



PAVEMENT REHABILITATION USING SOIL-CEMENT

“THINK SMARTER”

By: Donatas Greb, PE
HSI Engineering, Inc.



PAVEMENT REHABILITATION OUTLINE

PART I

- 1. How it works**
- 2. Applications of Soil Cement**

PART II

- 1. Pavement Recycling Processes**
- 2. Full Depth Rehabilitation**
- 3. Cold In Place Recycling**
- 4. Design & Construction**

Conclusion



**Our challenge is to do more with less
to rebuild America in a way that is:**

- smarter,**
- greener,**
- saves money**

AGGREGATE BASE



HOT MIX ASPHALT



CONCRETE



AGGREGATE BASE



HOT MIX ASPHALT



CONCRETE



SOIL CEMENT



SOIL CEMENT DEFINITION:

Soil-cement is a highly compacted mixture of _____, Portland cement, and water.

Stage 2 Distribution

July 2010

Draft Report: UCPRC-GL-2010-01

Guidelines for the Stabilization of Subgrade Soils In California

Authors:

D. Jones, A. Rahim, S. Saadeh, and J. Harvey

Partnered Pavement Research Program (PPRC) Contract Strategic Plan Element 3.14:
Subgrade Soil Stabilization Guide

PREPARED FOR:

California Department of Transportation
Division of Research and Innovation
Office of Roadway Research

PREPARED BY:

