

Cement Stabilization

The application of cement into soil, that results in **permanent** physical and chemical alterations. Physical properties, such as strength and bearing capacity are enhanced, while expansivity and plasticity are reduced; thus creating more stable and suitable conditions for design and construction of pavement and building foundations.

Design Considerations

- Time and Cost Considerations
 - Cost of import / export
 - Cost of geotextile reinforcement
 - Contractor time and equipment costs
 - Availability and cost of specific admixtures





Roadway Stabilization







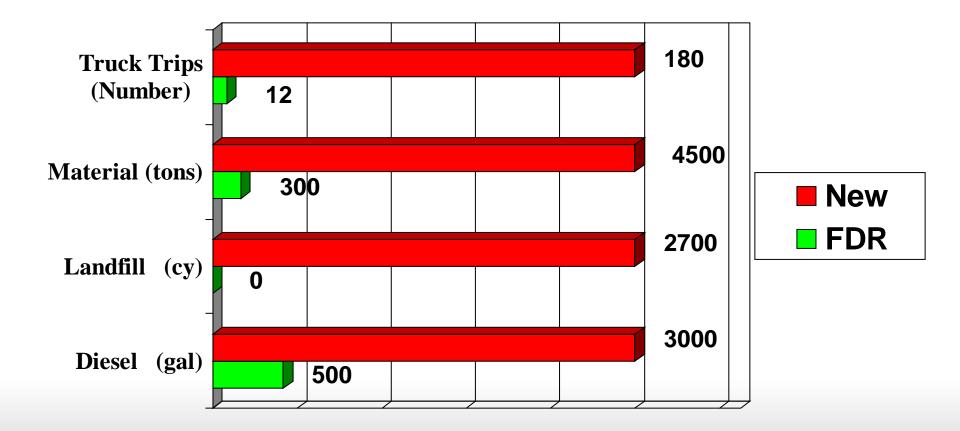


Reclamation Costs

ltem	Reclaim	Remove/Replace
Cement	\$0.72 to \$2.21	
Aggregate		\$1.52 to \$4.57
Processing	\$1.00 to \$2.50	\$0.75 to \$2.00
Haul		\$0.76 to \$1.96
Landfill		\$0.61 to \$19.90
Total	\$1.72 to \$4.71	\$3.64 to \$28.43

