLAN

- Strategies
  - What are you going to do?
  - Where are you going to do it?
  - How are you going to do it?
  - When are you going to do it?

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# Formulate a PLAN

| EXAMPLE | In-Place Recycling: Type 1 | In-Place Recycling: Type 2 |
|---|---|---|
| Year 1 | Develop tools, train, communicate | |
| Year 2 | One pilot project | Develop tools, train, communicate |
| Year 3 | One project per District | One pilot project |
| Year 4 | Expand use | One project per District |
| Year 5 | Keep tracking, communicating and improving | Expand use |

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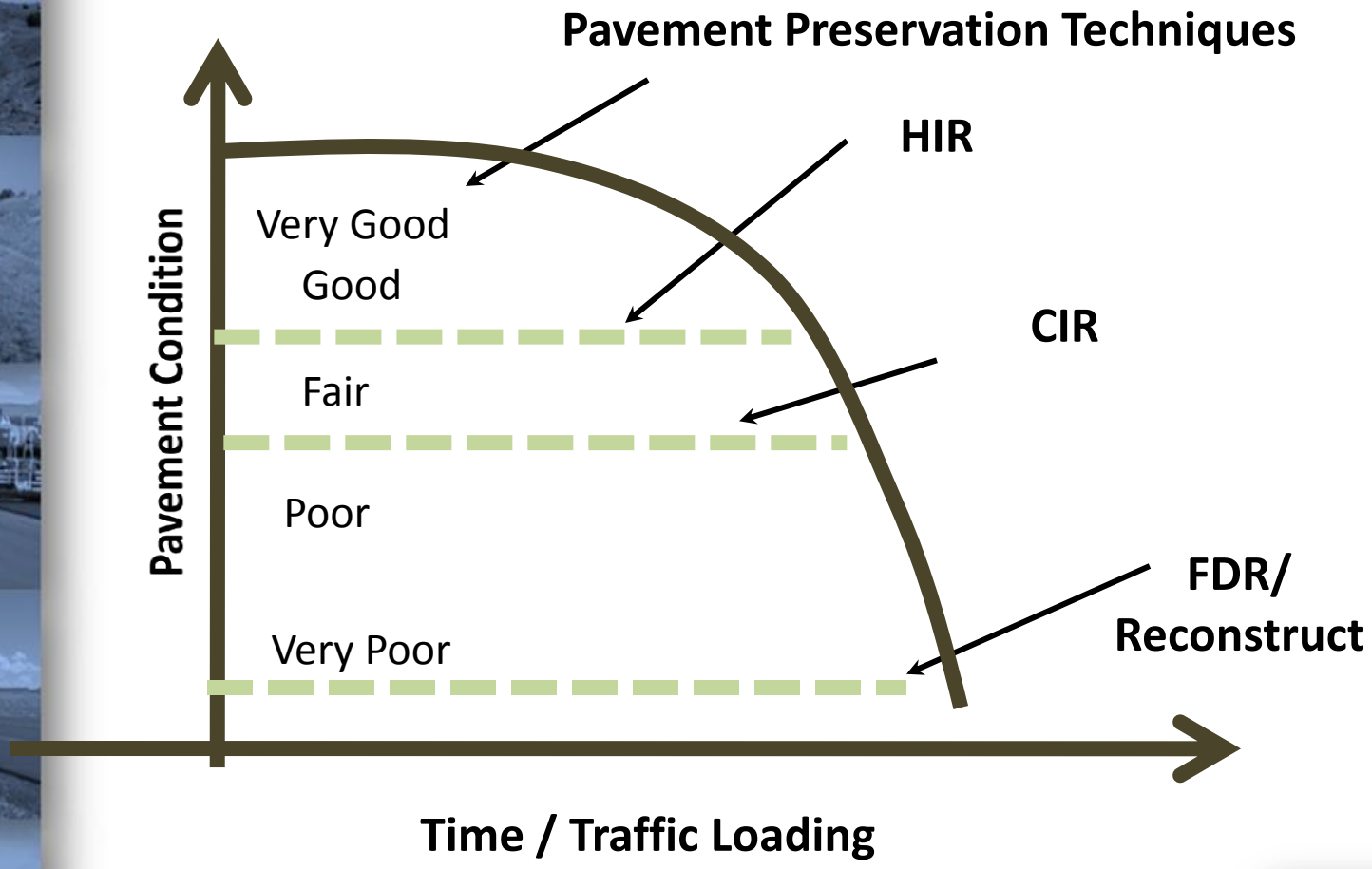
# Develop Tools

