ARRA™

Responsible Renewal. Reliable Results.

Full Depth Reclamation & Soil Stabilization

Jonathan Pease, President
Rock Solid Stabilization & Reclamation, Inc.

Dickinson, ND ARRA In-Place Recycling Seminar 2017

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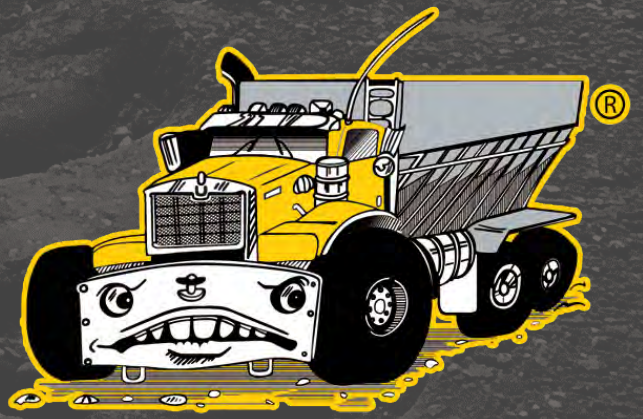
Jonathan Pease

- Purchased the family road construction business in 2002
- Formed Rock Solid Stabilization in 2007 & Joined ARRA
- Joined the Board of Directors of ARRA in 2015

"The reasonable man adapts himself to the world: the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man."

~George Bernard Shaw

ROCK SOLID™
STABILIZATION & RECLAMATION, INC.



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Asphalt Recycling & Reclaiming Association's (ARRA) primary function has been to promote the recycling of existing roadway materials through various construction methodology, to preserve resources and reduce costs. Made up of a mix of Material & Equipment Manufactures, Engineers, DOT's and Contractors.

PPRA™

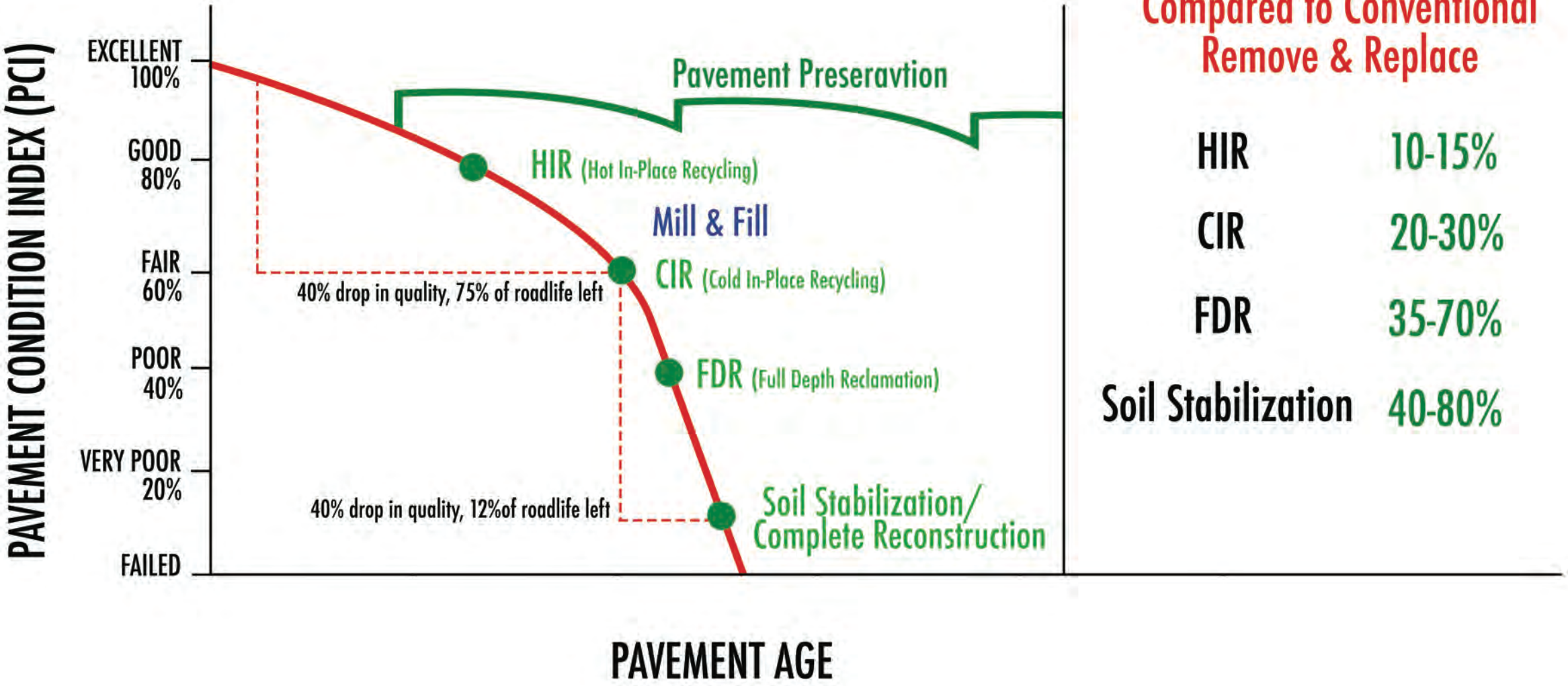
Better roads today. Stronger networks tomorrow.

