Rehabilitation Selection for Asphalt Overlay, Mill and Overlay, Cold In Place Recycling and Full Depth Reclamation

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Outline

- Project Selection
- Overlay
- Mill and Overlay
- Cold In Place Recycling
- Full Depth Reclamation

- Comparisons
Project Selection
Overlay/Mill and Overlay

- Direct Placement or Milling
  - Direct placement when all the following are true:
    - Additional structure is necessary
    - No issues with existing pavement materials
    - No vertical limitations
  - Mill when one or more of the following is true:
    - Adequate structure in existing pavement
    - Problems with existing pavement materials
    - Vertical limitations exist
Project Selection
Overlay/Mill and Overlay

- **Good Candidates** include pavements with:
  - Good subgrade, base and cross-section
  - Adequate strength
  - Where a short term fix is acceptable

- **Poor Candidates** include pavements with:
  - Poor subgrade and/or base support
  - Significant surface distresses
Project Selection
Reclamation

- Mill, haul and recycle at HMA plant
- Cold In-place Recycle (CIR)
- Full Depth Reclamation (FDR)
  - Pulverization
  - Stabilization
Project Selection - Recycling

Why Recycle?

- Improve serviceability of aged, deteriorated pavements
- Reduce raw material costs
- Level deformations & re-establish crowns
- Retain overhead clearances
- Minimize lane closure time, user delays
- Public acceptance of recycling
Cold In-place Recycling (CIR)

What is Cold In-place Recycling?

- CIR is the on-site rehabilitation of asphalt pavements without the application of heat during recycling.
- CIR interrupts the existing crack pattern and produces a crack-free layer for the new wearing course.
Cold In-place Recycling (CIR)  
The Train Machine Concept

Used when the Engineer’s design requires milled material needs to be screened, be of a uniform size and fully mixed in a pugmill.
Cold In-place Recycling (CIR) Applications for CIR

- Good candidates include pavement with:
  - At least 4” of hot mix
  - Adequate base and subgrade
  - Severe pavement distresses

- Poor candidates include pavements with:
  - Inadequate base or subgrade support
  - Inadequate drainage
  - Paving fabrics or inter-layers
Full Depth Reclamation (FDR)
What is FDR?

- The full thickness of the asphalt pavement and a predetermined portion of the base, subbase and/or subgrade is uniformly pulverized and blended to provide a homogeneous material.

- If new material is not a sufficient base for a new surface course, the reclaimed materials are stabilized by mechanical, chemical or bituminous means.
Full Depth Reclamation

- Typically consists of a combination of asphalt and aggregate base
  - Unstabilized
  - Asphalt Emulsion
    - Engineered Emulsion
    - Commodity Emulsion
    - Foamed Asphalt
  - Cement
  - Base One
  - Blends of 2 or more of the above
Full Depth Reclamation (FDR) Keys to Success

Stabilization Considerations

- Emulsion/Foamed Asphalt Stabilization
  - Mill to 3”- material (95% passing 2”)
  - Combination of Asphalt Pavement and Aggregate Base
  - Emulsion addition rate of 3-6% by weight
  - Foamed asphalt addition rate of 2-4%
  - Lower stiffness, higher flexibility
Cement Stabilization

- Mill to 3”- material
- Can incorporate some plastic subgrade soils
- Cement addition rate of 3-8% by weight,
  - Short working time due to hydration
- Specific design for each project
- Higher stiffness, lower flexibility
Full Depth Reclamation (FDR)

Applications for FDR

- Good Candidates include pavements with:
  - Need for upgrading, widening or rehabilitation
  - Bituminous surface on compacted base that:
    - Has sufficient depth to accommodate reclamation process (at least 2" greater than reclamation depth)
      - Exception: Compatible native materials meeting P200 & SE requirements
    - Generally has up to 20% fines (P200)
Full Depth Reclamation (FDR) Applications for FDR

- Good Candidates (Continued):
  - High severity distresses
    - Ruts
    - Base problems
    - Cracks
    - Edge failures
    - Potholes
  - Good drainage or drainage to be corrected
Full Depth Reclamation (FDR)

Applications for FDR

- Poor Candidates include pavements with:
  - Clay-like native soils
    - Exception: can be stabilized with lime/cement
  - Doesn’t meet P200 criteria & can’t or won’t accept added rock
  - Drainage problems
    - Including ditch & regional flooding problems
Project Selection

- FWD testing, coring, soil borings, ground penetrating radar
  - Identify weak areas and whether subgrade or surface need strengthening
  - Pavement Materials problems
  - Pavement Structure Variability
  - Moisture/drainage problems
Pavement Assessment
Pavement Strength Evaluation

- FWD Testing
  - Data used to calculate pavement strength, capacity and remaining life
Pavement Assessment
Pavement Structure Evaluation

- Ground Penetrating Radar (GPR) Data
  - Provides a “picture” of pavement structure
  - Used for FWD Analysis
Pavement Assessment
Pavement Structure Evaluation

Coring Data

- Pavement layers (surface, base and sub-base) are measured, classified and photographed
- Asphalt cores are measured and analyzed for stripping/segregation
- Data used to calibrate GPR data
Pavement Assessment
Surface, Base and Subgrade Analysis

- Soil Borings
  - Base thickness, type or classification
  - Moisture content
  - Subgrade soil type and contamination
Pavement and Materials Assessment
Approximate Costs

- Coring - $100 - $150 each
- Soil / pavement borings ~$150 - $300 (per mile)
- FWD w/ analysis - $150 to $200 (per mile)
- Ground Penetrating Radar - $150 - $200 (per mile)
- 20 Mile Project in MN ~ $12,000 - $18,000

Costs will vary depending on many factors, especially mobilization and traffic control.
Rehab Comparisons

- GE of asphalt overlay – 2.25 per inch
- Mill and overlay
  - Assume a reduction of GE of 1.5 – 2.0 per inch of milling
  - Increase 2.25 per inch of overlay
- CIR/FDR
  - GE of 1.5 – 2.0 depending upon quality of materials stabilized
Costs

- CIR
  - $100 – 120K per centerline mile (4 inches)
- SFDR – Emulsion or Foamed Asphalt
  - $130 – 150K per centerline mile (6 inches)
- SFDR - Cement
  - $65-90K per centerline mile (12 inches)
- Base One
  - $20-$30K per centerline mile (6 inches)
- Asphalt Overlay
  - $45,000 per centerline mile/inch
Questions?