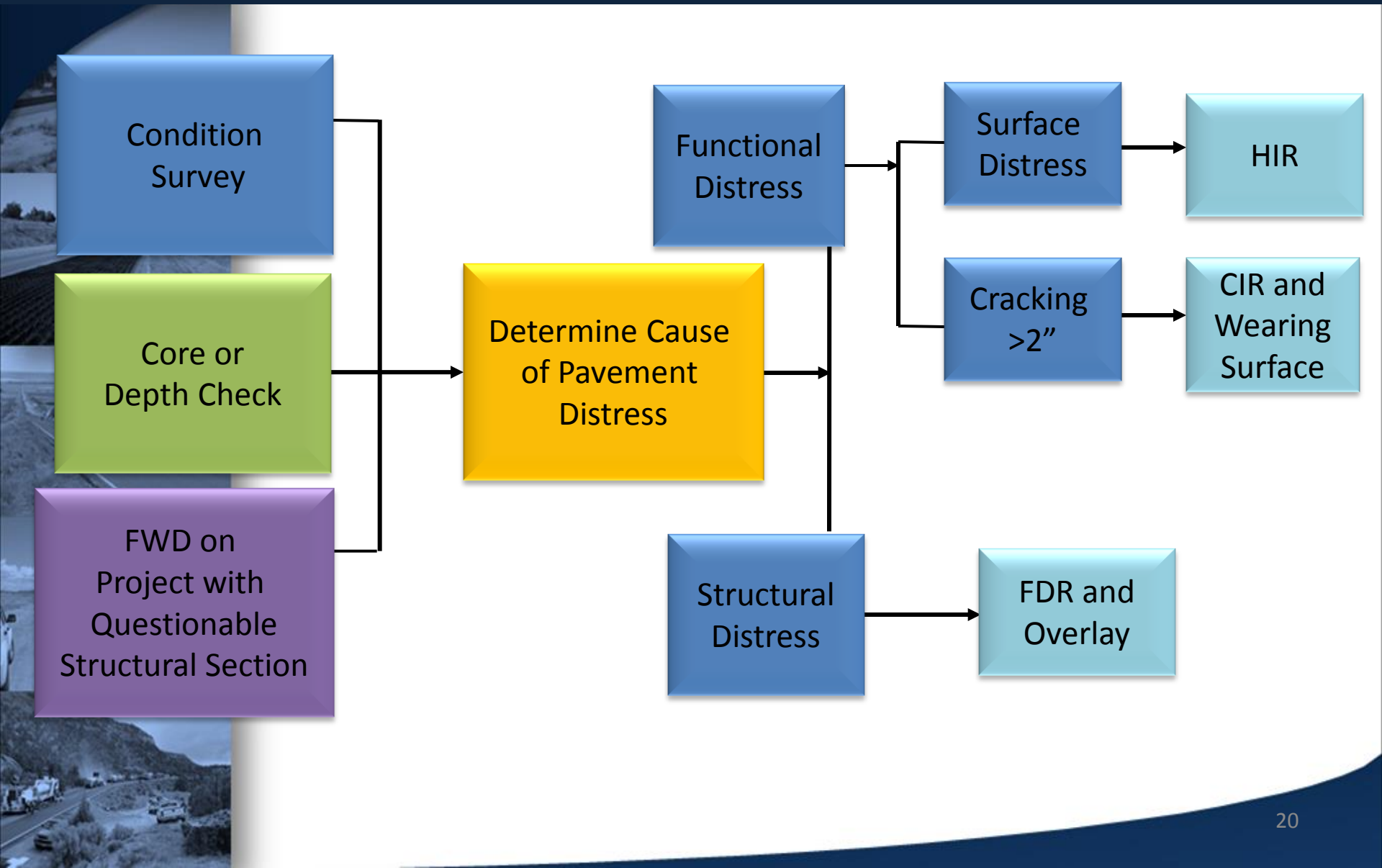
- Project selection guidelines
- Develop pavement design guidelines
- Develop mix design guidelines
- Develop construction specifications