ARRA is a partner of the Pavement Preservation & Recycling Alliance (PPRA) a unified voice collectively promoting technological processes and applications currently represented and promoted independently by AEMA, ARRA & ISSA

arra.org

ppralliance.org

PAVEMENT LIFECYCLE CURVE



Average Savings Compared to Conventional Remove & Replace

HIR	10-15%
CIR	20-30%
FDR	35-70%
Soil Stabilization	40-80%

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RIGHT PROCESS at the RIGHT TIME on the RIGHT PROJECT for the RIGHT PRICE

- Visual site investigation
- Subsurface investigation (includes subgrade)
- Is there a need for water control?
- Classify & Quantify each layer to determine existing condition/performance
- Mix Design and/or recommendations from experienced person for all present varying conditions, choose the “right team”
- Cost comparison of available options
- Fix subgrade drainage issues if needed
- Utilizing a competent “team” of civil engineer, geotechnical engineer and contractor
- Realize and inform customer that there can be field changes due to unforeseen circumstances at times
- Infield QC/QA when possible

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FDR FULL DEPTH RECLAMATION

Full Depth Reclamation is a technique in which the full flexible pavement section and a predetermined portion of the underlying materials are uniformly crushed, pulverized, or blended, resulting in a stabilized base course; further stabilization may be obtained through the use of available additives. By addressing the entire pavement section, full depth reclamation is able to correct delinquent cross sections, increase the load-bearing strength of the base, and utilize 100% of the existing materials. (ARRA)