University of California
Pavement Research Center
UC Davis, UC Berkeley



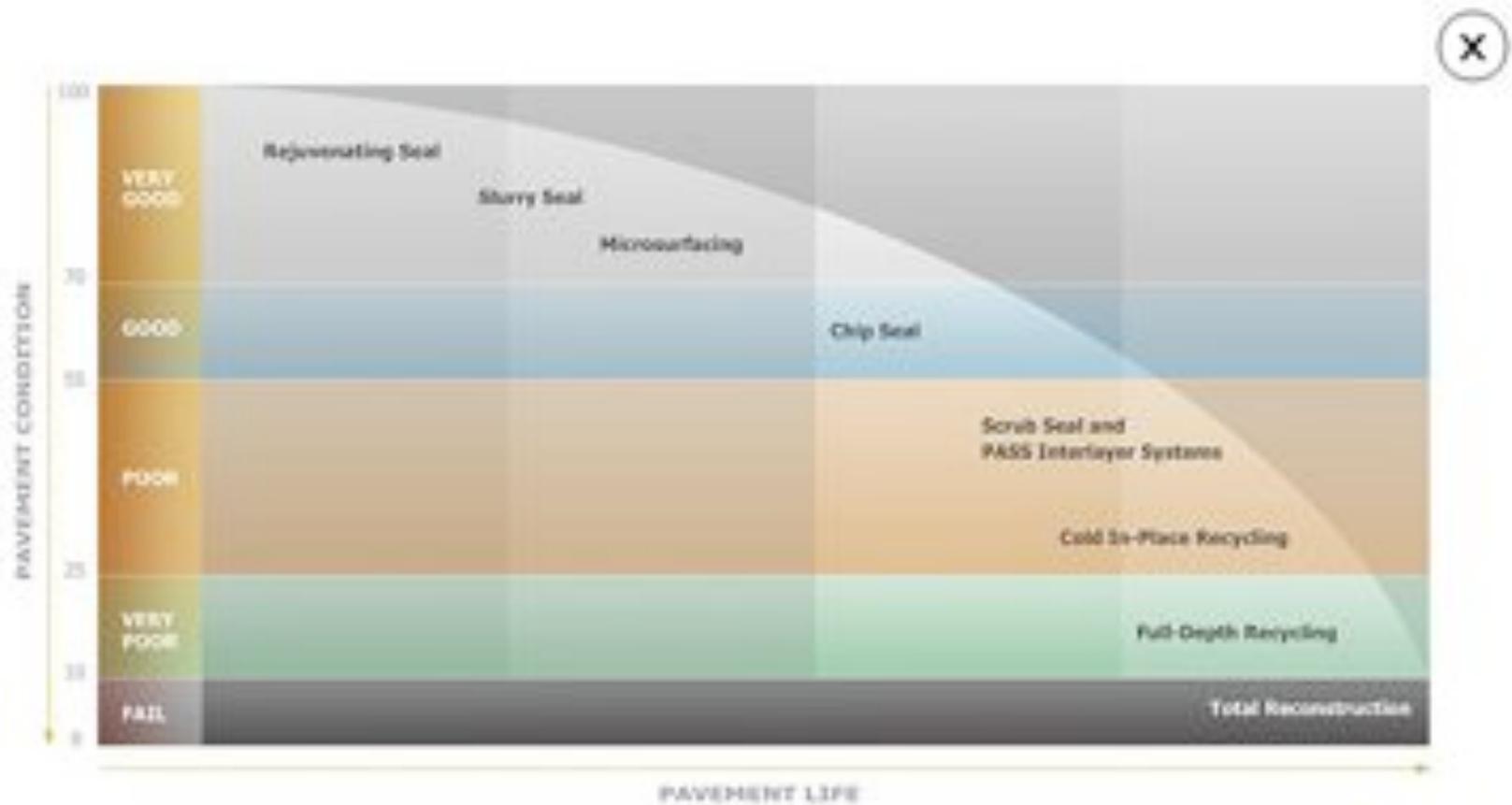
SOIL CEMENT APPLICATIONS



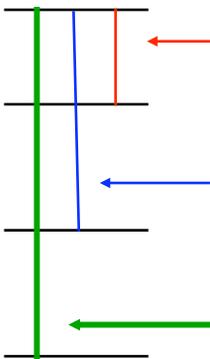
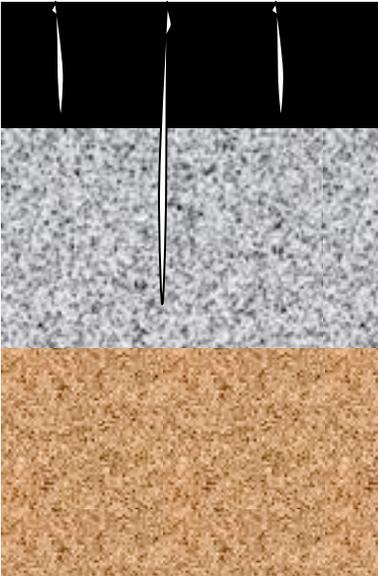
PART II. PAVEMENT REHABILITATION



PAVEMENT RECYCLING STRATEGIES



PAVEMENT RECYCLING OPTIONS



Hot In-Place Recycling
(0.6 to 4 inches/ 2-4 yrs design life)

Cold In-Place Recycling-Emulsion/Foam Asphalt
(2 to 9 inches/ 8-10 yrs design life)

Full-Depth Rehabilitation
(8 to 18 inches/ 20-30 yrs design life)



REHABILITATION COST COMPARISON

2 miles Typical 2-lane Collector Road (TI=9.0) 300,000 SFT.

6" HMA /17" AB (25 yrs)	\$7.50/sft.
4 " Mill & Fill (15 yrs)	\$3.50/sft.
Full Depth Rehab- 4" HMA / 17" FDR (30 yrs)	\$4.40/sft
Cold In Place Recycling 2" HMA / 4" CIPR (15 yrs)	\$3.30/sft.

