

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 sub base.
- ❖ 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

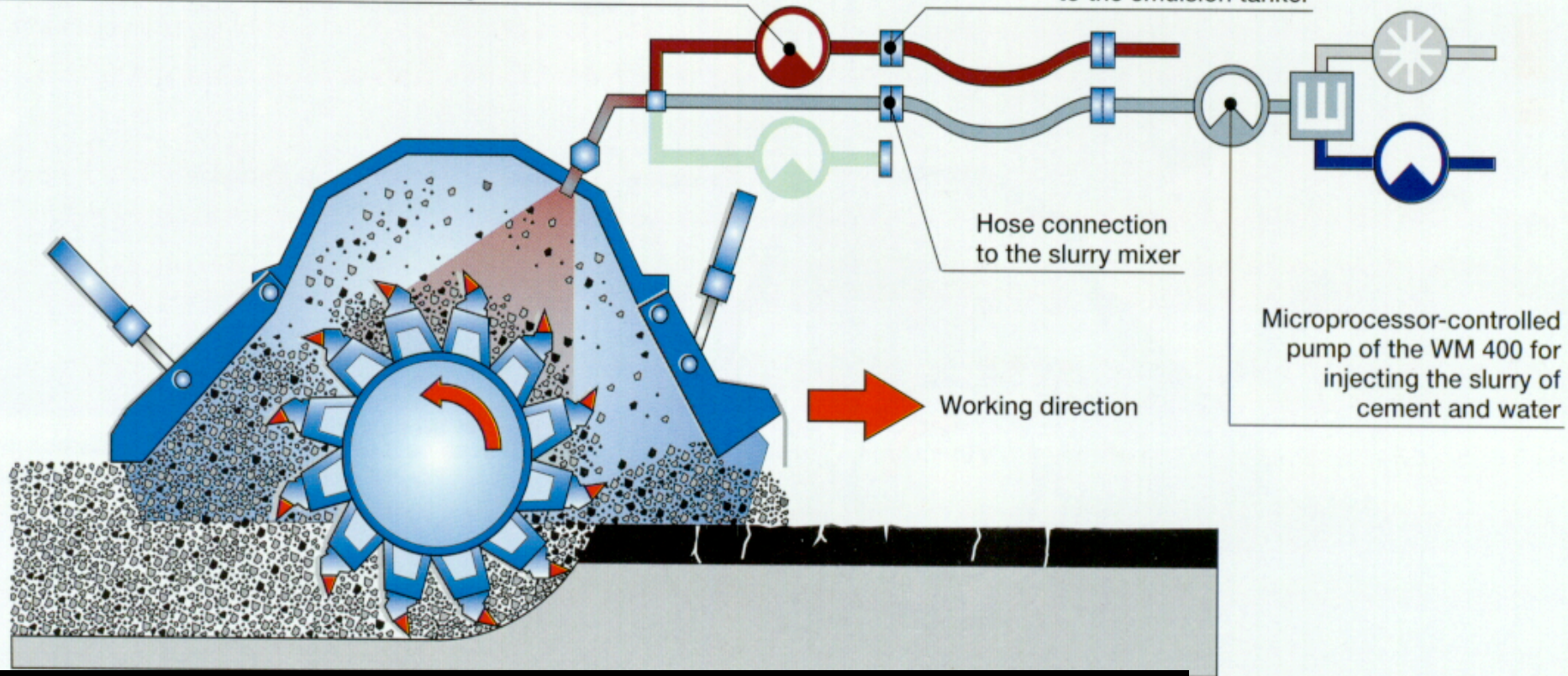
- ❖ Secondary roads
- ❖ Local roads
- ❖ New developments both residential and industrial.
- ❖ Old developments both residential and industrial.
- ❖ Parking areas, schools, shopping mall etc.
- ❖ Airport taxiways

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

Working direction

Recycled Material
Pavement

Milling
and Mixing Drum

Existing

Cutting Head

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

Chemical stabilization involves the use of dry and wet chemical additives. Some of those additives. Lime, Portland Cement, Fly Ash, Calcium Chloride.



Single Pass Reclamation

- 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 reclaimer**



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

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