Note: Costs are stated in U.S. dollars per square yard

Reclamation -vs- New Base



1 Mile of 24'-wide, 2-lane road with a 6-inch base

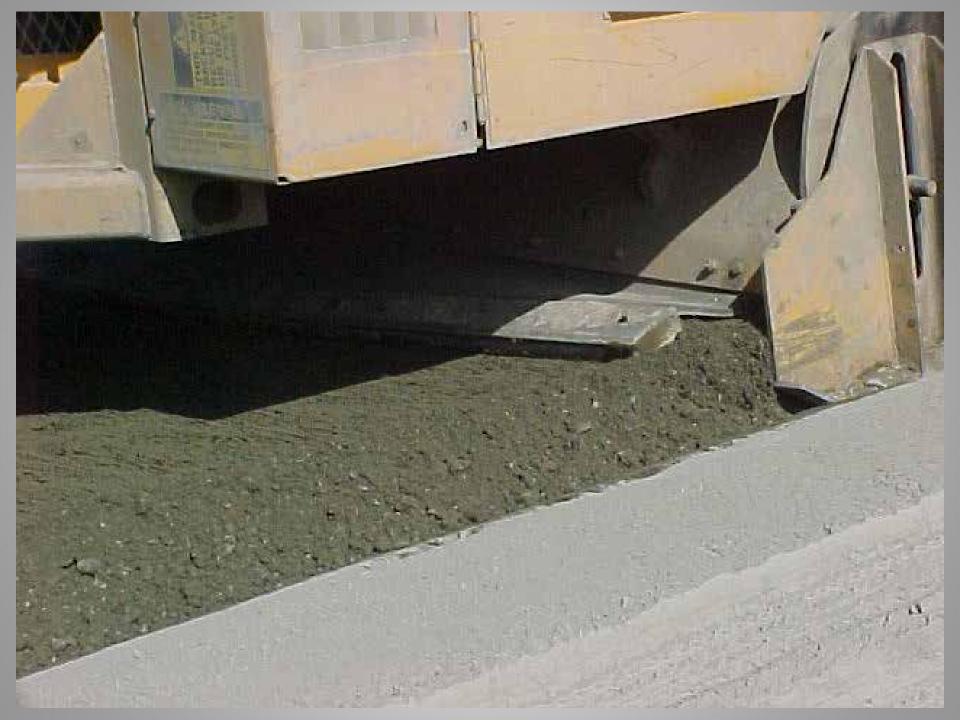
History

- Cement used in soils since the early part of this century
- First engineered use in South Carolina, on State Route 41 in 1935
- Joint research with South Carolina Highway Department and PCA
- Attempt to optimize both cement and moisture contents
- Systematized construction procedures
- Over 70 years of successful pavements across the United States and Canada