COST SAVINGS BENEFITS

The screenshot shows a software window titled "Decision Tree" with a menu bar containing "File". The main area is divided into two panes. The left pane displays a hierarchical tree structure of road types and conditions:

- Arterial
 - AC
 - Condition Category I - Very Good
 - Crack Treatment
 - Surface Treatment
 - Restoration Treatment
 - Condition Category II - Good, Non-Load Related
 - Condition Category III - Good, Load Related
 - Condition Category IV - Poor
 - Condition Category V - Very Poor
 - AC/AC
 - AC/PCC
 - ST
 - PCC
- Collector
- Residential/Local
- Other

The right pane is titled "Treatment Information" and contains a dropdown menu for "Treatment" with the selected option "RECONSTRUCT STRUCTURE (AC)". Below this, a label reads "Cost/100 Yd. except Seal Chips in LF" with a corresponding value of "92.00" displayed in a green box. At the bottom of the window, there are buttons for "Print", "Done", and "Cancel".

Decision Tree

Printed: 05/18/2012

Treatment	Cost/Sq Yd. except Seal Cracks in LF	Yrs Between Crack Seals	Yrs Between Surface Seals	# of Surface Seals before Overlay
SEAL CRACKS	\$1.70	3		
AR CAPE SEAL	\$10.83		9	
THIN RHMA OVERLAY W/ FABRIC	\$38.40			2
AR CAPE SEAL	\$10.83		9	
THIN RHMA OVERLAY W/ FABRIC	\$38.40			
THICK AC OVERLAY W/ FABRIC	\$49.50			
THICK AC OVERLAY W/ FABRIC	\$135.00			

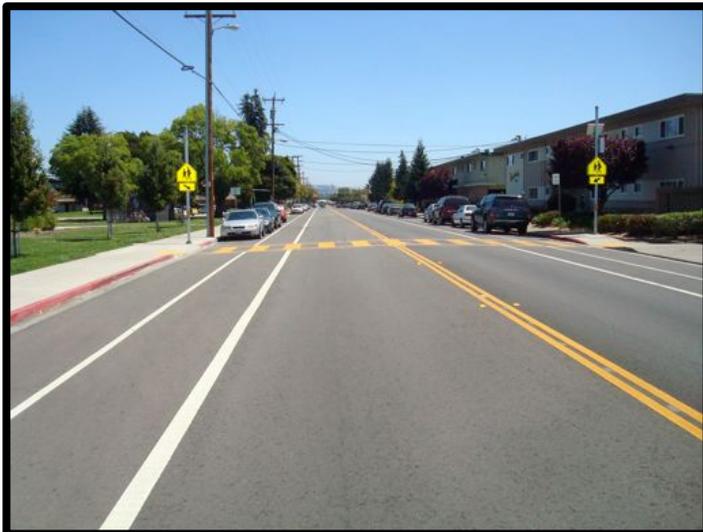
FDR COST SAVINGS BENEFITS

Bancroft Avenue, San Leandro

2-lane Major Collector, 136,000 sft.
4" AC over 12" FDR using 5% cement

\$7.36/sft. - Traditional Pavement Cost

\$4.05/sft. - FDR Cost (*45% COST SAVINGS*)





WHAT IS FDR?

Full Depth Rehabilitation

FDR is a process in which the existing asphalt surface is Pulverized in place and blended with the underlying base, sub-base, and/or subgrade materials, mixed with Portland Cement, and compacted to provide a new stabilized base.

THE FDR PROCESS

Start to Finish in about 3-5 Days

S
T
A
R
T



1. Before Full-Depth Rehabilitation



2. Pulverize Pavement



3. Re-Shape Grade



4. Apply Cement



5. Mix & Hydrate Cement



6. Initial Compaction



7. Final Grading



8. Final Compaction & Curing



9. Pave FDR

F
I
N
I
S
H

The Pothole Report: Can the Bay Area Have Better Roads?

