PAVEMENT REHABILITATION TECHNIQUES:

Applying Reasonableness & Avoiding Pitfalls

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Project Level Evaluation

Goals:

- Develop recommendations that are:
  - Cost effective solutions
  - Feasible
  - Managed risk

Project Level Evaluation

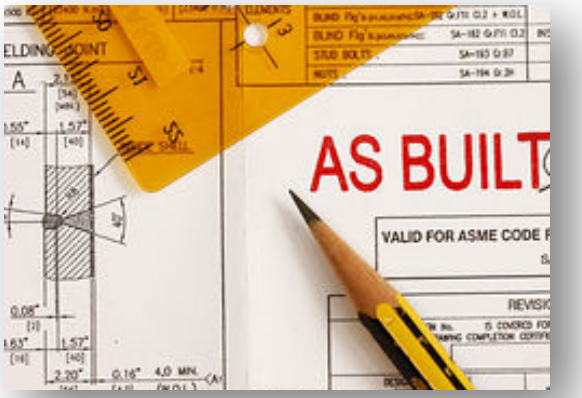
Goals:

- Manage Expectations
  - Communication – Aligning Goals
  - PMS Output
  - Expected Performance

Project Level Evaluation

Methodology:

- Reconnaissance and As-Built Review
  - Testing and exploration plan
  - Traffic control plan



Project Level Evaluation

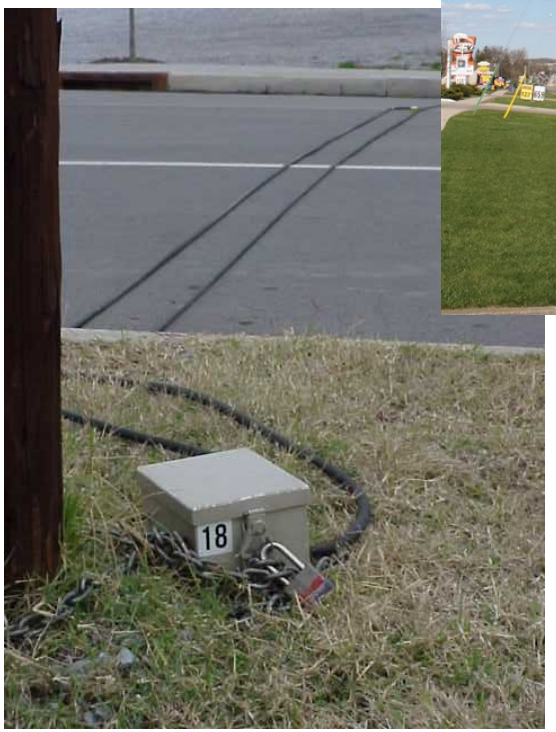
Methodology:

- Field Exploration and Testing
  - Number, location and type of explorations
  - FWD testing frequency
  - GPR
  - Visual survey

Project Level Evaluation

Methodology:

- Traffic Loading Estimate
  - Peak Hour Counts
  - ADT/percent trucks
  - Classified Counts
    - Tube counts
    - Video counts
  - Transit Buses



Project Level Evaluation

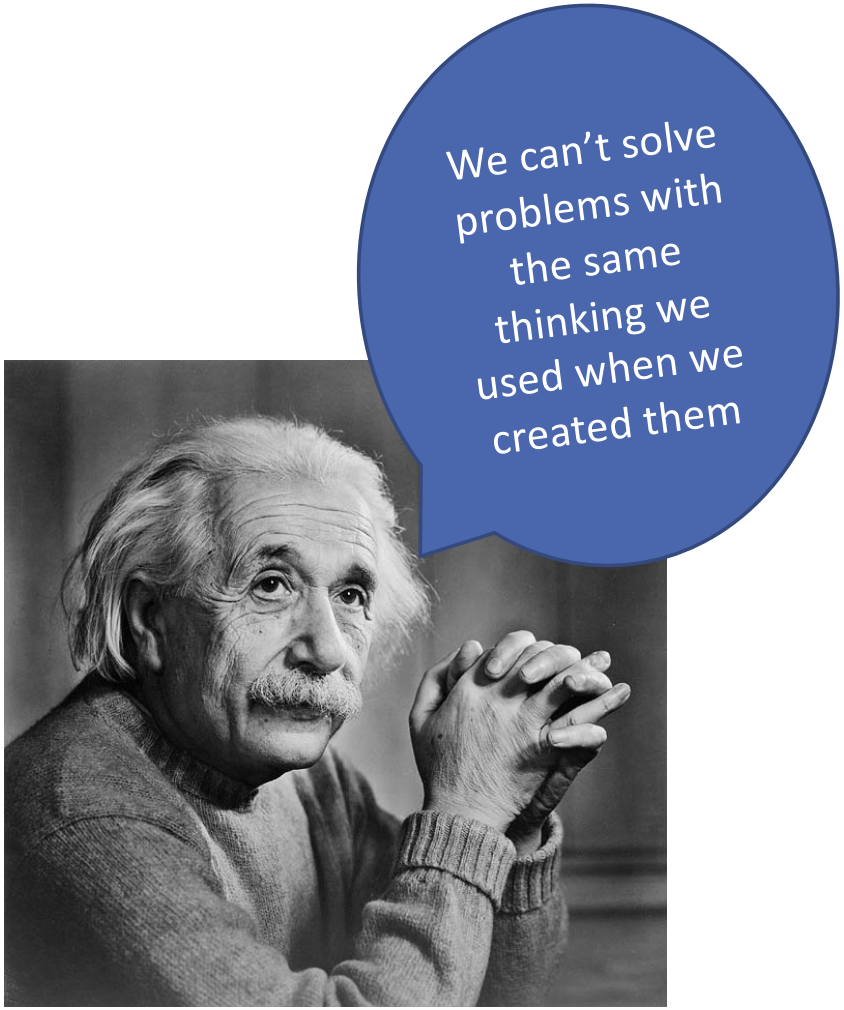
Methodology:

- Pavement structural analysis
  - Analysis units and backcalculation models
  - Backcalculation analysis
  - Overlay and inlay analysis
    - AASHTO input parameters

Project Level Evaluation

Methodology:

- Project Recommendations
  1. Structural requirements
  2. Grade constraints
  3. Reflective cracking



Typical Structural Improvements

Overlay is placed in 2 to 3-in. lifts above the existing pavement surface with an increase in grade equal to the overlay thickness.

