Full Depth Reclamation (SFDR)
Keys to Success

- Pavement & material assessment
- Engineered mix design
  - Choose correct additive for the application
- Performance-related specifications
- Construction guidelines & QC specs
Full Depth Reclamation (FDR) Keys to Success

Engineered Mix Design

Superpave Gyratory Compactor

Cohesiometer

Lab Mixer
Engineered Mix Design

- Virgin aggregate or RAP may be needed
  - To increase depth of finished structural layer
  - To improve gradation
    - Cleanliness (P200)
    - Material quality
    - Grading

Add rock
Stabilization Options

- Cutbacks/Roadmix
- Proprietary Products
- Engineered Emulsion
- Lime/chlorides
- Foamed Asphalt
- Flyash/Cement
- Combinations of above
Full Depth Reclamation (SFDR) Keys to Success

Stabilization Considerations

Prone to Rutting

Prone to Cracking

Surface

Flexible

Stiff

Granular A

Organic Clay B

Subbase

LRRB Pavement Rehabilitation Selection
Full Depth Reclamation (SFDR) Keys to Success

Stabilization Considerations

- Cutbacks or Road Mix
- Proprietary Products
- Engineered Emulsion
- Foam Asphalt or Lime
- Fly Ash or Cement

Prone to Rutting: Flexible
Prone to Cracking: Stiff
Granular: Organic Clay

LRRB Pavement Rehabilitation Selection
Stabilization Considerations

- Engineered Emulsion Technology is formulated for:
  - High asphalt content
  - Good dispersion with higher film thickness
  - Durable
  - Flexible
  - Climate-specific binder
  - Formulated for each project
Stabilization Considerations

- **Fly Ash or Cement Stabilization**
  - Mill to 3”- material
  - Can incorporate some plastic subgrade soils
  - Cement addition rate of 2-4% by weight, fly ash addition rate of 6-10% by weight
  - Short working time due to hydration
  - Specific design for each project
  - Higher stiffness, lower flexibility
## Performance-Related Specification Guidelines

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<th>Performance Parameter</th>
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<td><strong>Short Term Strength by Cohesiometer</strong></td>
<td>ASTM D1560</td>
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<td><strong>Retained Strength</strong></td>
<td>ASTM D4867</td>
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<td><strong>Resilient Modulus</strong></td>
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<td><strong>Indirect Tensile Test (IDT)</strong></td>
<td>AASHTO T 322</td>
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<td><strong>Construction &amp; QA/QC Requirements</strong></td>
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Tests run on 150-mm SGC prepared specimens

Full Depth Reclamation (SFDR)  
Keys to Success
Full Depth Reclamation (SFDR)
Keys to Success

Construction and Quality Control

• **Equipment**
  – Reclaimer
  – Padfoot compactor
  – Motor grader
  – Water truck
  – Finishing Rollers
Construction and Quality Control - Reclaimer

• Typically used in FDR construction

• Typical properties:
  – Center mount cutter
  – 8- or 10-ft wide
  – Accurate emulsion addition
  – Emulsion added to enclosed mixing drum
  – Cement or fly ash added after first pass of reclaimer
  – Road is usually reclaimed a third at a time
Full Depth Reclamation (SFDR) Keys to Success

Construction and Quality Control - Padfoot Compactor

- Best for achieving compaction at bottom of layer
- High amplitude/ low frequency
- Back drag blade preferred
- Examples:
  - CAT CP 563C or 563D (rounded pads)
  - Hamm and Hypac
  - SuperPac (34,000 lb)
  - Hyster (28,000 lb)
Full Depth Reclamation (FDR) Keys to Success

Construction and Quality Control - Motor Grader
Construction and Quality Control - Water Truck

- Many varieties / homemade
- Ability to apply a uniform spray over the width of road
- Adjust initial moisture content, if needed
- Aids in final compaction and appearance
Full Depth Reclamation (SFDR)  Keys to Success