# Project Selection Guidelines


# Timing of Rehabilitation Techniques




# Existing Pavement Evaluation



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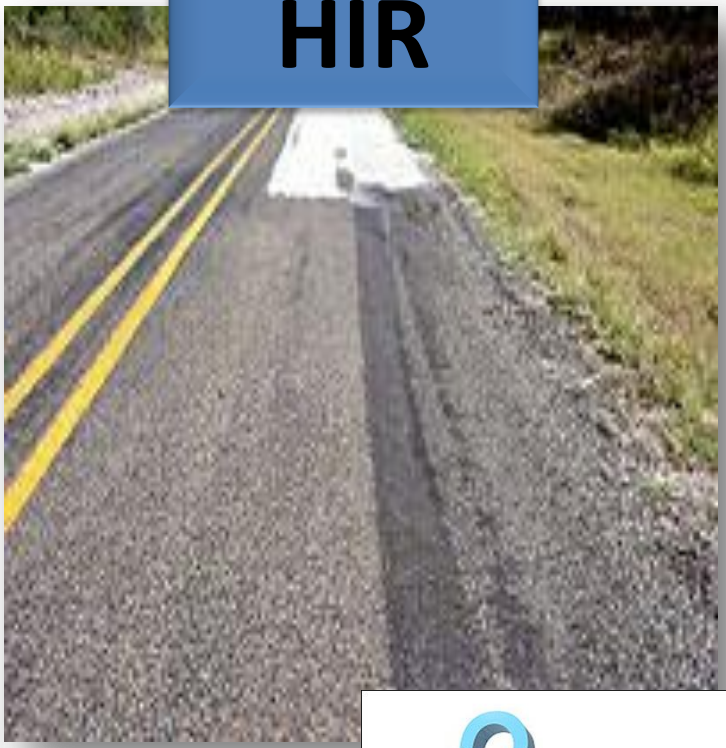
# What is a good strategy for surface raveling?



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# What is a good strategy for transverse and block cracking?

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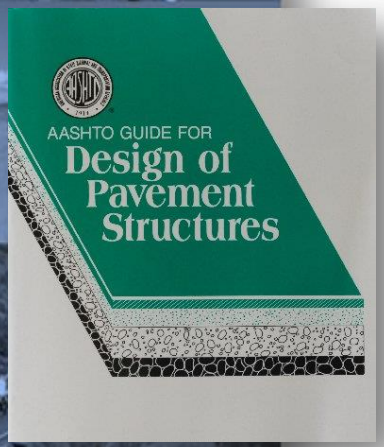
# What is a good strategy for alligator cracking?

# Pavement Design Guidelines

- MEPDG
- 1993-AASHTO Design Guide
  - Use structural number 0.28-0.35 for CIR
  - Mr. for CIR varies from low 200's to 1 M



# Pavement Design Guidelines

| FDR Method | Minimum Thickness of Riding Surface | Typical Structural Coefficient |
|---|---|---|
| Mechanical | 2" HMA | 0.10 – 0.12 |
| Bituminous | Surface Treatment or Structural HMA | 0.20 – 0.28 |
| Cement | Surface Treatment or Structural HMA | 0.15 – 0.20 |

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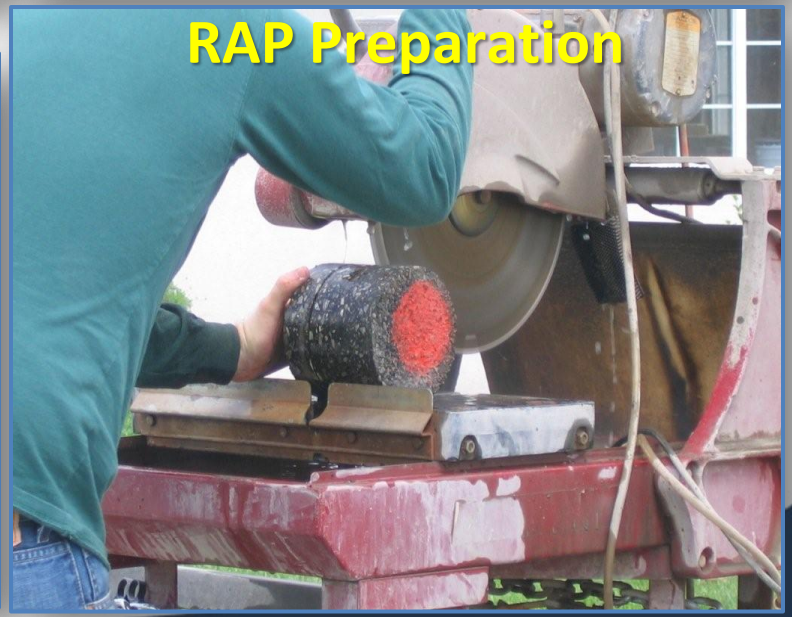
# Mix Design Process