June 2011



Fresh Data, New Developments

Building on the foundation established in MTC's original *Pothole Report*, published in 2000, this update includes both a primer on the cost and life cycle of pavement and a comprehensive look at the current state of the Bay Area's local streets and roads network, featuring a jurisdiction-by-jurisdiction ranking of the 2010 PCI scores of the region's nine counties and 101 cities. This report also provides a briefing on two important new developments in the pavement management field:

- **Cold In-Place Recycling:** a relatively new and highly promising technique that has been shown to cut asphalt rehabilitation costs by 20 percent to 40 percent, and to reduce greenhouse gas emissions from pavement repair projects by eliminating the need to produce new paving material or transport it to the worksite; and

THE CIPR PROCESS



By Bill Wilson
Editorial Director

AGGREGATE SHORTAGE CHALLENGE (Caltrans Warning)

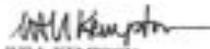
ATTACHMENT A
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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FEB 27 2006

Transportation Partners
February 27, 2006
Page 2

Please share this information with your planning commissions, city councils, and county board of supervisors. Thank you in advance for your assistance in helping the Department in its mission to improve mobility across California.

Sincerely,

WILL KEMPTON
Director

Enclosure

- Mr. Charlie Rea, Construction Materials Association of California
- Mr. Sam Haxson, ACC of California
- Ms. Tam Hux, Engineering & Utility Contractors Association
- Mr. Ed Kafish, Southern California Contractors Association, Inc.
- RTPAs
- MPOs
- County Transportation Commissions

February 27, 2006

Dear Transportation Partners:

As I am sure you are aware, the Governor has proposed the Strategic Growth Plan, which calls for \$325 billion to be invested in transportation over the next ten years, plus \$2 billion for mitigation of existing air quality impacts from ports and goods movement. In all, nearly half of the estimated \$222 billion expected to be raised under the plan is slated for transportation.

Part of the Governor's Strategic Growth Plan is a historic comprehensive transportation investment package that incorporates GoCalifornia, a mobility action plan designed to decrease congestion, improve travel times, and increase safety. Last fiscal year, the California Department of Transportation (Department) delivered about \$900 million in highway construction. This year we are on track to deliver over \$3 billion. If the Legislature adopts the Governor's infrastructure program, the Department will be challenged to deliver an even larger program over the next few years. Although highway construction is a relatively minor component in overall aggregate consumption in California, we are concerned about availability and pricing. As part of GoCalifornia, the Department's statewide strategy is to work with communities and other State agencies in securing adequate industry capacity for California's needs.

Towards this effort, I would like to bring to your attention the tremendous amount of aggregate needed to supply the projects that support the improvement of the State's transportation infrastructure and the need for new aggregate sources. In recent industry capacity expansion workshops, our construction industry partners shared their concern about the availability of aggregate and other commodities in California. Based upon information from the Department of Conservation, possible cost increases because of potential shortages of aggregate would impact the fiscal budgets of local, regional, and State public works agencies (see enclosed reduced copy of Map Sheet 52, and visit the following internet site http://www.construction.ca.gov/CGIS/pollitic_research/industry_production/ms52.htm).

At these workshops, the industry also informed the Department of the many years it can take to get a new aggregate source through the permitting process. We encourage the development of new material sources for aggregate reserves that are identified and developed within California, but recognize that the permitting of any new mining locations must be done in accordance with Federal, State, and local laws and regulations while being environmentally sensitive.

"...tremendous amount of aggregate needed..."

"...concern about the availability of aggregate..."

"...encourage the development of new material sources..."

SOLUTION: RECYCLE FIRST

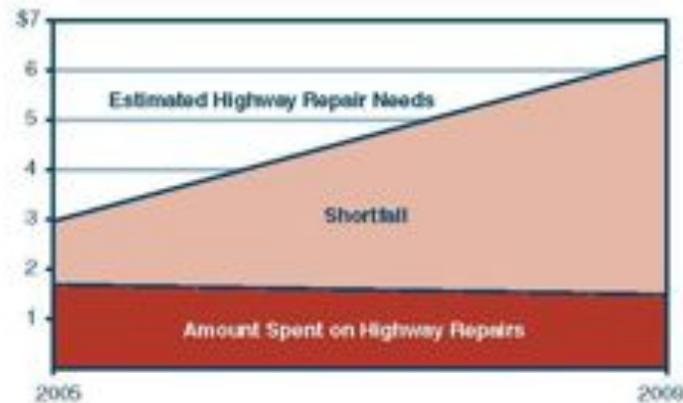


CALIFORNIA BUDGET CHALLENGE



Highway Maintenance and Reconstruction Severely Underfunded

Annual Spending on Highway Repairs Falls Short of Needs (In Billions)



Transportation Funding Overview - Legislative Analyst's Office 2/28/11

CONSTRUCTIBILITY & BIDDING CHALLENGES

Excerpt taken from a recent Geotech report.....

