Full Depth Reclamation (FDR)
What is Full Depth Reclamation?

- A process which pulverizes the existing pavement materials and mixes a specified depth of underlying materials to create a new subbase.
- Typical depth of 6 to 8 inches.
- Recycling method where all of the asphalt pavement section and a predetermined amount of underlying materials are treated to produce a stabilized base course.
Features & Benefits

- Pulverizes all asphalt failures.
- Incorporates underlying material in mix.
- Additive equipment delivers the product directly onto reclaimed area.
- Reclaimers are by-directional.
- Reclaimers are four wheel drive vehicles.
- Single lane closures can be achieved
- Reclaimed materials add years of longevity to your new roadway
Equipment

- Reclaimers
- Additive delivery trucks & trailers, liquid and dry.
- Compaction equipment.
- Graders
- Water truck.
- On site storage capability for additives.
Materials

- Hydrated Lime or Quicklime.
- Portland Cement.
- Fly Ash Class “C” or “F”.
- Emulsified or Foamed asphalt
- Calcium Chloride
- Cal-Cement
- Kiln Dust. Lime(LKD), Cement(CKD).
Road Preparation for Full Depth Reclaiming

- View roadway project
- Take cores that represent the full depth of the intended pavement.
- Have laboratory analyze material and give recommendation on new additive.
- Check roadway with metal detector for hidden utilities.
Where to apply Full Depth Reclaiming

- Secondary roads
- Local roads
- New developments both residential and industrial.
- Old developments both residential and industrial.
- Parking areas, schools, shopping mall etc.
- Airport taxiways
FDR Operation

- Pulverization
- Mixing
- Compaction
- Fine grading
- Final compaction
- Application of asphalt base course
Microprocessor-controlled pump for injecting bitumen emulsion

Hose connection to the emulsion tanker

Hose connection to the slurry mixer

Microprocessor-controlled pump of the WM 400 for injecting the slurry of cement and water

Recycled Material Pavement

Milling and Mixing Drum

Existing Pavement

Cutting Head
Compaction is **Critical!!**

Typical Compaction Sequence

- **Initial (breakdown)**
  - Single drum vibratory pad-foot Compactor

- **Intermediate**
  - 25-30 ton rubber tire roller or smooth single or double drum vibratory compactor

- **Finish**
  - Single or double drum roller operating in static mode
Types of Full Depth Reclamation

- Mechanical stabilization
- Bituminous stabilization
- Chemical stabilization
Mechanical Stabilization

- Utilize pulverized asphalt pavement as an aggregate sub base.
- Add aggregate (AASHTO # 3, 57, or 67) and mix to create a stronger sub base.
Mechanical Stabilization

Involves the incorporation of imported granular materials

- Crushed virgin aggregate
  -- coarse to fine in gradation
- Asphalt pavement millings (RAP)
- Crushed concrete (RPC)

Can be performed with a single pass or with multiple passes
Types of Bituminous Stabilization

- Asphalt emulsion
- Foamed or expanded asphalt
Bituminous Stabilization

Bituminous stabilizing additives can be blended into the reclaimed material through the integrated liquid additive injection system on the reclaimer.

CSS-1h is one of the more commonly used asphalt emulsion.
Chemical Stabilization

- Lime
- Portland Cement
- Fly Ash
- Calcium Chloride
- Cal-cement
- Kiln Dust
Chemical stabilization involves the use of dry and wet chemical additives. Some of those additives are Lime, Portland Cement, Fly Ash, Calcium Chloride.
1.) Pulverize the existing pavement and underlying layers while simultaneously adding and mixing various stabilizing additives, if any
2.) Fine grade and compact the mixed pulverized base material.
3.) Fog seal or prime the soil stabilized base, as required.
4.) Apply the specified surface treatment
Structural Coefficients
Per inch in depth

- Dry pulverization 0.11 per inch
- Bituminous stabilized base 0.20 per inch
- Cement stabilized base 0.25 per inch

- Comparisons to other base courses:
  - Asphalt binder 0.40 per inch
  - Cold-in-place asphalt recycling 0.35 per inch
Stone Mountain Road. Wayne Township, Schuylkill County. PA
Existing Conditions
Weak Thin Shoulders
6% Cross Slope
Aggregate and RAP added
Change in elevation. Aggregate and RAP added
Pulverize RAP, asphalt and soil
Pulverization
Pneumatic tire rollers compact FDR
Finish rolling with steel drum roller
Gradation of material
Full width paving.  ID-3 overlay
ID-3 overlay compaction
Completed Project
Caln Township, Chester County. PA

Bituminous Stabilization 1999
Full depth reclaiming between curbs and cul-de-sac’s
Curb line pre-milled with small mill
Material along curb is graded into cart way
Curb line material graded onto pavement
Larger material incorporated into mix through FDR reclamer
Cul-de-sac after FDR
Hillsborough County
Florida

Lime Stabilization
Using
Liquid Lime Slurry
Existing conditions

6000 ADT ------ 50% trucks
Sequence of Operation

- Pulverize 16 inches, windrow 8 inches.
- Prepare & grade surface for lime.
- Apply lime slurry to bottom 8 inches.
- Mix, rough grade & compact.
- Apply lime slurry to top 8 inches.
- Fold over windrow pulverize material.
- Grade and compact.
- Fine grade & compact.
- Apply wearing surface.
Pulverize pavement
Slurry application unit
Lime slurry application
Mixing lime slurry & road materials
8” stabilized depth complete
Slurry tanker application
Mix lime slurry & grade
Compacting lime treated material
Pad foot roller compaction pattern
Fine grading lime treated soil
Compaction using pad foot roller
Stabilized base before prime coat
Benefits

1.) Completely erases deep pavement crack patterns, thereby eliminating the potential of reflective cracking.

2.) FDR can be utilized to depths exceeding 12”. (6” to 9” typical)

3.) Pulverized layers along with stabilizing additives (if any) become a homogenous, well graded (2”/50mm minus) material with improved structural characteristics
Benefits

4.) With proper design and process selection cross-slope and/or profile grade adjustments and corrections can be made.

5.) If widening of the roadway is necessary it can be incorporated easily into the design.
Overview

Time + Traffic = Deterioration
Overlay or Mill & Fill
= Extended Service Life
Eventually, costly major repairs or total reconstruction needed
Alternative =
Full depth reclaiming
FDR
THANK YOU

❖ E.J. Breneman LP.
1117 Snyder Road
West Lawn, PA 19609

❖ Phone: 610-678-1913 or 610-636-0121
❖ e-mail: mpolak@ejbreneman.com
❖ web site: www.ejbreneman.com