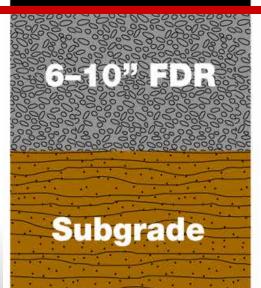


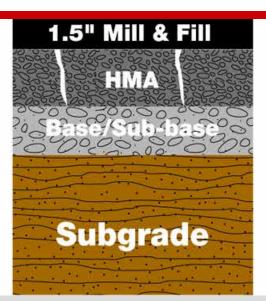
Retards Reflective Cracking

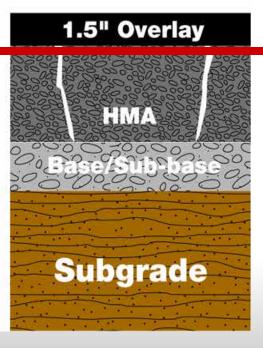
Mill & Fill

Full Depth Reclamation

Surface Course

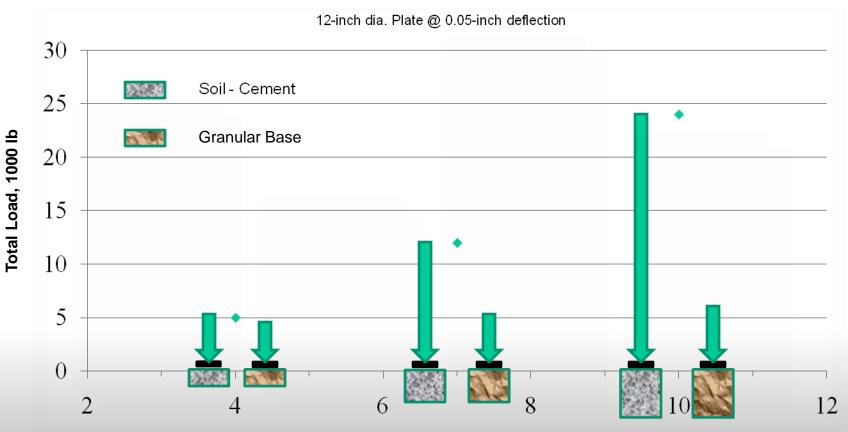




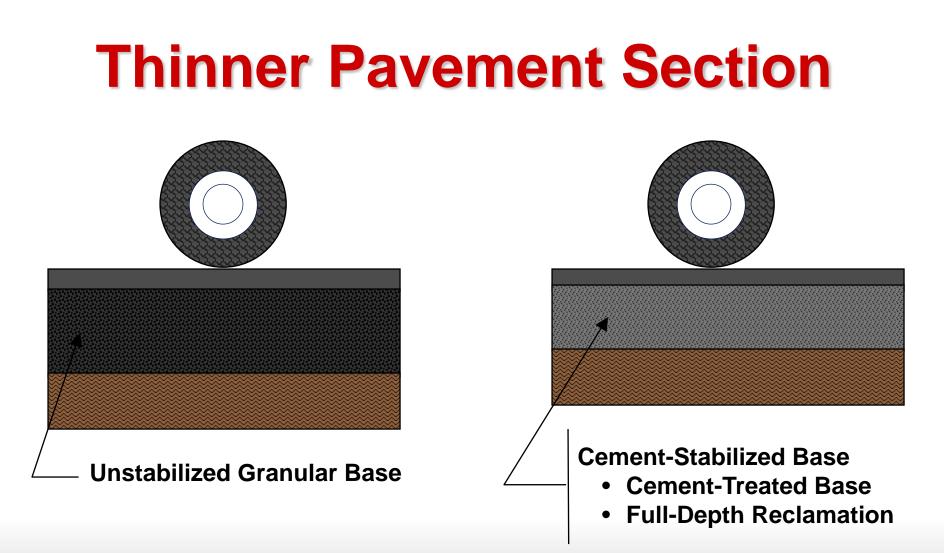


Overlay

Load-carrying capacity of soil-cement and granular base.

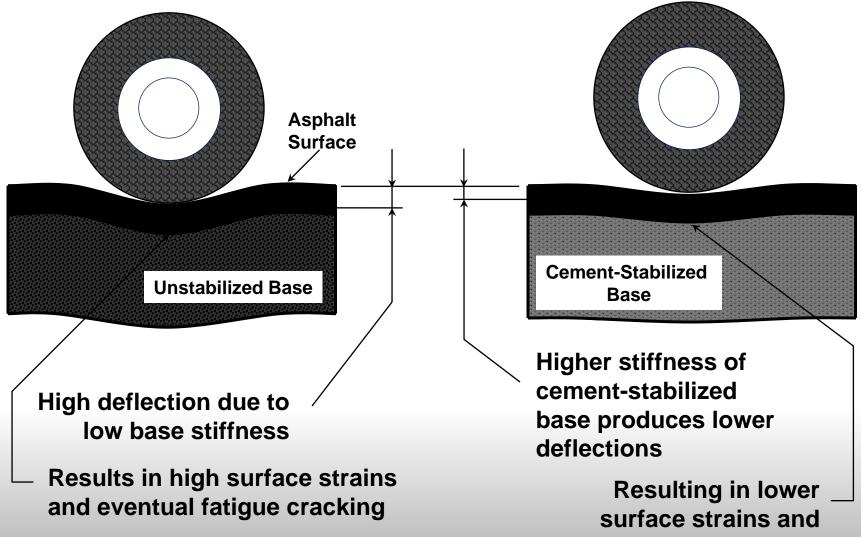


Base Thickness, inches



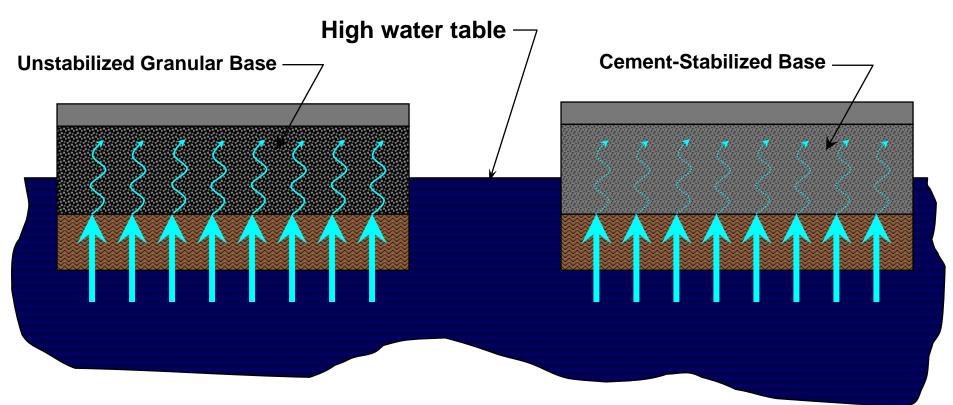
Example: A typically accepted rule-of-thumb is that 8 inches of crushed stone base is equal to 6 inches of FDR.