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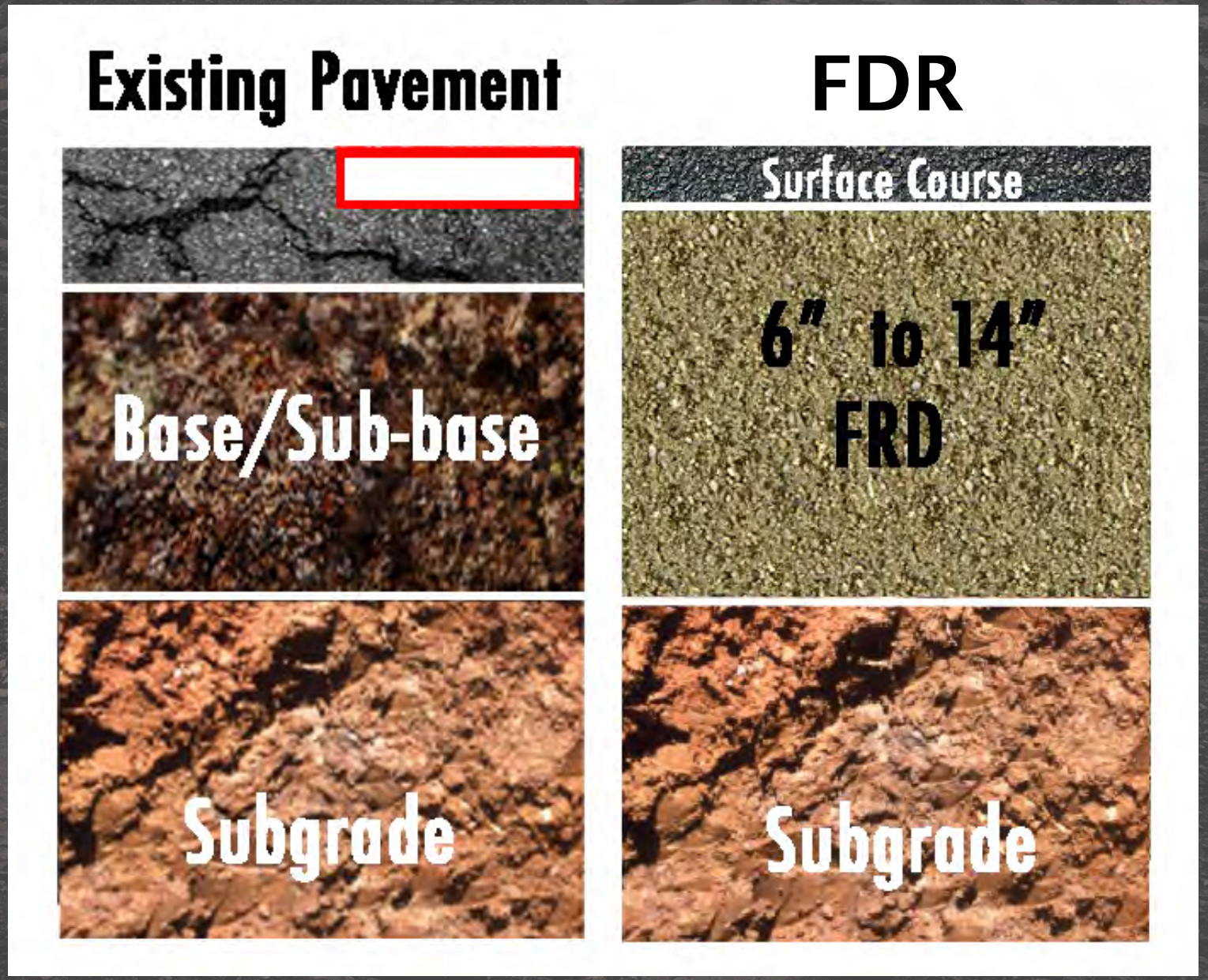
CONVENTIONAL METHODS

vs. FDR



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FDR: Types

Mechanical

- Asphalt Pulverization
  - Can add rock to change the matrix of the gravel base

Bituminous

- Emulsified Asphalt
  - Typically 3-3.5%
- Foamed/Expanding Asphalt
  - Typically 2.5%+-
- Single pass or multiple passes for consistency with thick/irregular pavements

Chemical

- Portland Cement (dry or slurry)
  - Typically 3-6%
- Fly Ash – Type “C” not “F”
  - Typically 6-12%
- Polymers, Enzymes & Ect.

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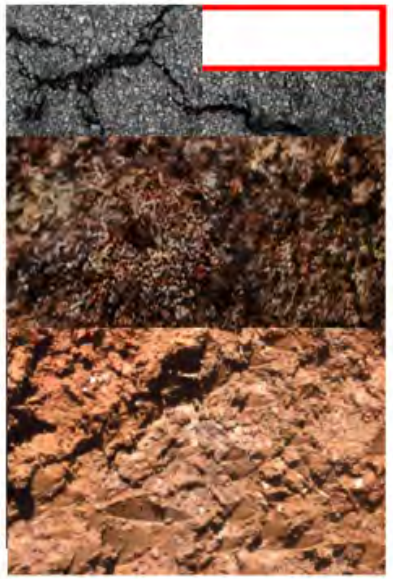
FRD: Process Cross Section



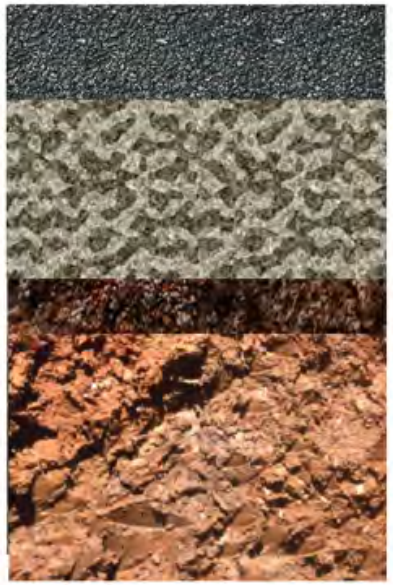
EXISTING ROAD

Removal of existing material if necessary

PULVERIZATION TO DESIRED DEPTH

SELECT MATERIAL & & ADD STABILIZING AGENTS

(Mix, Reshape, Compact)



