Project Selection Criteria for Cold In-place Recycling

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Objectives of Presentation

- Identify factors to consider in project selection for cold in-place recycling (CIR) projects
- Review the type of field investigations to be conducted

Project Selection Criteria

- Design life
- Funding availability
- Geometric design considerations
- Construction factors
- Traffic control considerations
- Pavement assessment

Other Factors to Consider

- Conservation of natural resources and energy
- Environmental concerns
- Life cycle cost analysis

Design Life

- What is expected from CIR pavement in terms of life?
- CIR can provide 10 to 20 years of service
- Preventive maintenance should be planned for all CIR projects

Funding Availability

- Funds are limited these days
- Agencies are looking for more cost effective treatments
- CIR cost less than the traditional mill and fill operation

Geometric Design Considerations

- What can CIR do?
  - Minor improvements in the cross slope or super elevation
  - Take out some roughness or high spots if there is sufficient thickness
- What CIR cannot do?
  - Improve longitudinal profile deficiencies
  - Improve the strength of the pavement without an overlay

Geometric Features Can Limit CIR

- Tight turns
- Steep grades (>6 %)
- Castings in the pavement
- Cul de sacs –the ends

Construction Factors

- Proper construction procedures and knowledgeable contractors are needed for a successful project
- Climate or weather can affect the cure time
- Effective communications between the contractor and agency are essential
- Need for proper inspection-you get what you inspect!

Traffic Control Considerations

- Traffic control for CIR is similar to a mill and fill operation, with much fewer trucks
- Mat can be opened to traffic within a few hours or at the end of the day
- Engineered emulsions allow the mat to be compacted immediately after the paving operation

Pavement Assessment

- What pavement distress is best suited for CIR?
- What types of pavement structures are best suited for CIR?
- What distresses are not suited for CIR?

Pavement Factors to Consider

Factor	Level	CIR applicability
Ride	Poor	Yes
Rutting	> 3/8 inch	Needs further investigation*
Cracking	Longitudinal or transverse	Yes

* **Determine the cause of rutting**

Pavement Factors to Consider

Factor	Level	CIR applicability
Surface condition	Dry or raveled	Yes
Surface condition	Flushing or Bleeding	Needs further consideration*
Potholes	Surface only	Yes, unless they are related to subgrade

***If due to excessive oil, may need to add new aggregate**

Pavement Factors to Consider

Factor	Level	CIR applicability
Stripping in mix	Cohesion or adhesion failures	Needs further consideration*
Skid resistance	Poor	Yes
Drainage	Poor	Needs further consideration**

***Determine extent and depth of problem, possibly use lime, check mix design**
****Poor drainage has to be improved**

Other Factors to Consider

Factor	Level	CIR applicability
Type of facility	Rural	Yes
Type of facility	Urban	Yes*
Snow plow usage	Rural or urban	Yes

*To be discussed more later

Steps for a CIR Project Evaluation

- Conduct a pavement condition survey
- Determine whether the distress is functional or structural
- Conduct field testing to quantify pavement condition and structure
- Perform laboratory testing
- Establish structural or overlay design
- Perform a LCCA

Conduct a Pavement Condition Survey

- Determine the type and extent of distresses
- Use a standard pavement distress manual (e.g. LTPP StreetSaver, or Caltrans)
- Look for potential drainage related distresses

Determine Whether the Distress is Functional or Structural

- Types of distress
  - Functional-ride, surface cracking, raveling, flushing
  - Structural-fatigue cracking or severe rutting
- Identify if possible the possible causes of the distresses
- CIR is the best solution for functional distresses

Defects and Features to Look For

- Edge Support
  - Are shoulders present? If not shoulders, are side slopes to ditches shallow
  - If not to both, problems could occur
- Pavement Width
  - If pavement is to be widened, is there sufficient depth or will new materials be added
- Patches
  - Patches are an indication of subgrade problems

Field Testing

- For functional distresses
  - Take cores to determine the thickness of the hot mix
  - Pavement thickness should be at least the depth of recycling
  - Intact structural section must support the train. This can be measured using a FWD or DCP
- Looking to identify construction and material variations and deficiencies

ARRA Proposed Guidelines for Sampling

Testing	Frequency	Purpose
Pavement thickness	Every ¼ mile	Feasibility and recycling depth
Subgrade soil	1 per mile	Structural design
FWD survey (not always)	Every 300 ft	Determine subgrade strength
Bulk pavement sampling	Represent project conditions	Determine mix designs

