

Full Depth Reclamation:
*A Cost-Effective and
Environmentally-Friendly
Alternative*

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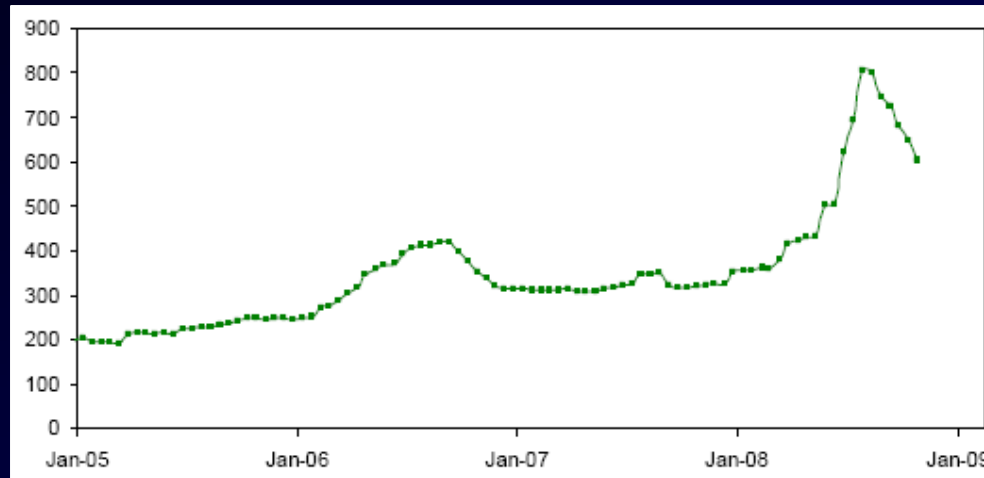
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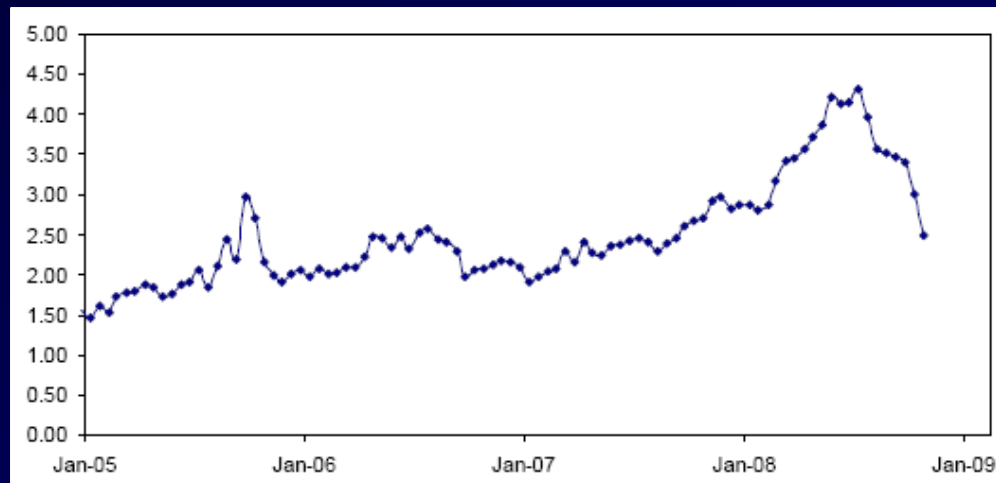
Road Rehabilitation

- Inadequate transportation infrastructure
 - Population increase and new developments
 - Increase in traffic loading
 - Deteriorating roads
- Under funded state and county municipalities
- Inflation of construction costs.

Inflation



Inflation of PG64-22 Liquid Asphalt Binder



Inflation of Diesel Fuel

The Solution: FDR

- Lowers construction costs
 - Quick construction
 - Less use of fuel and asphalt binder
- Conserves natural resources
 - Recycles of existing materials
- Reduces emissions
 - Uses fewer trucks

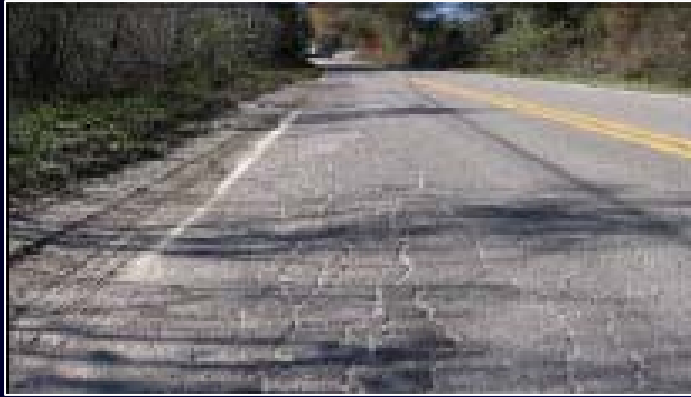
Full Depth Reclamation (FDR)

- Process
- Advantages
- Environmental Effects
- Case Studies

The FDR Process

- Pre-Construction:
 - Road assessment
 - Mix design
- Construction:
 - Pulverization and gradation
 - Application of admixture and water
 - Compaction, Shaping, and Grading
 - Surface treatment

Road Assessment: Common Failure Modes



Fatigue Cracking



Rutting



Shoving

Mix Design

- AASHTO Guide for Design of Pavement Structures
- State and local DOT Specifications
- Portland Cement Association (PCA)
- 7-day strength of 300 - 400 psi.