FINAL SURFACE TREATMENT

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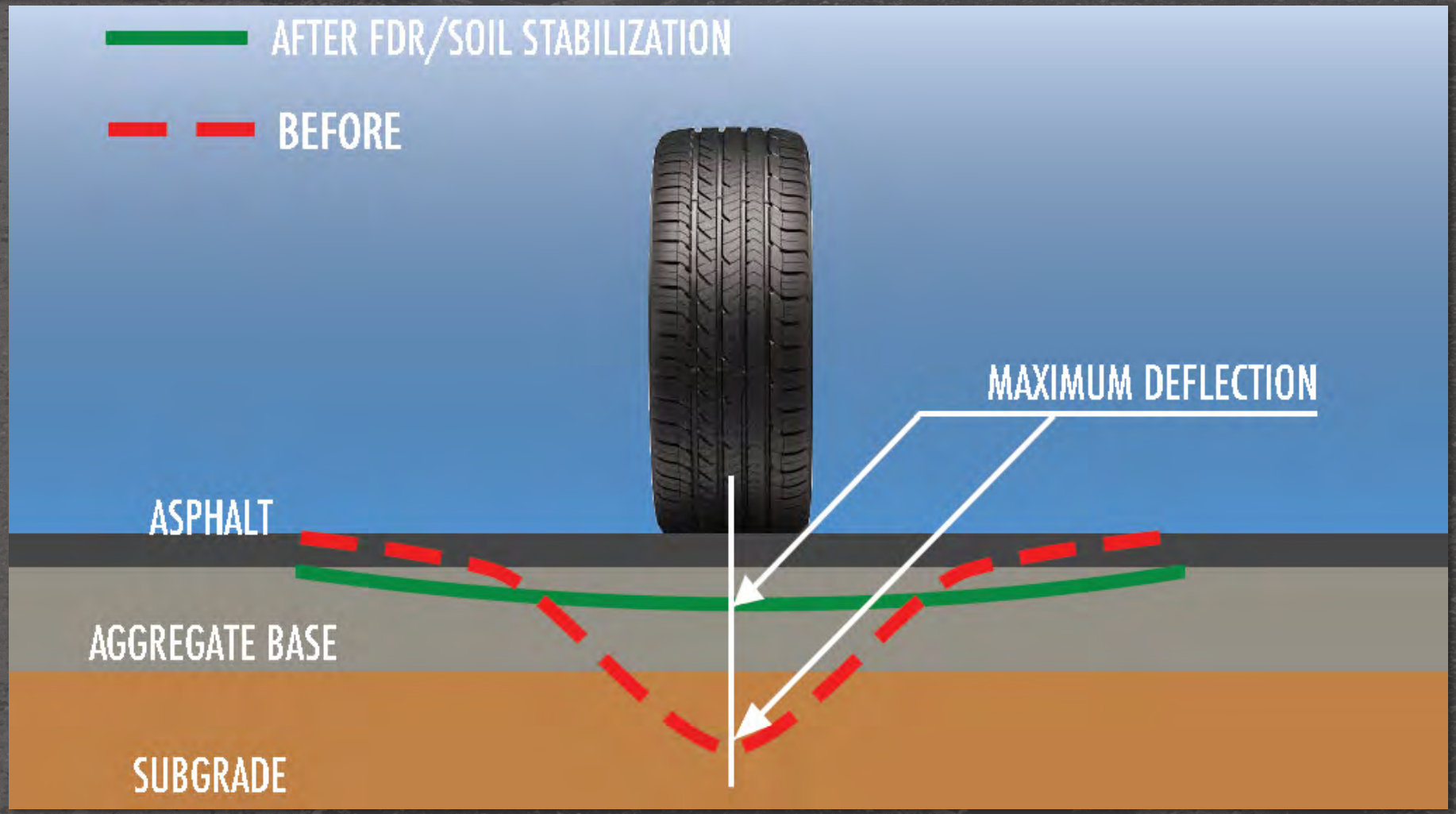