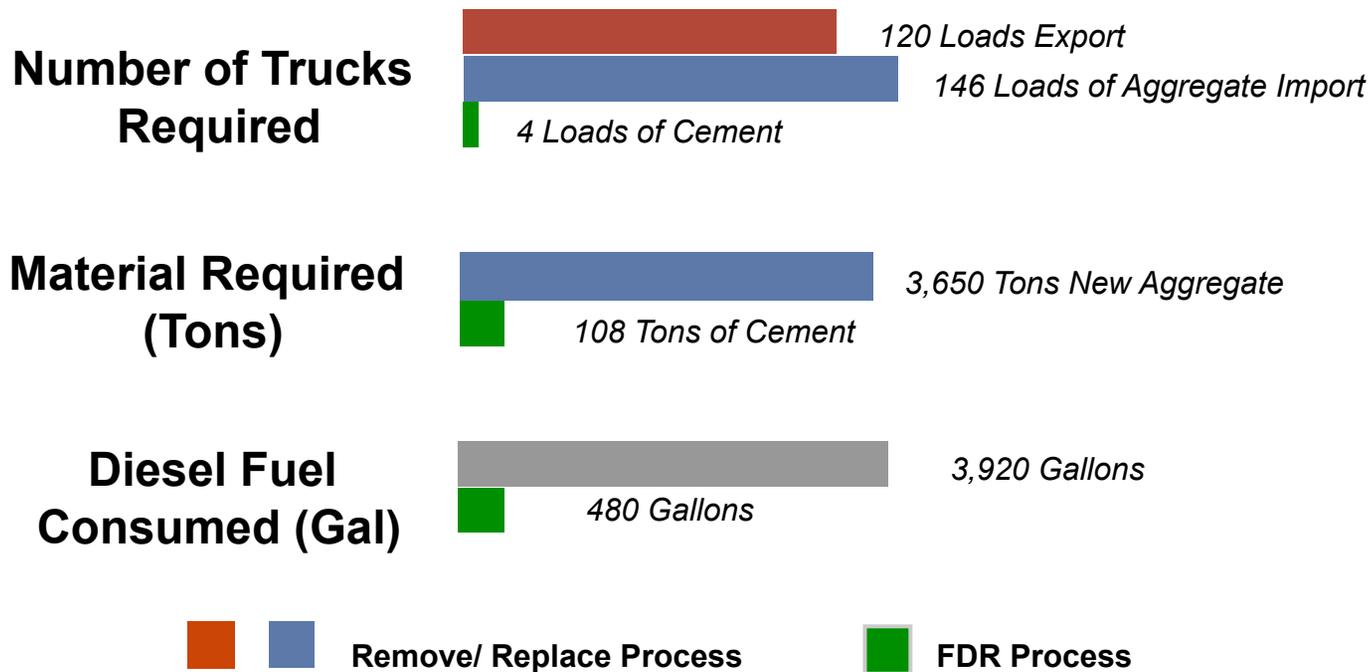
“Where unstable soft, loose or pumping soils are encountered, we recommend over-excavating.....

To bridge these yielding soils the contractor may consider a number of methods including utilizing bedding material combined with geogrid reinforcing (Tensar BX 1200 or equal) and/or concrete slurry at the base of the over-excavated area as needed to create a non-yielding condition.”