Pulverization

- Existing pavement and underlying materials are crushed and blended together.
- Done using a reclaimer
- Gradation, moisture content, and amount of additives are controlled.

Pulverization



Admixtures

- Portland cement
 - Good early strength and moisture resistant
- Calcium chloride
 - Used to prevent cracking from frost-heaving
- Hydrated lime
 - Used with fine in-situ soils
- Emulsions
 - Prevents fatigue cracking

Portland Cement Application



Water Application

- Used to achieve a specified moisture content
- Added in mixing chamber or spread with a water truck

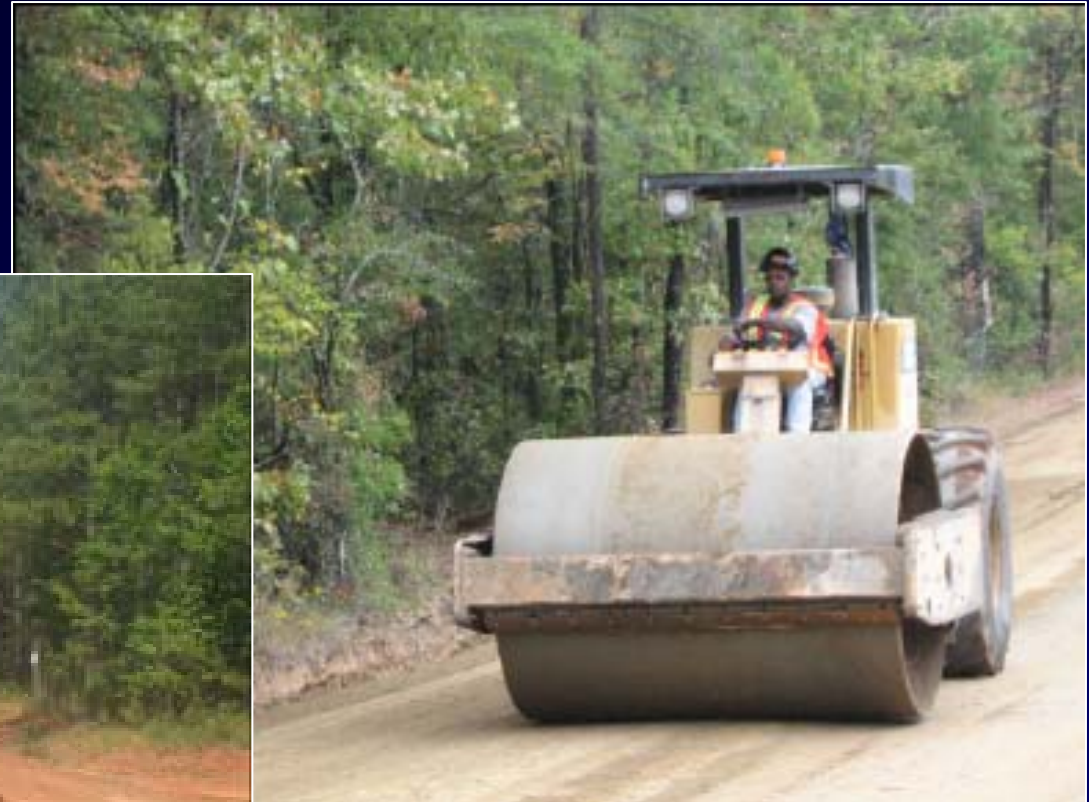
Water Application



Compaction, Grading, and Shaping

- Typically compaction to minimum of 96% of max. density
- Grading and Shaping done with a motor-grader

Compaction



Grading and Shaping



Sealant and Surface Course

- Sealant
 - Resists moisture
 - Bonds reclaimed base to surface course
- Surface application
 - Hot-Mix Asphalt (HMA)
 - Interstates
 - Concrete
 - Airports and Interstates
 - Bituminous Chip Seal
 - County and Secondary Roads