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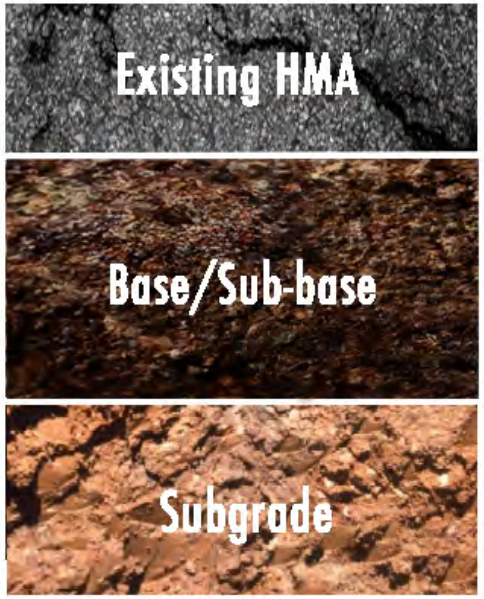
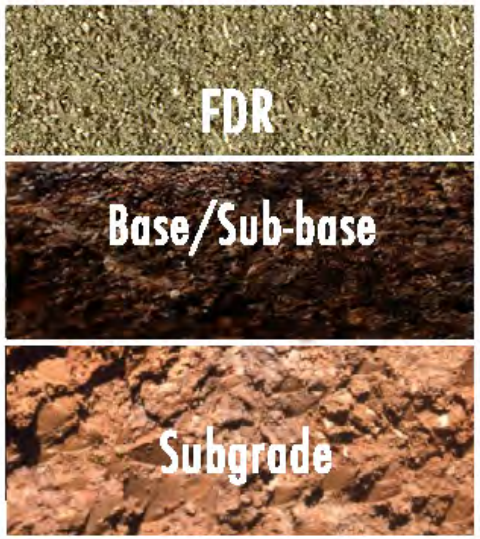
108th FDR vs. REMOVE & REPLACE

Existing Road	R&R w/ 18" Gravel	R&R w/ 8.5" HMA	10" FDR
			
	0.14 S^n/in. 2.52 IBR $696,000	0.30 S^n/in. 2.55 IBR $813,000	0.25 S^n/in. 2.50 IBR **$385,000**

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FDR: When & Where

- Frequent Deep Cracking
- Reflective Cracking
- Heavy Pothole Patching
- Severe Rutting/ Shoveling
- Frost Heaves (may require drainage corrections)
- Insufficient Base Strength

Spec'd or Value Engineered on Asphalt Pavements in Need of Replacement

- Parking Lots
- Industrial Storage Lots
- Secondary Roads
- City Streets
- Interstate Highways
- Airport Runways

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PULVERIZATION: Reclaimer Vs. Cold Recycling Mill

The Reclaimer uses a powerful milling and mixing rotor to granulate and mix the existing soil without added binders

- Keeps pulverized material in same path
- Creates homogenous blend
- Adds volume/ raises grade
- > 6” ? compact before grading

- Collects millings into central windrow
- Utilize to remove surface asphalt if your project is sensitive to grade/ elevation

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Pre-Pulverization

- Using a Reclaimer, the old asphalt and granular base is crushed & mixed to a predetermined depth.
- Water is the only additional material used in this process to achieve the required density

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Pre-Shape/ Grade

- Important to meet desired elevations & cross slope of the finished plans. To avoid cuts and fills after the fact

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Transport

- Pneumatic hauling
- Bulkers are necessary to transport materials that will be used with a spreader

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Spread

- Computerized & meter controlled for uniform distribution
- Spreaders cause less dust then old dup and spread methods, making it more environmentally friendly

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Incorporating Stabilizing Agents

- Mixing powders with water injection creates greater control over water distribution and percentages than top dressing
- Mixing with a Tiller ensures a uniform cut depth and consistent gradation

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Incorporating Bituminous Agents

- Direct incorporation with water injection creates consistent distribution
- Mixing with a Tiller ensures a uniform cut depth and consistent gradation

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Initial Compacting/ Breakdown

- Intelligent compaction
- Proper roll patterns
- Density testing
- Speed Control
- Proper “break” times
- Quality testing