Perform Laboratory Tests

- Base and Subgrade (Sometimes)
  - Gradation
  - Strength or modulus
- Asphalt Pavement (Always)
  - Binder properties
  - Mix gradation
  - Mix design to determine type and amount of added emulsion

Establish Structural or Overlay Design

- Use a standard thickness design procedure
  - AASHTO
  - Caltrans
  - Mechanistic
- Recommended equivalency factors
  - G_f = 1.7 vs. 2.0 to 2.5 for HMA
  - a value = 0.3 vs. 0.42 for HMA
  - Stiffness-normally less than HMA

Types of Surfaces Used on CIR

- Low volume Roads
  - Chip seals
  - Slurry surfacings
  - Thin HMA overlay
- Medium to high volume roads
  - HMA overlay
  - Open graded or dense graded

Nevada DOT Design Guide

Traffic index	CIR depth inches	HMA depth, in	Wearing surface
< 6.5	3	none	Chip seal
< 7.5	3	2	Chip seal
< 8.5	3	2.5	Chip seal
< 9.5	3	2.5	Open graded
< 10.5	3	3	Open graded

Perform a LCCA

- Recommended to determine most cost effective treatment
- CIR generally offers the lowest LCC
- Other benefits include energy and emissions savings

Things to Consider in Urban Areas

- Mobilizations-keep them to a minimum
- Mix designs-the more variation in the projects, the more the number of mix designs
- Effective widths- the most effective widths of treatment are 12-17 ft
- Effective lengths-In urban areas, about 1.2 to 1.7 miles can be completed in one shift (3 inch depth)

Things to Consider in Urban Areas (Con't)

- Utilities- need to lower if possible to prevent stops
- Trees-can cause cleanup issues, slow curing, and require trimming
- Petromat or crack seals-slows production rates
- Soft subgrade-not good candidates as the train can punch through

Are These Candidates for CIR?

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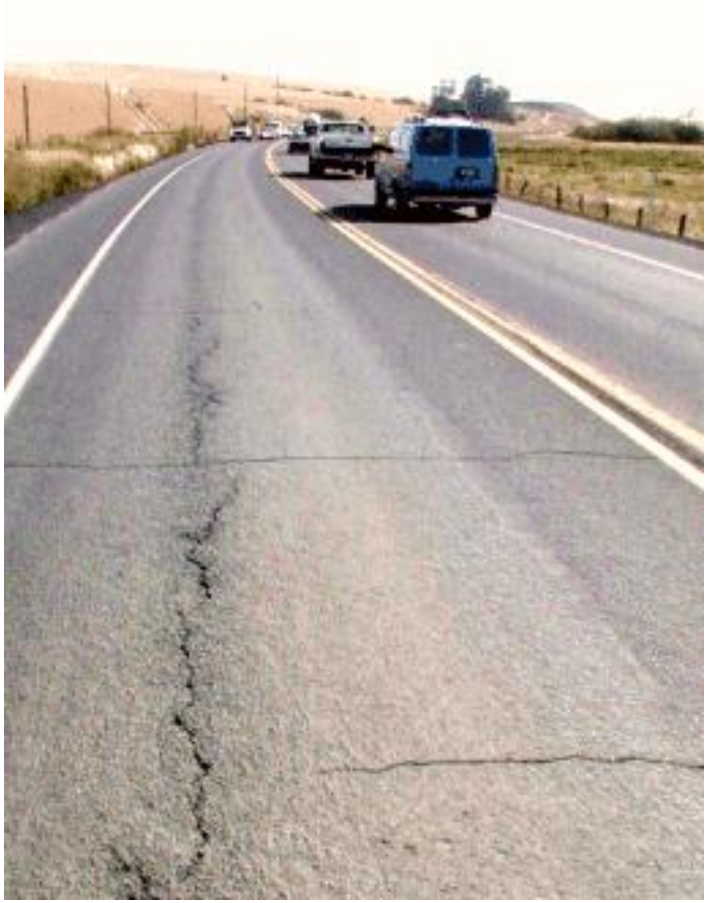

Are These Candidates for CIR?

Summary

- Presented factors to consider in selecting projects for CIR
- Identified the steps used for preliminary engineering
- Discussed the need for mix and thickness design
- Identified the importance of having a knowledgeable contractor and inspection
- Benefits of CIR can be very great

Other Sources of Information

- Basic Asphalt Recycling Manual, ARRA, 2001
- NCHRP Synthesis 421, Transportation Research Board, 2011
- Selection of the Right Project for the Cold In-place Recycling Process, Draft report, ARRA, 2012

Questions

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