

Puerto Rico

Pavement Preservation Conference  
and  
Technology Implementation

# Full Depth Reclaiming and Soil Stabilization

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# 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 12 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.

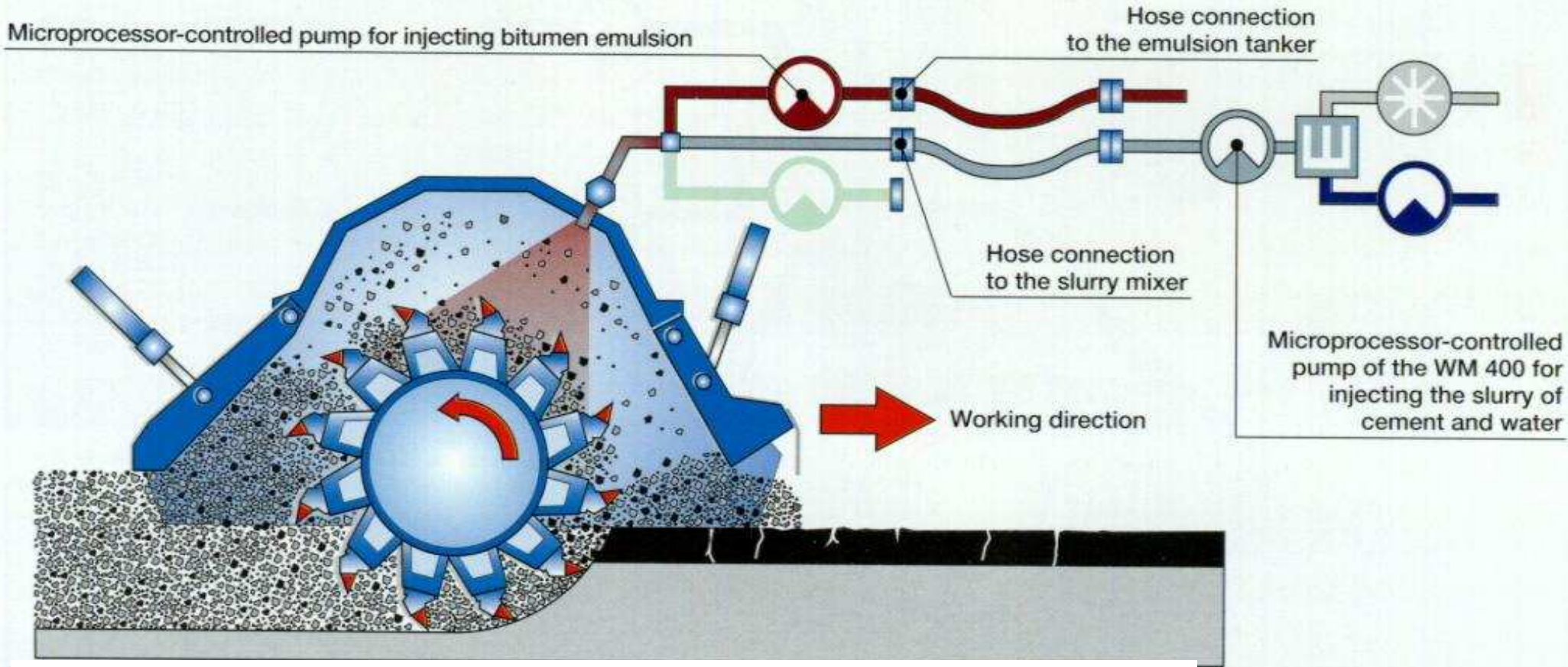


# Where to apply Full Depth Reclaiming

- ❖ 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



Recycled Material    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  
rollers or with  
compactors