Gyratory Compactor


Marshall Stability


Raveling Test


RAP Preparation

# Constructing a Successful Project

# Constructing a Successful Project

- End-result specifications
- Inspector checklist
- Field acceptance testing
- Pre- and post-construction meetings
- Partnering - successful projects are based on win-win strategy

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# Training

- NHI 131050 – Asphalt Paving In-Place Recycling Technologies
- ARRA – Basic Asphalt Recycling Manual
- Just-in-time training for:
  - ✓ Project selection
  - ✓ Pavement and materials mix design
  - ✓ Construction and inspection

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# Resources

- FHWA: http://www.fhwa.dot.gov/pavement/recycling/currentproj.cfm
- National Center for Pavement Preservation: http://www.pavementpreservation.org/
- Foundation for Pavement Preservation: www.fp2.org/
- Greenroads: https://www.greenroads.org/
- Pavement Recycling Systems: www.pavementrecycling.com

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# Develop a Tracking System

- Projects
- Volume of recycled materials
- Performance
- Dollars saved
- Environmental benefits

# Evaluate Progress

- Compare results: traditional vs. recycled
  - Costs, performance
  - Collect, tabulate and calculate
- Update specifications
- Continue improving process

# Cost-Effectiveness for Nevada DOT

| Category | ESALs | Strategy | Total GRAVEL FACTOR Numbers | Strategy Cost | Reduced Cost/ Mile | Change in SN |
|---|---|---|---|---|---|---|
| LOW | < 1 Million | 2” Mill &fill | 2”(0.35-0.18)= 0.34 | 625K | 63% | (12%) |
| | | 3” CIR Double Chip Seal | 3(0.28-0.18) =0.30 | 230K | | |
| MEDIUM | > 1 Million < 3 Million | 3” Mill 3” HMA | 3”( 0.35-0.18)=0.51 | 910K | 37% | 60% |
| | | 3” CIR 1.5” HMA | 3” (0.28-0.18) +1.5” *0.35=0.82 | 570K | | |
| HIGH | > 3 Million | 3” Mill 6” HMA | (6”)(0.35)-(3”) (0.18)=1.56 | 1.82 M | 28% | 10% |
| | | 3” CIR 4” HMA | 3(0.28-0.18) +4(0.35)=1.70 | 1.3 M | | |

# Cost-Effectiveness for MNDOT

| | 3" CIR & 1.5" HMA | 3" Mill & 3" HMA |
|---|---|---|
| GF | 3(1.5 – 1.25) + (1.5" x2.25) = 4.125 | 3 x (2.25-1.25) = 3 |
| Cost | CIR:<br>50,688 S.Y.@ $2.30 = $116,582<br><br>Recycling Binder:<br>196 tons @ $535 = $104,860 | Rotomill:<br>50,688 S.Y. @ $1.50 = $76,032<br><br>HMA:<br>8,781 tons @ $95.00 = $834,195 |
| | 1.25 inch HMA Overlay<br>3,659 tons @ $95.00 = $347,605 | |
| | TOTAL: $569,047 | TOTAL: $910,227 |

***CIR & HMA provides*** **37% less cost**

***Save $341,180*** **37% increase in SN**

GF for MNDOT
New HMA = 2.25
CIR = 1.5
Existing HMA = 1.25

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# Communicate


- Marketing is critical to success
- Repeating the message several times
- Monitor, evaluate and report projects
- Conference presentations
- Videos
- Apply for awards

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# Seven Steps of Implementing In-Place Recycling by Public Agencies

## Questions for you:

1) What additional steps are there?
2) Which step is the most challenging?
3) How can you overcome it?

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## QUESTIONS ?

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