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
FDR Project Development

Original Scope of Work

- Sidewalk (4 scenarios)
- Storm sewer
- Full road reconstruction
- New curb and gutter
FDR Project Development

- 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
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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
FDR Explained
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

- Water Truck
- Emulsion Tanker
- Reclaimer
- Pad Foot Roller
- Motor Grader
- Finish Roller

The FDR “Train”
FDR: Two Step Process

- Pre-Pulverization
- Injection
FDR: The Reclaimer
FDR: Padfoot Roller
FDR: Finish Roller
FDR: Completed Base
FDR: Wearing Surface
FDR: Design Considerations

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
FDR: Drainage Considerations

- 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

Depth from Surface (in.)

CBR Values from DCP

CBR < 5
CBR = 13
CBR = 100
HMA

NB 5 ~2.0 mi N of Lindenwood
Flexible pavement system
  o No shrinkage cracking
  o No reflective cracking

RAP and Aggregate Base
  o Ideal for emulsion stabilization

No subgrade
  o No clay pumping into layer
  o Not processing into subgrade
  o 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
- Tensile Strength
  - Resistance to rutting
- Adhesion
  - Resistance to water damage
- Strength Development
  - Rate of Development
Added additional streets
  - 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
CIR Project Development

Marr Rd

Kruetzer and Mapleton
Recycle existing HMA

Partial depth
- 3” – 5”

Cost effective
- If patching is excessive
- Or if milling and replacing thicker treatments
CIR: Recycler
CIR: Paver Laid
CIR: Rollers
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
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
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?