Pavement Recycling: Reusing Your Most Valuable Asset

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Outline

- Full Depth Reclamation (FDR) Project Development
- Full Depth Reclamation Explained
- Cold In-place Recycling (CIR) Project Development
- Cold In-place Recycling Explained
- Project Conclusions
Snap Shot of 2014 Columbus Road Improvement Projects

- Full Depth Reclamation (Central TIF) - $1,419,648.21
- Full Depth Reclamation (Airport TIF) - $256,129.12
- Street Resurfacing Project (includes CIR) - $2,663,824.56
- Concrete Street Repairs - $332,721.00
- Universal Access Ramp Installation - $449,472.98
Original Scope of Work

- Sidewalk (4 scenarios)
- Storm sewer
- Full road reconstruction
- New curb and gutter
Total Reconstruction for International Dr.

- Cost
  - Estimated cost: $1.4 to $1.7 million
- Time Consuming
- Removal
  - Uses completely new material
- Closures

Other Options

- FDR on most of Woodside/Woodside South
- Let’s use material we already own
Unique Set of Challenges

• .... Just like every job does....
FDR Project Development

- 2011 FDR Past Experience
- Norcross Drive
- Woodside Industrial Park
- Good performance
- Cost savings
Industrial Parks

Encouragement from businesses to rebuild roads

Pavements built in the 1970’s

Series of mill and fills and full depth patching

Drainage

NTN, Impact Forge, Toyota Lift
  
   ○ Lots of delivery trucks in and out
FDR Project Development
Project candidacy is critical
  - Sampling of existing pavements
  - Establishes treatment depth
  - Pavement Design

Drainage improvements
  - Underdrains
  - Grading ditches
Reconstruction Estimate:
  - Approximately $4.6 million

Engineer’s Estimate for FDR:
  - $2.246 Million
  - Including underdrains, ditch regrading
  - Variable thickness FDR
  - 3 inch HMA Overlay
  - Stone Shoulders

Winning Bid:
  - $1.43 million
FDR Project Development

- Educate Users
- Pre-Con Meeting
  - Agency
  - Contractor
  - Facilities
- Educate on Process
- Minor Delays
  - Roads still open
What is Asphalt Emulsion?

- **Combination of:**
  - Asphalt
  - Water
  - Surfactants

- **Delivered and mixed at low temperatures**
  - “Cold” Process
  - Workability

- **Chemical Break**
  - Formulated to release water
  - Gains strength upon break
  - Curing
FDR: How Are They Built?
FDR: The Train

- The FDR “Train”
  - Water Truck
  - Emulsion Tanker
  - Reclaimer
  - Pad Foot Roller
  - Motor Grader
  - Finish Roller
FDR: Two Step Process

- Pre-Pulverization
- Injection
FDR: The Reclaimer
FDR: Motor Grader
FDR: Finish Roller
FDR: Wearing Surface
Depth of FDR influenced by...

- Thickness of HMA
  - Get through all the HMA
  - Incorporate Aggregate Base if needed
  - Material to build density against
- Pavement Design
  - SN for bituminous FDR (0.25 to 0.30)
  - FDR must have a wearing surface
- Utilities
- Not compatible with composite pavements
- Streets (Industrial, Urban, Residential, Rural)
- Parking Lots
Good drainage required for system to work as designed

Underdrains effective
  - Woodside Roadways
  - Be careful of cutting depth

Ditches

Curb and gutter
Things to consider

- "Fluff "factor
  - FDR will not compact back to original thickness
- Geometrics
  - Curb and gutter
  - Premilling
- Widening
  - Trenching and spreading
Obtain material from project site
Cores are recommended
Keep mix design material same as project design
Obtain samples of aggregate base
Subgrade testing
FDR: Dynamic Cone Penetrometer

DCP Testing

- Handle
- Upper Stop
- Hammer (8 kg)
- Cone dimensions
- Zero mark
- Cone angle 60°
- Anvil - where rods screw together
- Upper clip - reference point for scale
- Steel rods, Ø 16 mm
- Measuring rod with adjustable scale
- Lower clip

Approx. 1,935 mm

575 mm

3 mm

20 mm

5 mm

CBR Values from DCP

NB 5 ~ 2.0 mi N of Lindenwood

Depth from Surface (in.)

0

5

10

15

20

25

30

35

- CBR < 5
- CBR = 13
- CBR = 100
- HMA
FDR: Layer Characteristics

- Flexible pavement system
  - No shrinkage cracking
  - No reflective cracking

- RAP and Aggregate Base
  - Ideal for emulsion stabilization

- No subgrade
  - No clay pumping into layer
  - Not processing into subgrade
  - No need to get into it
FDR: Mix Design

- Verify suitability of selected materials
- Establishes stabilizing agent to improve engineering properties of recycled materials
- Established type of agent and dosage
- Determine if recycling additives are required
- Initial investigation is critical
Which parameters do we investigate for good performance?

- Moisture-Density Properties
  - Resistance to rutting
- Tensile Strength
  - Resistance to water damage
- Adhesion
  - Resistance to water damage
- Strength Development
  - Rate of Development
Added additional streets
  o FDR better suited than resurfacing
“We need to do something more than patching, milling, and resurfacing...”

Where does patching begin and end?

Minimize reflective cracking in new surface layers
Look at CIR on three streets
  - Marr Rd
  - Kruetzer Dr
  - Mapleton St

Incorporated in Resurfacing Project
  - CIR instead of patching and overlay
  - 1.5” Surface HMA over CIR
Marr Rd

Kruetzzer and Mapleton
Recycle existing HMA

Partial depth
  - 3” – 5”

Cost effective
  - If patching is excessive
  - Or if milling and replacing thicker treatments
CIR Explained

[Image of construction vehicles on a road]
CIR: Recycler
CIR: Paver Laid
CIR: Design Considerations

Things to consider

- "Fluff "factor
- Drainage
- Uses
  - Urban, Residential, Rural Highways
- Geometrics
  - Curb and gutter
  - Premilling
- Adding Structure
  - Add rock or Add RAP
- Widening
  - Trenching and spreading
CIR: Curb and Gutter Applications
Sampling and Investigation Critical
- Crush RAP to Similar Field Gradations
- Similar performance requirements
  - Stability, Adhesion and Cohesion
CIR: Curing & Surfacing
FDR Project Conclusions

- FDR is part of project planning
- Realized cost savings
- Constructability
- Reduced user delays
- Project performance
CIR Project Conclusions

Kruetzer Dr

Mapleton St.
Project Conclusions

- Technology Looks Promising
- Upfront assessment is key
  - Drainage issues
- Things to do differently
  - Stone shoulders
- Reusing material makes sense
Conclusions

- Continue to maintain roads same way leads to same performance
- Need to find ways to reduce cost
  - Reuse material we already own
- Other technologies important to consider
  - New to us, but not to others
- Environmental Benefits
  - Less demand for virgin materials
Thank you!

Questions or Comments?