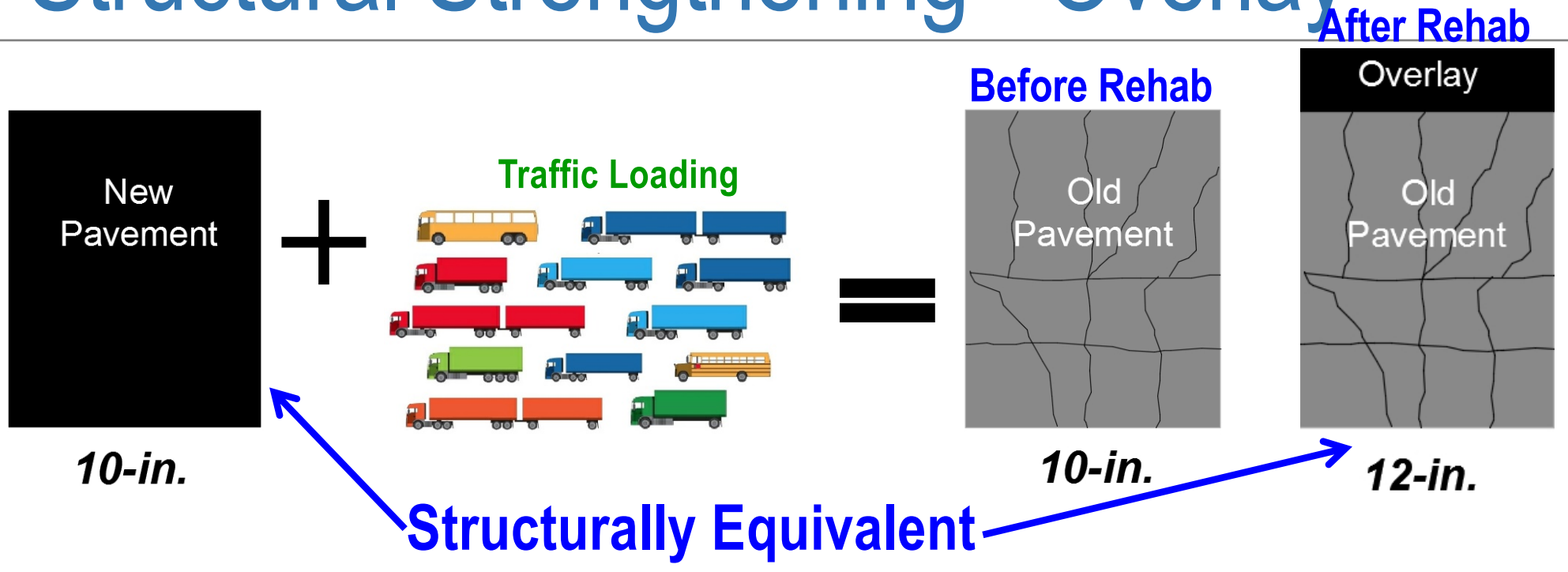
Inlay is removal of a portion of the existing asphalt concrete (by milling) and replacement with new asphalt concrete, with no increase in grade.

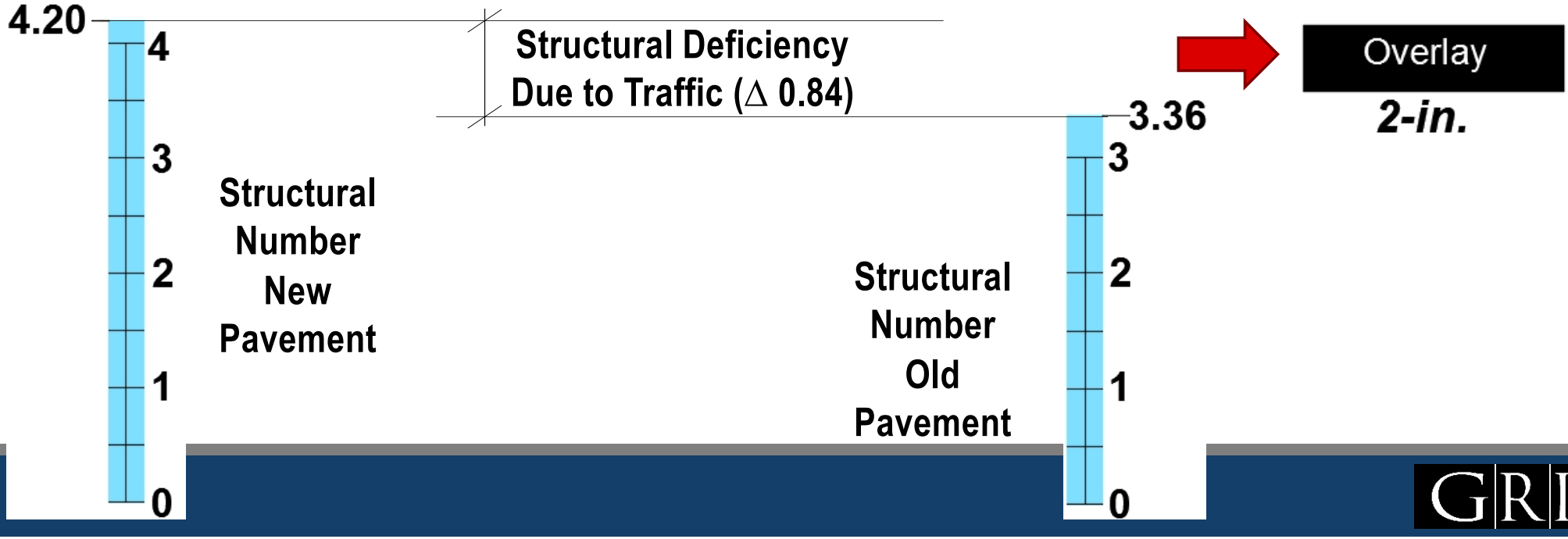
Mill and Overlay is removal of a portion of the existing asphalt concrete and placement of new asphalt concrete that results in an increase in grade.

Partial Depth Reconstruction is removal of the entire thickness of existing asphalt concrete and placement of new asphalt concrete on top of the existing aggregate base layer.