# 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



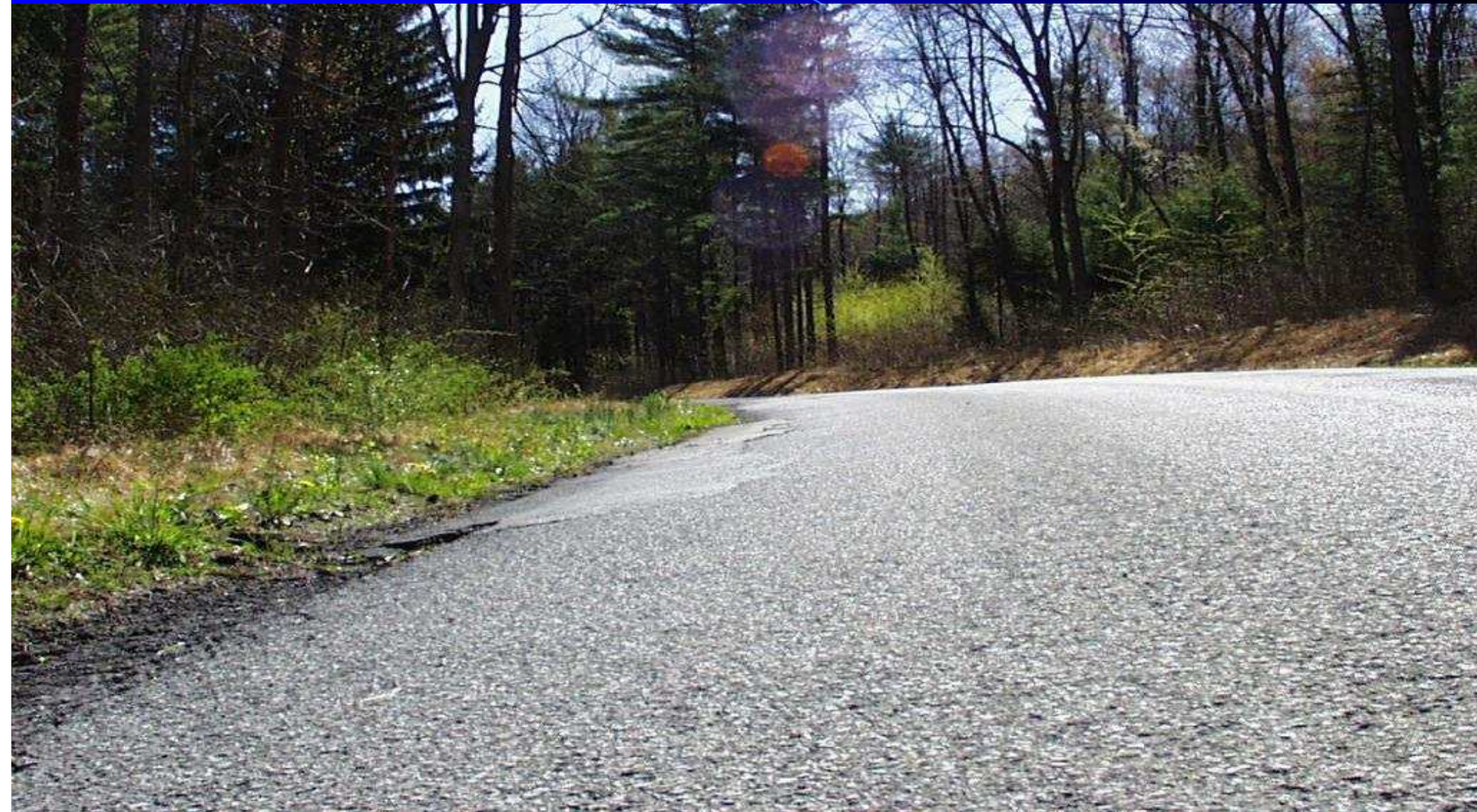


# Weak Thin Shoulders





# 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





# 19mm super pave hot mix asphalt 3" inches





# Completed Project

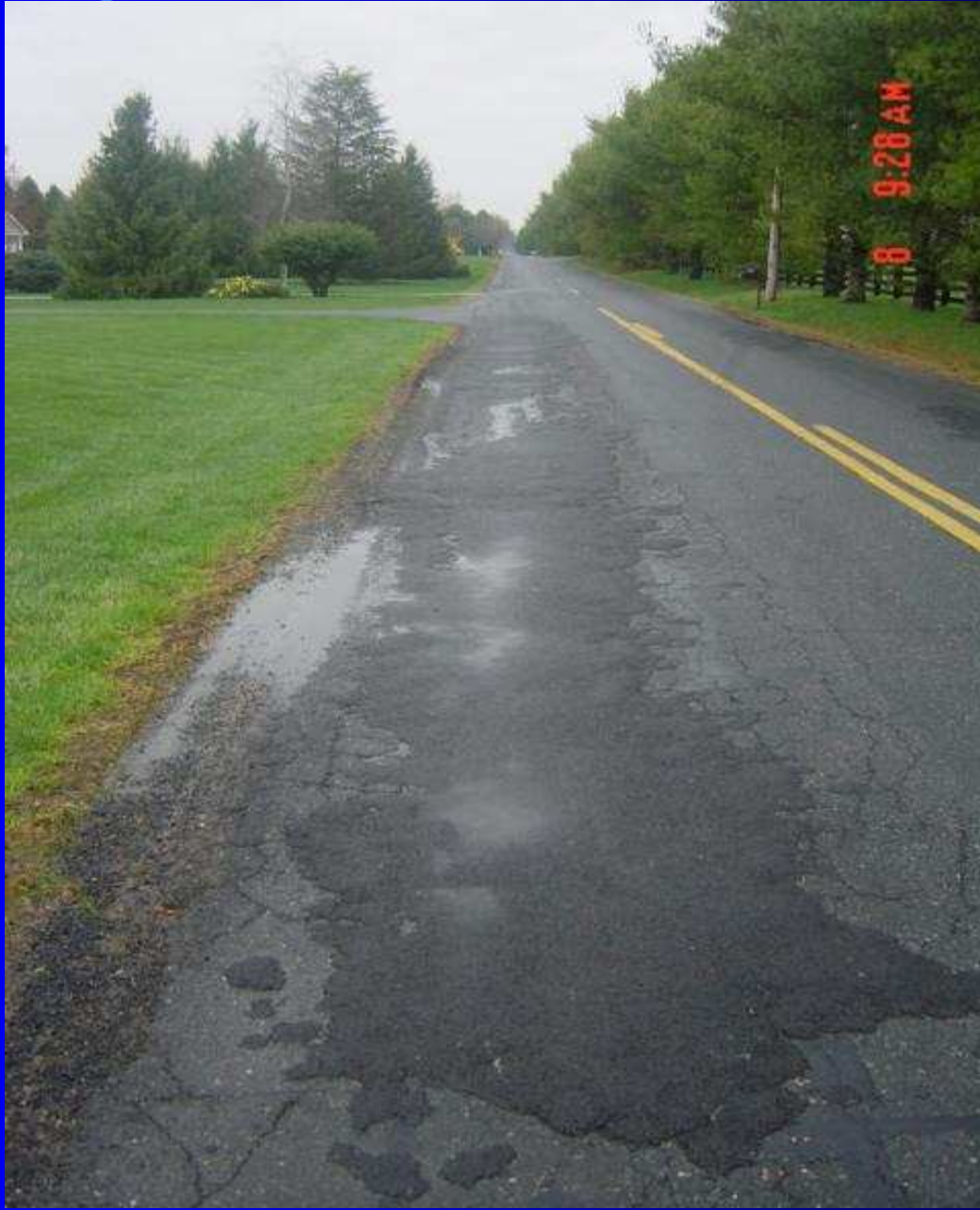










































# Hillsborough County Florida

**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





**16" 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**



# Delaware Department of Transportation

Church Road, Suffolk County



































# Benefits

- 1.) Completely erases deep pavement crack patterns, thereby eliminating the potential of reflective cracking.**
- 2.) FDR can be utilized to depths exceeding 16”.**
- 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
- 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  
repairs or total reconstruction  
needed**

**Alternative =**

**Full depth reclaiming**

**FDR**





# THANK YOU

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