“A PREDICTABLE PROCESS”

ENVIRONMENTAL & ECONOMIC BENEFITS

FDR VS. REMOVE/REPLACE (50,000 sft., 12-in Deep)



ENVIRONMENTAL SAVINGS

1 Cement Truck =

40 Gravel Trucks

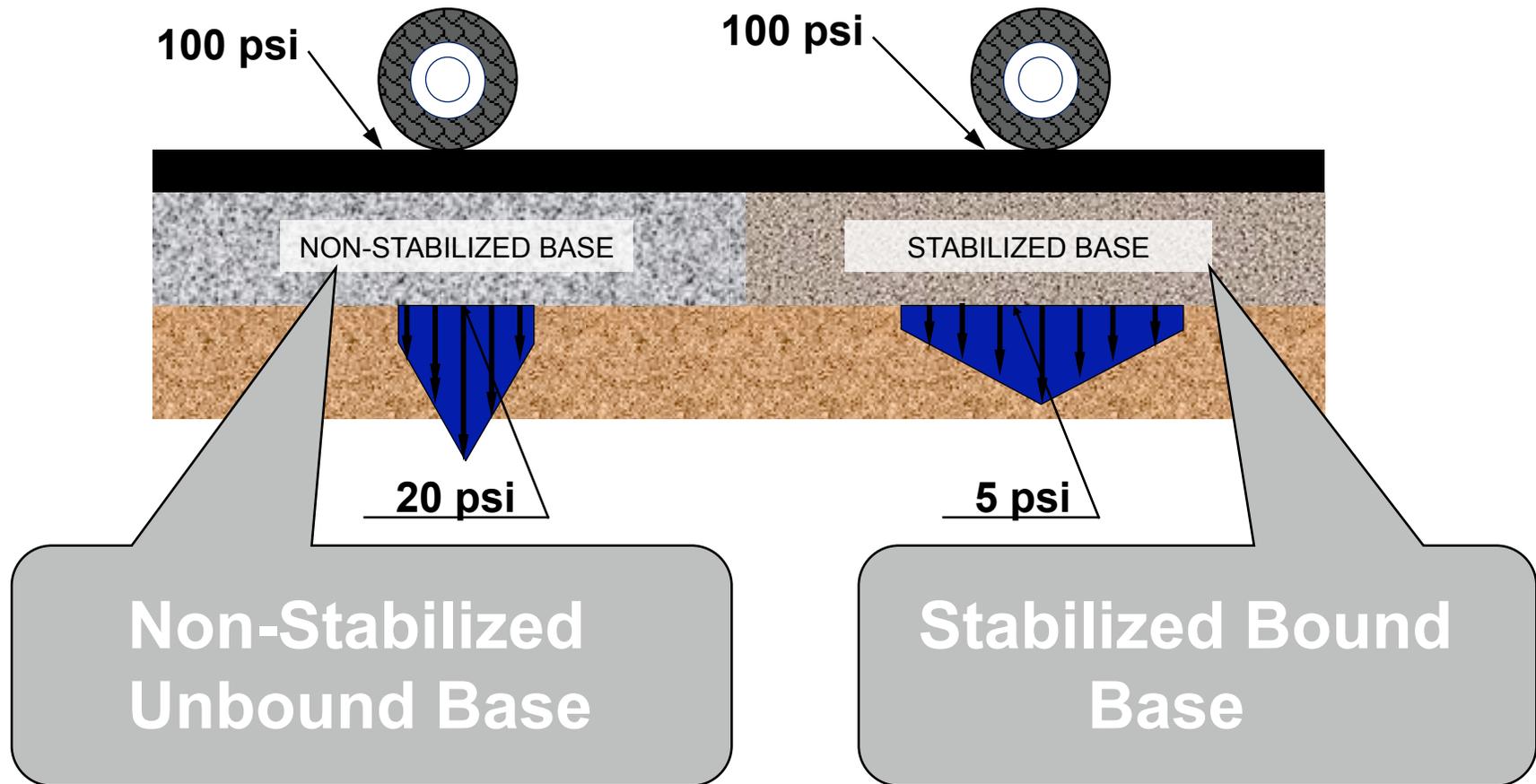


COST SAVINGS BENEFITS

Being Green=Saving Money

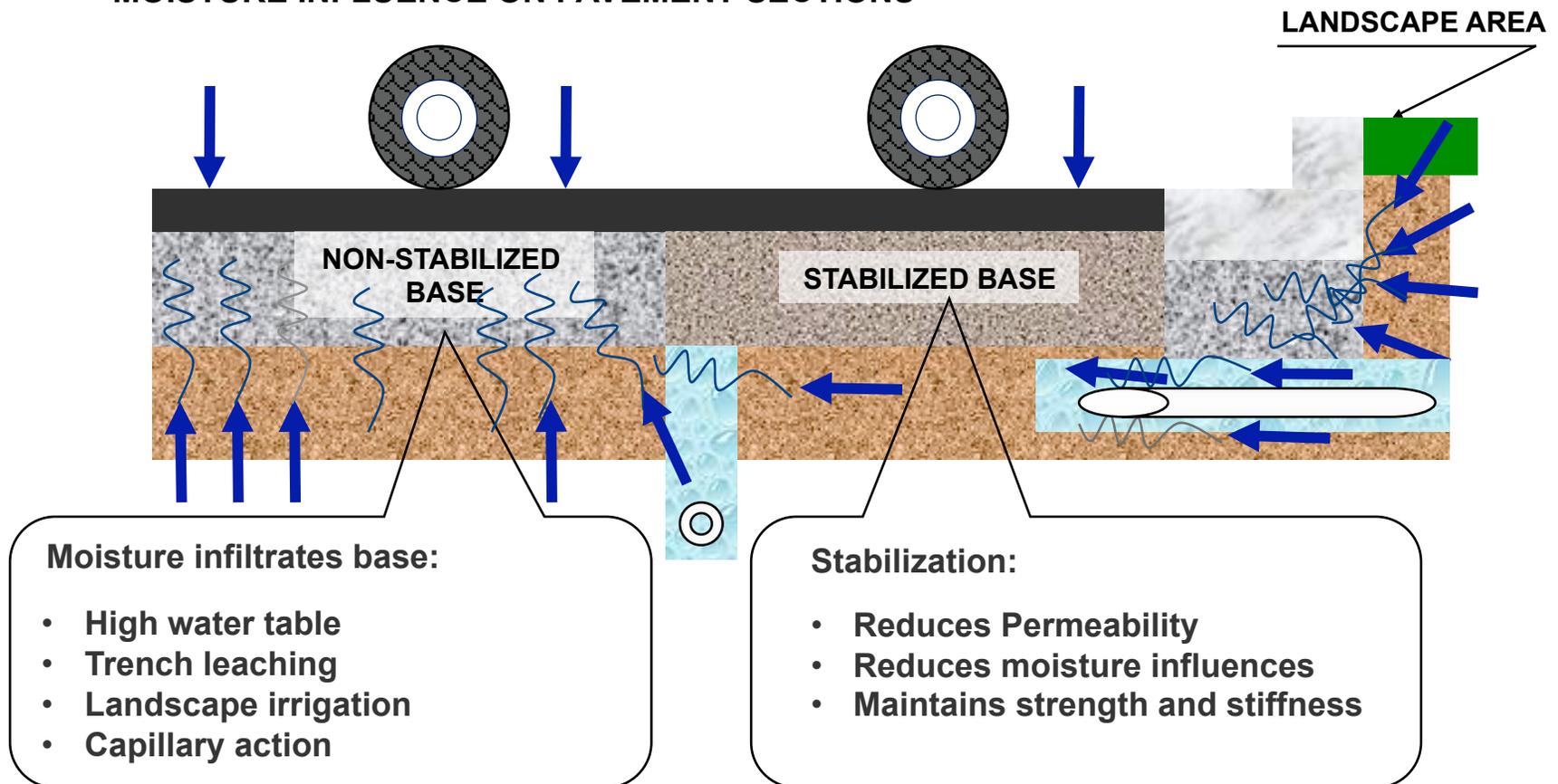


PERFORMANCE BENEFITS: IMPROVED LOAD DISBURSEMENT



PERFORMANCE BENEFITS: MAINTAIN STRENGTH WHEN SATURATED

MOISTURE INFLUENCE ON PAVEMENT SECTIONS



PERFORMANCE BENEFITS:
CREATES AN “*INVERTED PAVEMENT*”



RECAP: BENEFITS OF FDR

- Increased Strength Spreads Loads
- Bound Base Material Section
- Reduced Moisture Susceptibility
- Faster & Easier to Construct
- Thinner AC Pavement Section
- Longer Pavement Life Cycle
- 30%-50% lower cost



DESIGN OF FDR

1. Coring/ Sampling
2. Lab Analysis/ Mix Design
3. Pavement Design
4. Construction Inspection/
Support



CLIENT- Caltrans
PROJECTS – I-580 EB HOV Lane and
RT 4 / Loveridge Road Interchange

APPLICATION- stabilization of subgrade



**CLIENT- Ports of America, Port of Oakland
PROJECT – Berths 22-24 reconstruction**