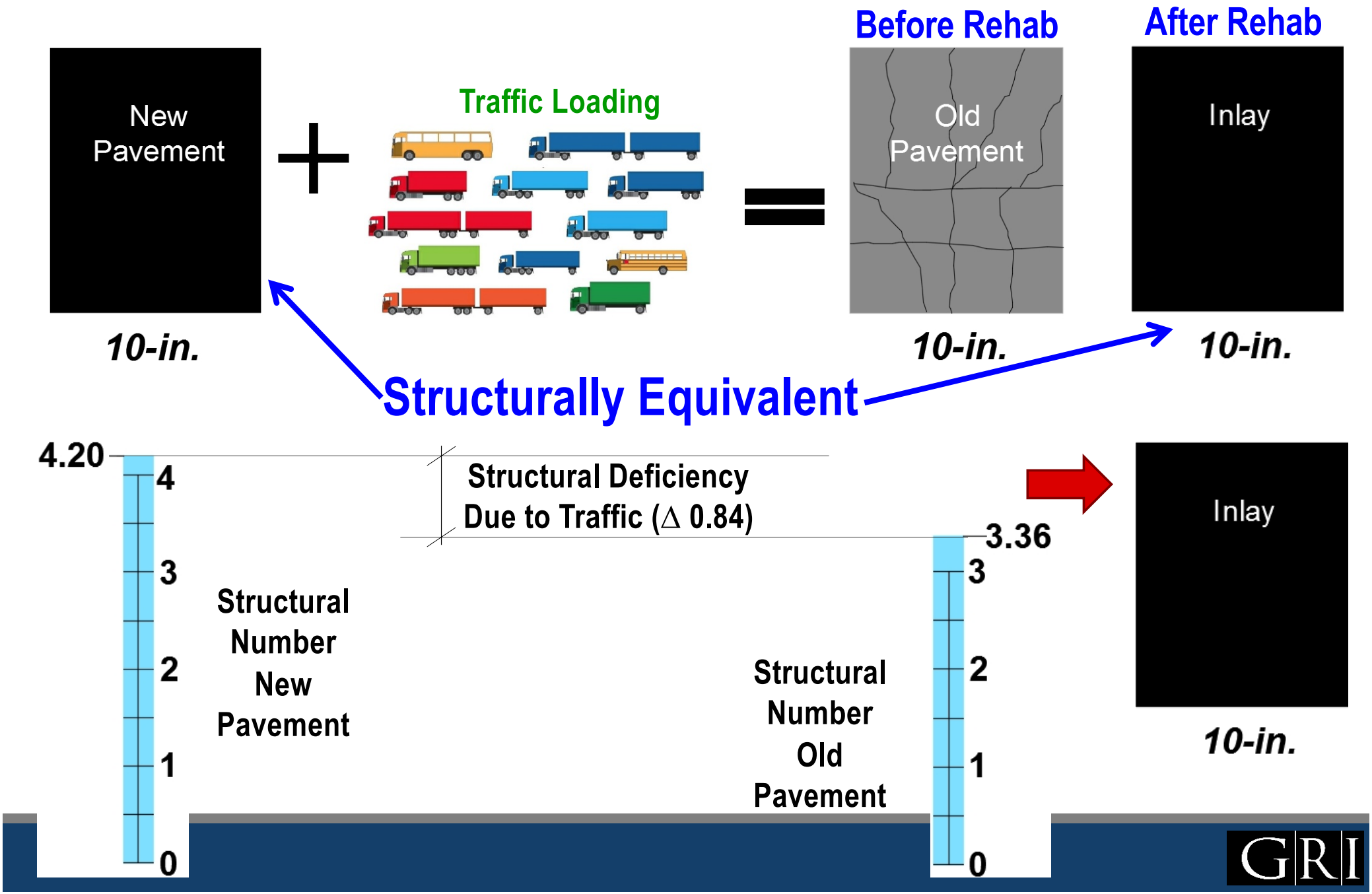
Full Depth Reconstruction is replacement of the existing pavement structure with a new pavement structure and may include construction on compacted or undisturbed subgrade, aggregate or mechanical stabilization, treated subgrade and full depth reclamation (FDR).