Construction and Quality Control - Finishing Rollers

- Achieve surface compaction & final appearance
- Pneumatic roller
  - 20-ton minimum
  - 90 psi tire pressure
- Vibratory steel roller
  - 10-ton minimum
  - low amplitude/ high frequency
Construction and Quality Control

- **Field Testing**
  - Specific tests & testing frequency determined by agency & road requirements
    - Water content
    - Depth
    - Top size
    - Additive content
    - Compaction
    - Modified Proctor for target density
    - Traffic return
Construction and Quality Control

- Corrective actions
  - Sub-cut & replace weak spots
  - Fix drainage
  - Fix thickness deficiency
    - Add rock
  - Widen
- Cut out soil
Full Depth Reclamation (SFDR)

Keys to Success

Construction and Quality Control

• Surfacing
  – To support needs of road
  – Structural
    • Traffic
    • Load levels
  – Climate
  – Chip seal at a minimum

Chip Seal

HMA Overlay

Concrete Overlay
Full Depth Reclamation (SFDR)
FDR Expectations

• Site Assessment Critical
  – Can’t fix poor subgrades
  – If pre-construction assessment not done (borings, FWD, etc.), problems should be addressed during construction

• Amount of fines must be manageable
  – If surface or gravel base too thin, may have too many fines unless sufficient additional rock can be added
Full Depth Reclamation (SFDR)
FDR Expectations

• Construction start-up expectation
  – Additives shouldn’t be added until moisture content is corrected, most notably
    • On all-gravel roads
    • In heavy rainfall or high water table areas

• Account for variability in road
  – Sufficient sampling & testing
  – Adjust as necessary during construction
Full Depth Reclamation (SFDR)
FDR Expectations

• May require multiple reclaimer passes
  – For adequate sizing
  – For emulsion dispersion (high fines)
  – For moisture management

• Manage time to compaction when using additives
  – Too soon, soft areas
  – Too late, raveling
Full Depth Reclamation (SFDR)
FDR Expectations

- Traffic control
  - Road may need to be closed during working day
    - Requires working full width of road
  - During construction, local traffic may need access to road if the full road width is being processed
  - During construction, constructing one lane at a time will require a pilot vehicle or an extra lane
Full Depth Reclamation (SFDR) Applications for SFDR

- 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 (SFDR)
Applications for SFDR

• Good Candidates (Continued):
  – High severity distresses
    • Ruts
    • Base problems
    • Cracks
    • Edge failures
    • Potholes
  – Good drainage or drainage to be corrected
Full Depth Reclamation (SFDR) Applications for SFDR

• Poor Candidates include pavements with:
  – Clay-like native soils
    • Exception - can be stabilized with fly ash or cement
  – Doesn’t meet P200 criteria & can’t or won’t accept added rock
  – Drainage problems
    • Including ditch & regional flooding problems
Full Depth Reclamation (SFDR) Summary

• Builds structure down into pavement
  – Site assessment, sampling & mix design key to success
  – Performance-related design tests & specs improve reliability & performance
    • Early Strength
    • Cured Strength
    • Cracking Resistance
    • Moisture Resistance
    • QA / QC
CIR and SFDR Considerations:

- What is the depth of my existing pavement?
  - CIR is best for pavements at least 5” thick
  - FDR / SFDR is for any depth

- Is the pavement thickness consistent or variable?
  - FDR is better for variable thickness pavements
CIR and SFDR Considerations (Continued):

• What is the condition and strength of the pavement base and subbase?
  – CIR requires base support for the heavy train equipment
  – FDR/SFDR will break up cracking patterns in the base

• What is the required ease of construction?
  – CIR is all done at once
  – SFDR has greater difficulty in getting material placed
CIR and SFDR Differences

For CIR processes a mobile screen deck and pugmill are used to process aggregate and incorporate emulsions, foamed asphalt and/or other liquids or solids.
Cold Central Plant Recycling (CCPR)

- Stockpile RAP (QC very important)
- Crush RAP (Fractionation)
- Mix with Binder (Formulated for project)
- Transport to Project (Handling Time)
- PAVE (Bound recycled mix)
- Compact to specified density
- Apply Surface Treatment or Overlay