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Grading

- Match predetermined cross sections

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Smooth Finish Roll

- Static rolling
- Initial curing
  - Wet curing (fogging)
  - Emulsify curing

- After 48 hours, micro-cracking is possible

Pre-Pulverization & Shaping if necessary

Spread

Emulsion

Transport

Pulverization w/ Water Tanker

Drum Roll

Grade

Smooth Roll

Surface Course

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FDR: Benefits

- Eliminates rutting below surface
- Reduces moisture susceptibility
- Reuses up to 100% of the existing road bed
- Allows for thinner pavement sections
- Increase rigidity spreads weight loads

	FDR	Overlay	Remove & Replace
New pavement	√	√	√
Fast construction	√	√	X
Minimal traffic dissruption	√	X	X
Minimal material transportation	√	X	X
Conserves resources	√	X	X
Maintains existing elevation	√	X	√
Lower cost	√	X	X

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SOIL STABILIZATION VS. SOIL MODIFICATION

Soil Modification

- sometimes referred to as “mud drying”
- primarily intended to reduce moisture content and the plasticity in order to expedite construction

Soil Stabilization

- long-term physical and chemical alteration of soils to enhance their physical and engineering properties
- incorporating available additives can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load bearing capacity of a subgrade to support pavements and foundations. (ARRA)

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SOIL STABILIZATION VS. SOIL MODIFICATION

Unstable Wet Subgrade

Stabilized Subgrade

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SOIL STABILIZATION/ SOIL MODIFICATION: Candidates

Soil Modification

- Up to 20'+
- Dry wet/ unstable soil that cannot be properly compacted due to high moisture
  - High groundwater
  - Previous rain events
  - Unstable soil
- Reduce moisture/ strengthen subgrade

Soil Stabilization

- Spec'd to add strength to the top 8" – 14" of subgrade
- Spec'd to reduce moisture and stabilize soil characteristics of swelling and/or shrinkage

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Soil Modification – Soil Stabilization
NIMC Change Order

Example:
Road project, 9,000 SY, 80 – 85% failed proof roll

12" UNDERCUTTING
Excavation of 2500 CY at $50.00/CY_____ $125,000.00
(unsuitable soil hauled off site)

SOIL STABILIZATION
9,000 SY stabilized @ 12" depth @ $4.25/ SY_____ $38,250.00

Undercut vs. Stabilization savings of $86,750.00

Modified Pavement Cross Section – Value Engineering
7,900 SY of 2" HMA @ $4.80/ SY _____ $37,920.00
9,000 SY Stabilized @ 12" depth @ $4.25/ SY _____($38,250.00)

Change Order Costs after Value Engineering $0!

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SOIL STABILIZATION/ MODIFICATION:

Reactive Uses

Reactive

- To avoid project delays
- To reduce costs of undercuts
- To utilize onsite materials
- To improve subgrade prior to aggregate placement (pass a proof roll)
- With stands future moisture influx in the soils and has retained strength

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SOIL STABILIZATION/ MODIFICATION:
Specified Uses

Spec'd
To improve structural integrity of the entire pavement section

To reduce thickness of aggregate base or asphalt to achieve overall structural strength determined by the engineer
1" stabilized subgrade = 1" compacted aggregate base (.10 – .14 structural coefficient)

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SOIL STABILIZATION/ MODIFICATION:

Typical Stabilizers & Binders

KEY: GOOD / FAIR / POOR	Fine -Grained: More than 35% Passing No. 200					Course-Grained: Less than 35% Passing No. 200	
Type of Stabilizer	0	10	20	30	40+	0	10 +
Portland Cement							
Lime							
Kiln Dust							
Class C Fly Ash							
Bituminous *Special Applications		Not Applicable					N/A

- **Lime (%)**
- Lime Kiln Dust (LKD) (3-6%)
- Quicklime (1-3%)
- **Fly Ash(%)**
- Class C (8-12%)
- Class F, not on its own
- **Portland Cement (3-6%)**
- Type I/II
- **Slurry**
- Mostly urban areas
- More expensive than powders
- Less dusty
- **Others**
- Enzymes, polymers, other stabilizers

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SOIL STABILIZATION/ MODIFICATION: Benefits

- Prevents lateral spreading of the base
- Increases the stiffness and strength of the base
- Improves vertical stress distribution on the subgrade
- Reduces overall stress in the subgrade
- Increases the pavement life and reduces the potential for reactive maintenance

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