Structural Strengthening - Overlay

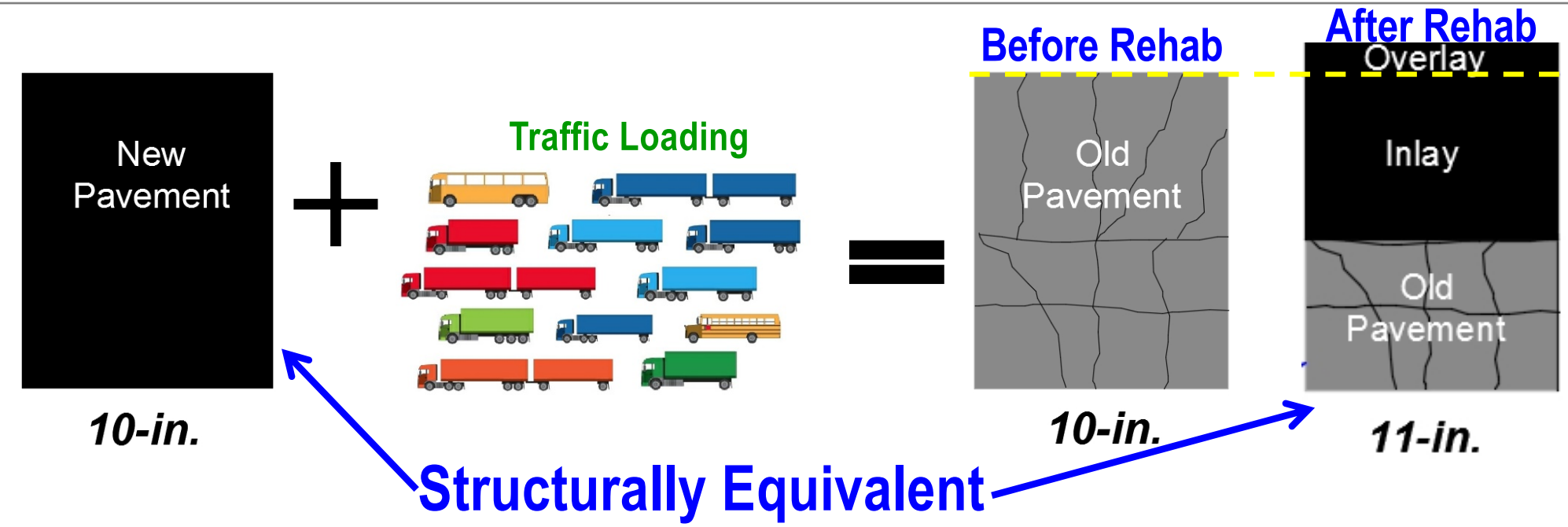


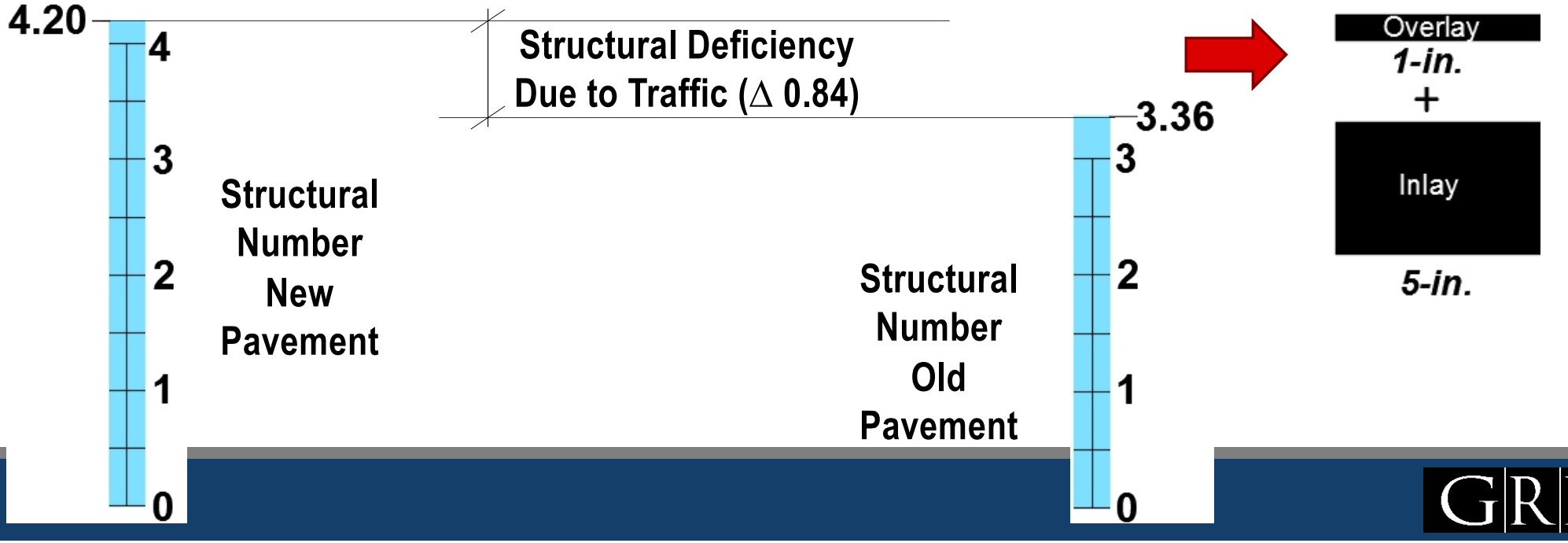


Structural Strengthening - Inlay



Structural Strengthening – Mill + Overlay