Reduced Fatigue Cracking



longer pavement life

Reduced Moisture Susceptibility



Moisture infiltrates base:

- Through high water table
- Through capillary action
- Causes softening, lower strength, and reduced modulus

Cement stabilization:

- Reduces permeability
- Helps keep moisture out
- Maintains high level of strength and stiffness even when saturated

Eliminates Rutting Below Surface

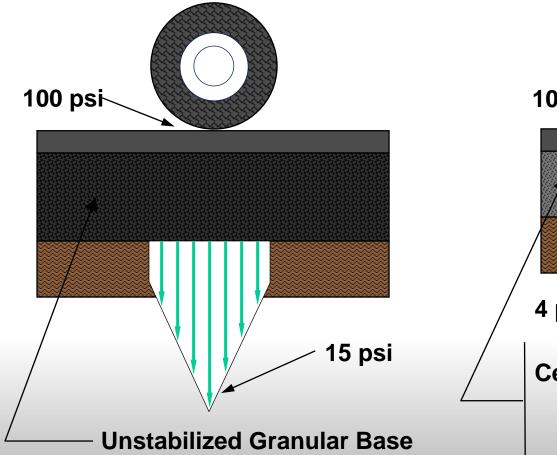
Rutting can occur in surface, base and subgrade of unstabilized bases due to repeated wheel loading

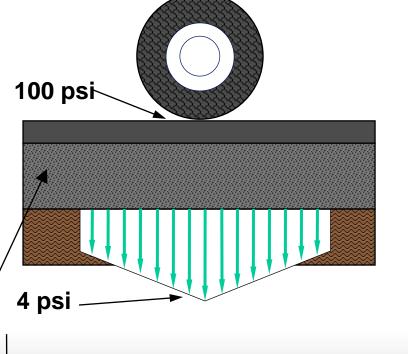
Unstabilized Base

Cement-Stabilized Base

Cement-stabilized bases resist consolidation and movement, thus virtually eliminating rutting in all layers but the asphalt surface.

Increased Rigidity Spreads Loads





Cement-Stabilized Base

- Cement-Treated Base
- Full-Depth Reclamation

Engineering Benefits

- Increased Rigidity Spreads Loads
- Eliminates Rutting Below Surface
- Reduced Moisture
 Susceptibility
- Reduced Fatigue
 Cracking
- Thinner Pavement
 Section
- Retards Reflective
 Cracking



Advantages of Reclamation

- Use of in-place materials
- Little or no material hauled
 off and dumped
- Maintains or improves existing grade
- Conserves virgin material
- Saves cost by using in-place "investment"
- Saves energy by reducing mining and hauls
- Environmentally friendly



Rehabilitation Strategies

Solution	Advantages	Disadvantages
Thick structural overlays	 New pavement structure Quick construction Moderate traffic disruption 	 S Elevation change S Large quantity of materials S Old base may still need fixing S High cost
Removal and replacement	 New pavement structure Eliminates failed base/subgrade Maintain existing elevation 	 \$ Long construction cycle \$ Increased congestion \$ Weather delays \$ Large quantity of materials in \$ Old materials dumped \$ High cost
Reclamation with cement	 S New pavement structure S Fast construction cycle S Minimal traffic disruption S Minimal material in/out S Conserves resources S Maintains existing elevation S Low cost 	 Subgrade may still need fixing Shrinkage cracks may reflect