Chip Seal Application



Advantages to Using FDR

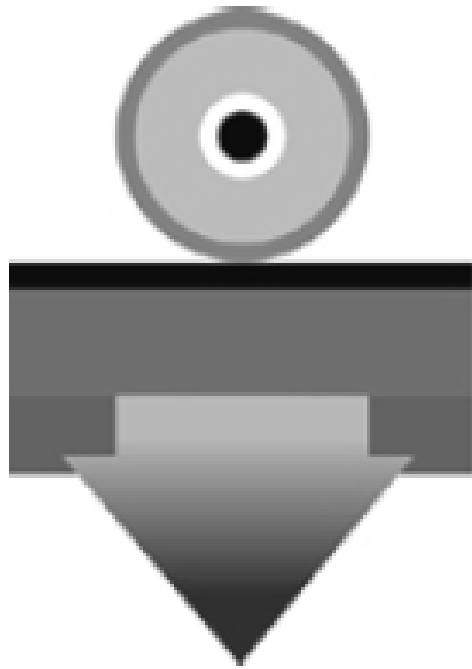
(Compared to Conventional Road Rehabilitation)

- Superior to mill-and-overlay technique
 - Most road failures come from weak subgrade materials.
 - Eliminates weak spots in soil by creating a stronger road base
- Better than total reconstruction
 - No need to haul away construction debris or bring in new material
 - Not nearly as expensive

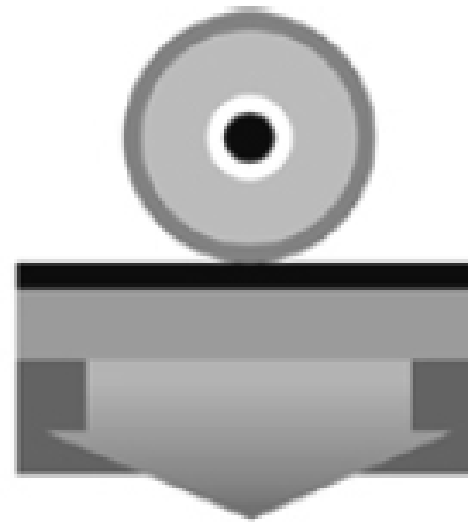
Advantages to Using FDR

- Resistance to freeze-thaw effects
 - Acts as a continuous slab
- Distribution of traffic loading
 - Results in smaller deflection
 - Reduces stress on the pavement surface and subgrade soil
 - Prolongs life of the roadway
 - Allows for a thinner asphalt overlay

Load Distribution



Unstabilized Granular Base



Cement-Stabilized Base

Comparison of Core Samples



4" Asphalt

6" FDR Road

Advantages to Using FDR

- Construction cost reduction
 - Existing materials recycled
 - Short time for construction
 - Fewer trucks needed
 - Less fuel used

Asphalt vs. FDR

Assume 1 mile road with a 20 foot roadway.

Length	5280	LF
Width	20	LF

Asphalt Roadway

Item	Units	Quantity	Price	Extended Price
Hot Mix Asphalt Surface Type D (1.5" Depth)	SY	11733	\$13.00	\$152,533
Graded Aggregate Base Course (6" Depth)	SY	11733	\$9.00	\$105,600
			Total	\$258,133 per mile

Roadway Reclamation

Item	Units	Quantity	Price	Extended Price
Double Treatment	SY	11733	\$2.75	\$32,267
Single Treatment	SY	11733	\$1.75	\$20,533
6" Cement Stabilized Base Course	SY	11733	\$5.25	\$61,600
			Total	\$114,400 per mile

Cost Savings of \$143,733 per mile

Average Cement Price per Ton	\$150
Average Asphalt Cement Price per Ton	\$800

Environmental Effects

- Recycles in-situ materials
- Reduces greenhouse gas emissions
- Cuts back on fuel use

Reuse of In-situ Materials

- 100% of the existing road reclaimed
 - Reduces the use of virgin materials
- No need for material to be hauled away
 - Lessens strain on landfills
- Conservation and reuse of asphalt binder
 - Reclaimed asphalt pavement (RAP)
 - Savings on heating costs

Reduced Fuel Usage

- Less traffic delay or detours
 - No emissions from idling cars
 - An average idling car emits 1.19 pounds of CO₂ per hour!
- Fewer trucks needed for construction
 - Typically from 180 trucks to just 12
 - From 3000 to just 500 gallons of diesel fuel
 - 83% reduction in CO₂ and N₂O
 - One gallon of diesel fuel produces about 22.2 pounds of CO₂ (EPA)

Reduction of 2500 gallons of fuel equates to about 27.5 TONS LESS of CO₂ per mile of roadway!

Global Applicability

- No specialized equipment or materials
- Quick and easy to design and implement
- Not limited to particular climate
- Lower construction cost

Case Study: Fairfield County, SC

- Low-income, rural county
- County roads mostly dirt or gravel
- Not enough money for road repair
- FDR is chosen for a road rehabilitation program.
- Design by Dennis Corporation of Columbia, SC

Fairfield County Road Improvement Program

- Prior to 2005, county was paving an average of 2 miles per year.
- Using FDR in 2006, 2007, and 2008, the county has been able to pave about 35 miles of road.
- Since 2005, the price of asphalt has risen almost 180%.

Conclusion

- A stronger, longer-lasting road base
- Conservation of fuel and natural resources
- Reduction of greenhouse gas emissions
- Lower cost of construction
- Global application

Questions?