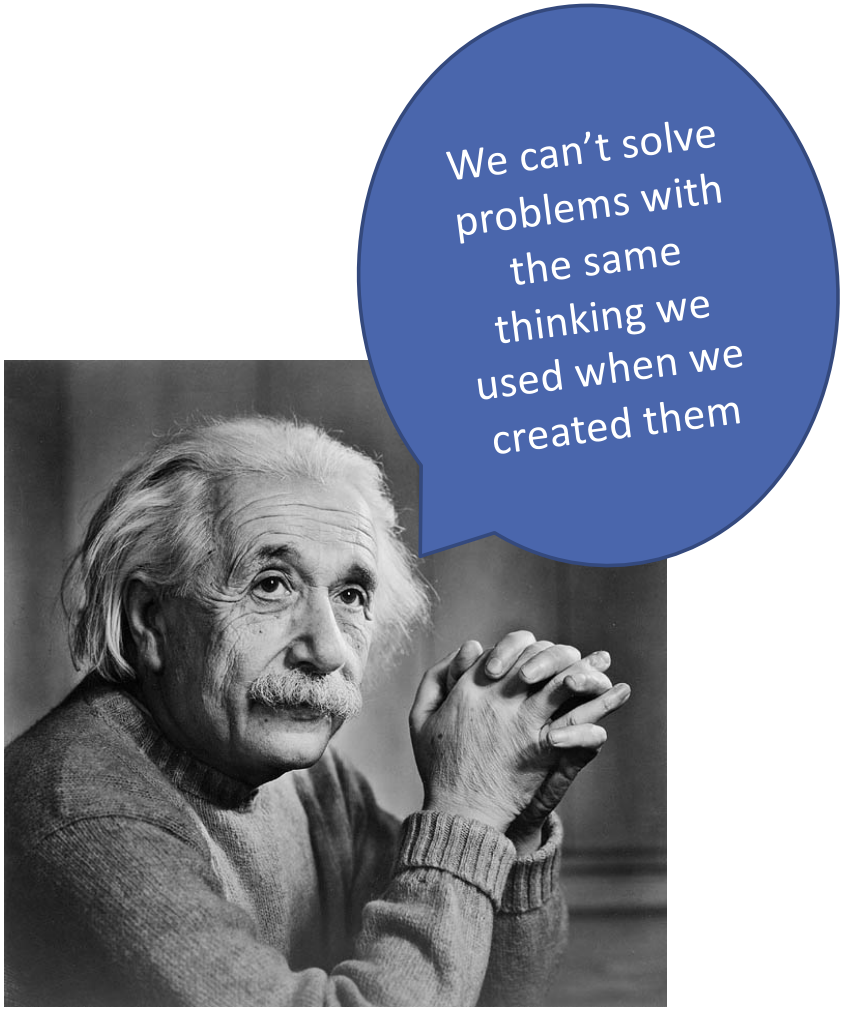




Project Level Evaluation

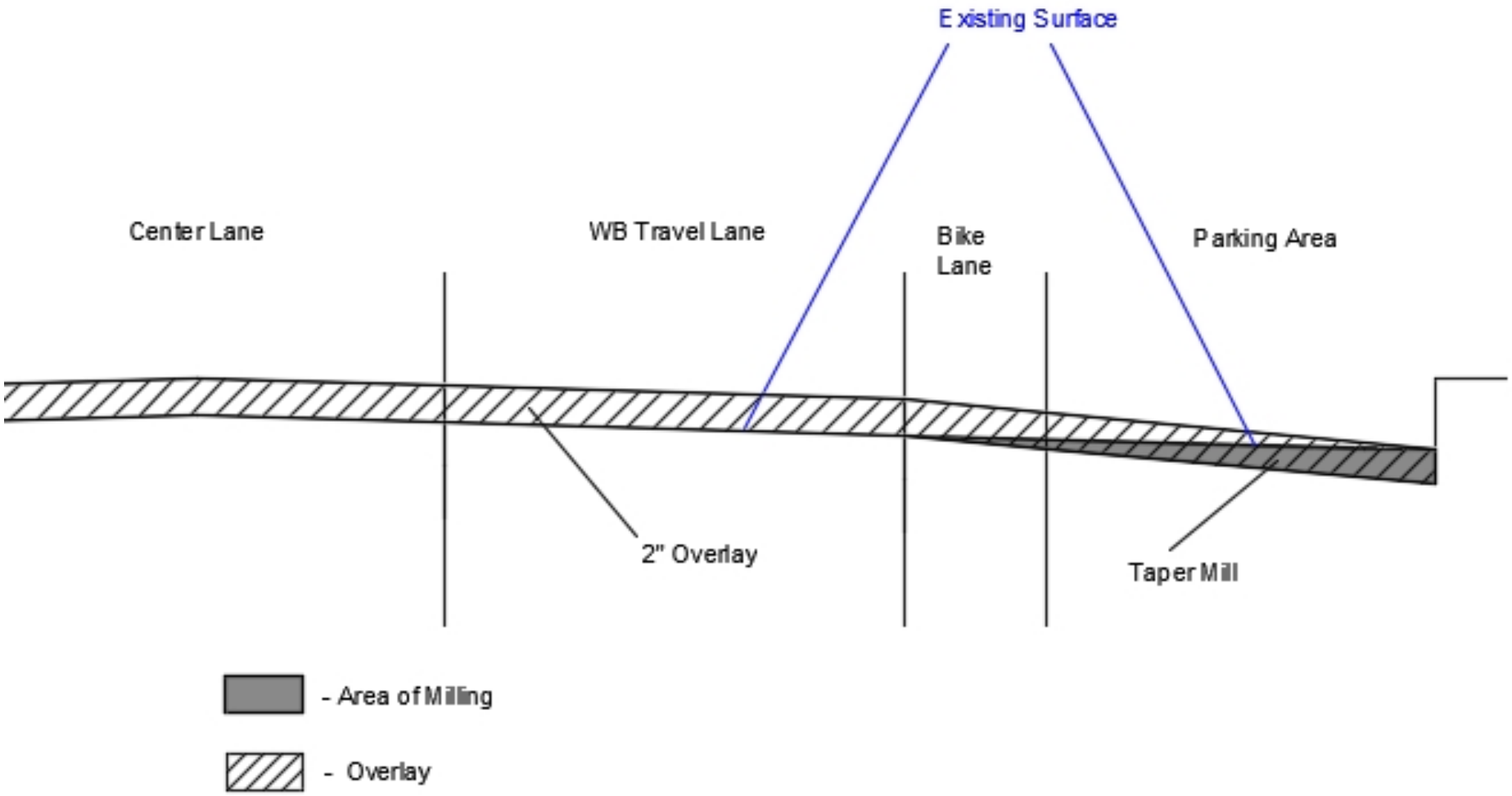
Methodology:

- Project Recommendations
  1. Structural requirements
  2. Grade constraints
  3. Reflective cracking