APPLICATION- recycling/stabilization base



CLIENT- Christian Presbyterian Church, Danville
PROJECT – Parking lot Reconstruction

APPLICATION- recycling/stabilization base



CLIENT- City of Hayward-
PROJECT – Hayward Airport Taxiway

APPLICATION- In-place Recycling /Stabilization



CLIENT- City of Watsonville
PROJECT – Green Valley Road Reconstruction

APPLICATION- Recycling/stabilization



Public Works Client Base

CITIES

City of American Canyon
City of Antioch
City of Foster City
City of Hayward
City of Lafayette
City of Marysville
City of Martinez
City of Oakland
City of San Leandro
City of Santa Clara
City of Seaside
City of Soledad
City of Palo Alto
City of Pittsburg
City of Richmond
City of Santa Cruz
City of Sunnyvale
City of Tracy
City of Watsonville

COUNTIES

Los Angeles County
Merced County
San Mateo County
Santa Cruz County

OTHER PUBLIC AGENCIES

CALTRANS
Department of the Army
Department of Water Resources
Port of Stockton
Ports of America

Engineering Client Base

Arcadis

Aurora Biofuels

Azari Engineering

Bechtel

Berlogar Stevens & Associates

Cornerstone Earth Group

CSG Consultants

Earth Systems Pacific

Engeo

ERS Corporation

Fugro Consultants

Geocon Consultants

Harris & Associates

KC Engineers

Kleinfelder

Laco Associates

Mark Thomas

Miller Pacific

Moore Twining Associates

Ninyo & Moore

PARIKH Consultants

Pavement Data Group

SMGURS Corp.

Contractor Client Base

Appian Engineers
Black Diamond Paving
Central Valley AG Grinding
Coast Inland Constructors
Delta Grinding
De Silva Gates
Don Chapin Company
DPR Construction
DRYCO Construction
Flatiron Construction
Fremont Paving
Ghilotti Brothers
Granite Construction
Graniterock

Griffin Soil
H&H Trenching
James Riolo Paving
Northwest General Engineering
O.C. Jones
Pedroia & Sons
Redgwick Construction
Robert A. Bothman
R&L Brosamer
RQ Construction
Slater & Son
Top Grade Construction
Walbridge/Overaa (joint venture)
Walsh Construction
WR Forde

**SOIL CEMENT &
PAVEMENT REHABILITATION
QUESTIONS ?**

www.hsi-engineering.com
www.fulldepthrehabilitation.com



SOLUTIONS IN CEMENT STABILIZATION