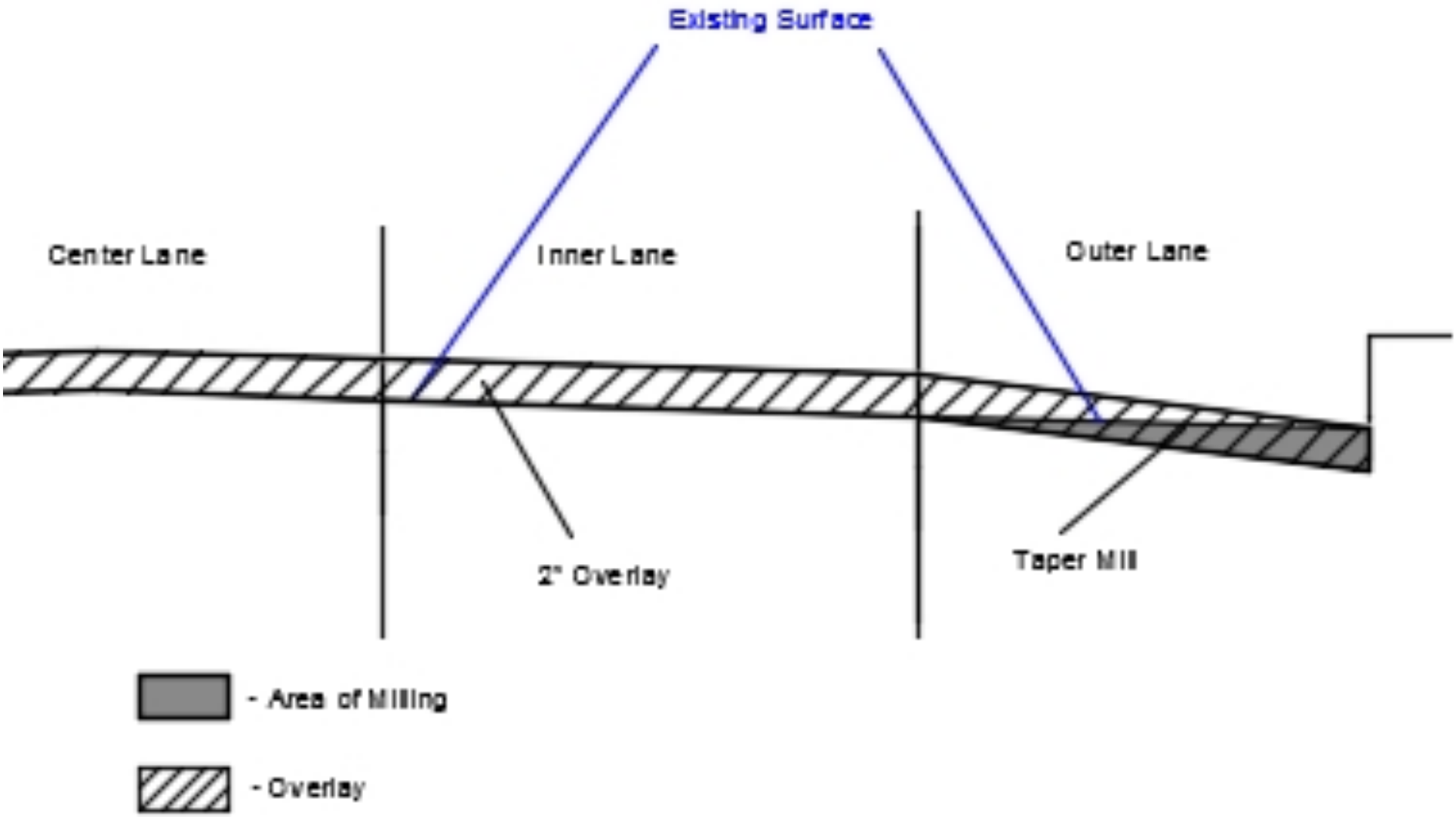


Grade Constraints

Grade Constraints



Grade Constraints



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Project Level Evaluation

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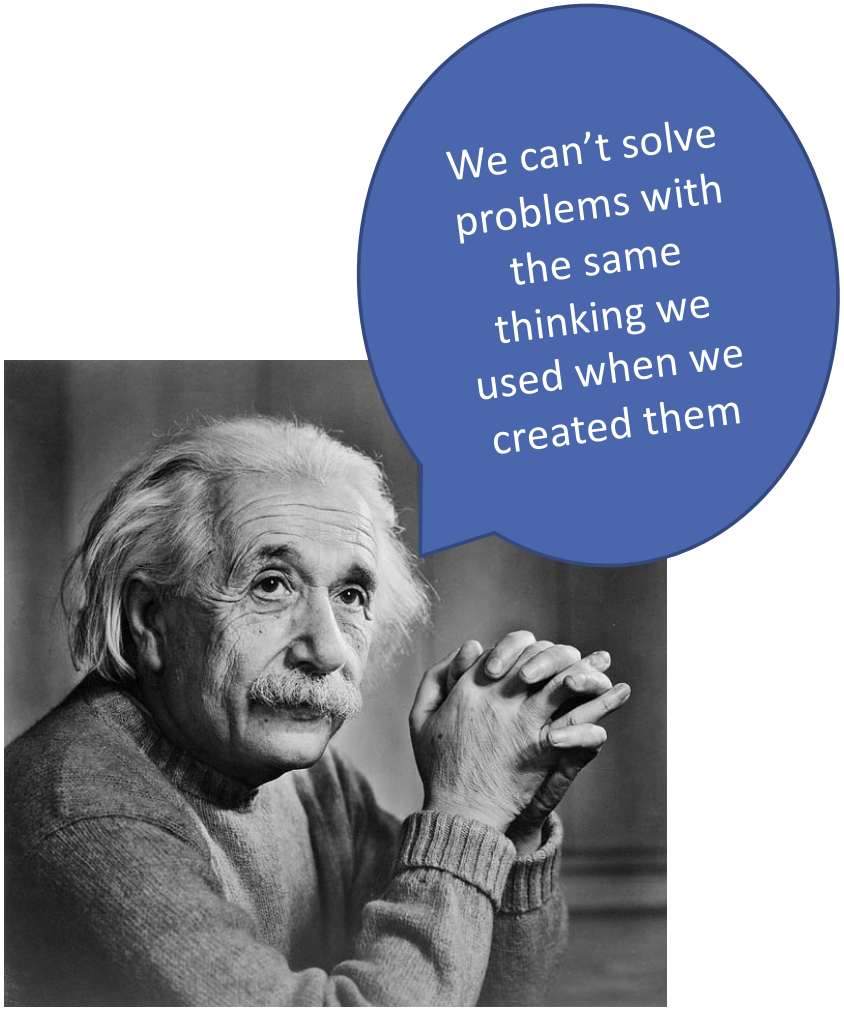
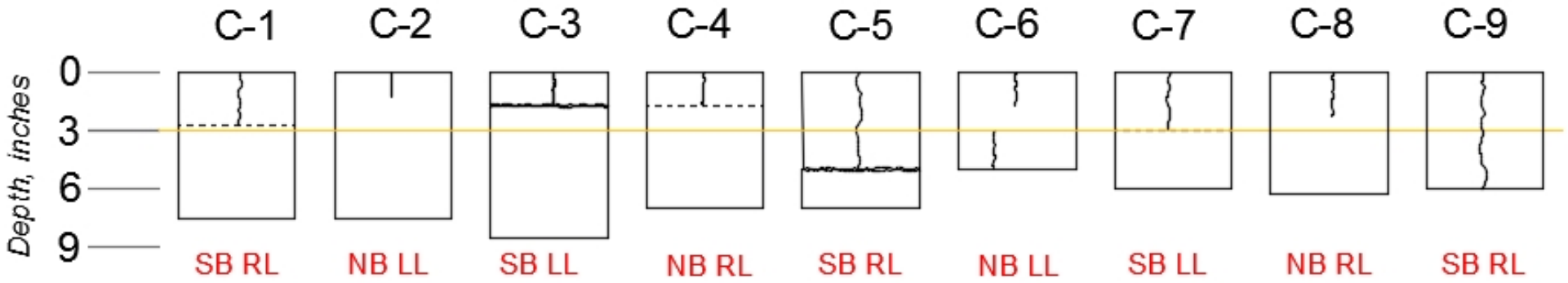


Reflective Cracking

Reflective Cracking



Case Study

Avoiding Pitfalls When Moving From PMS Output → Project Recommendations

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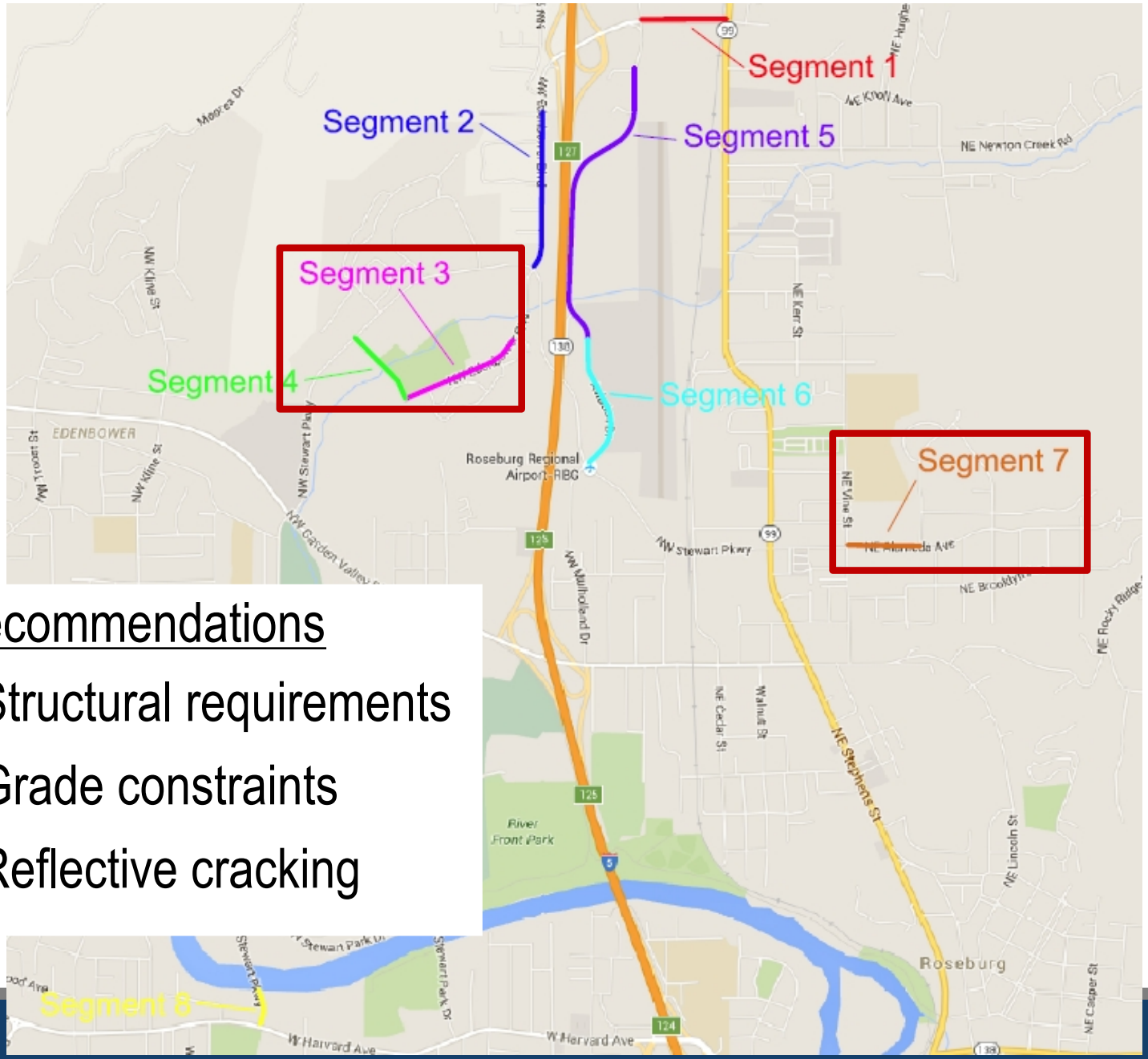
PMS Output

Segment	Project Location	Project Year	Street Classification	PCI	Decision Tree M&R Recommendation
7	Alameda	2016	Collector	62	2” Overlay
5-6	Aviation	2016	Collector	63	2” Overlay
1-3	Edenbower	2016	Arterial/ Collector	63	2” Overlay
4	Rennan	2016	Collector	62	2” Overlay
8	Stewart	2016	Arterial	58	3-4” Grind/Inlay

Project Level Evaluation

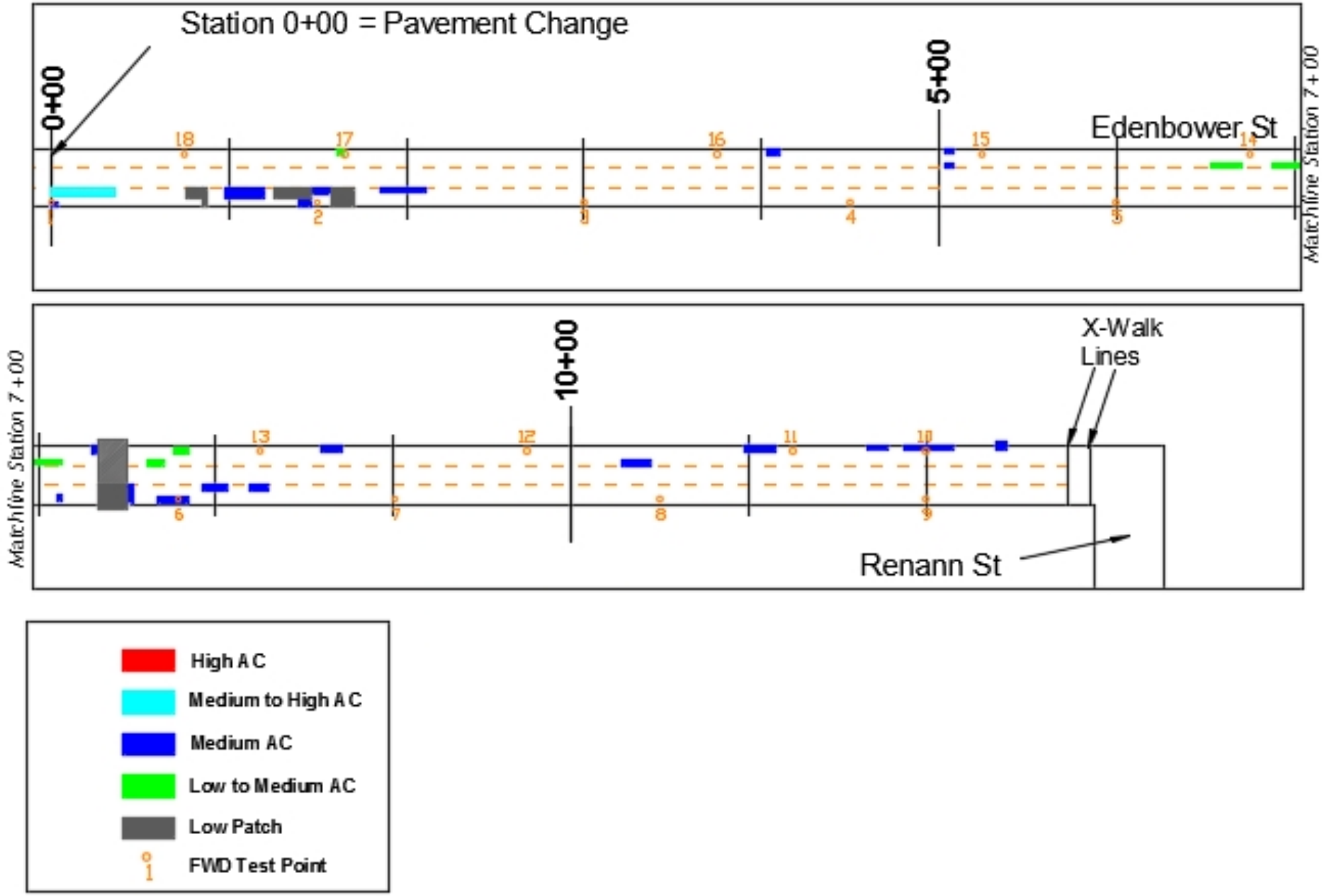


Project Recommendations

1. Structural requirements
2. Grade constraints
3. Reflective cracking

Project Level Evaluation - Edenbower

Visual Survey



Project Level Evaluation - Edenbower

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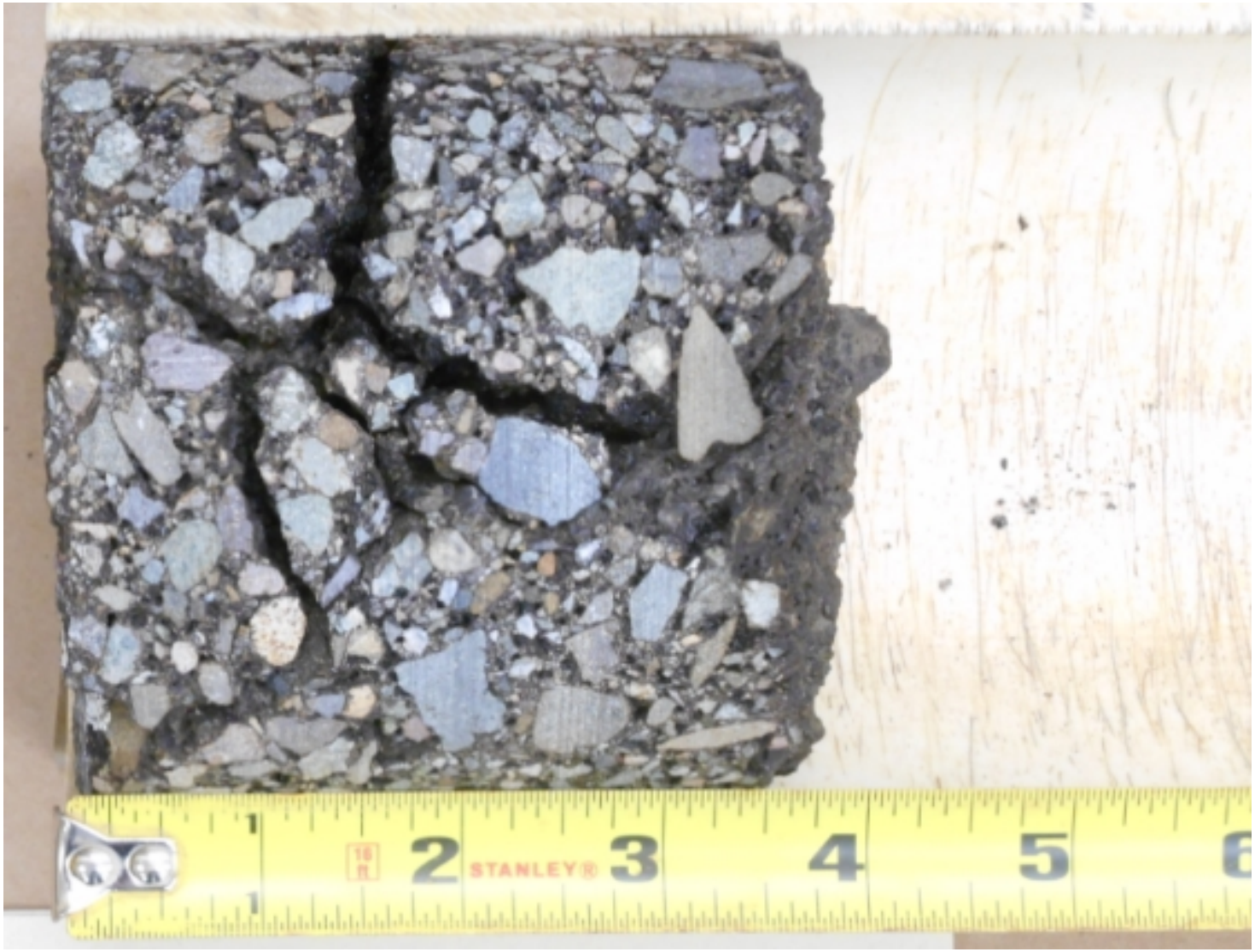

Project Level Evaluation - Edenbower

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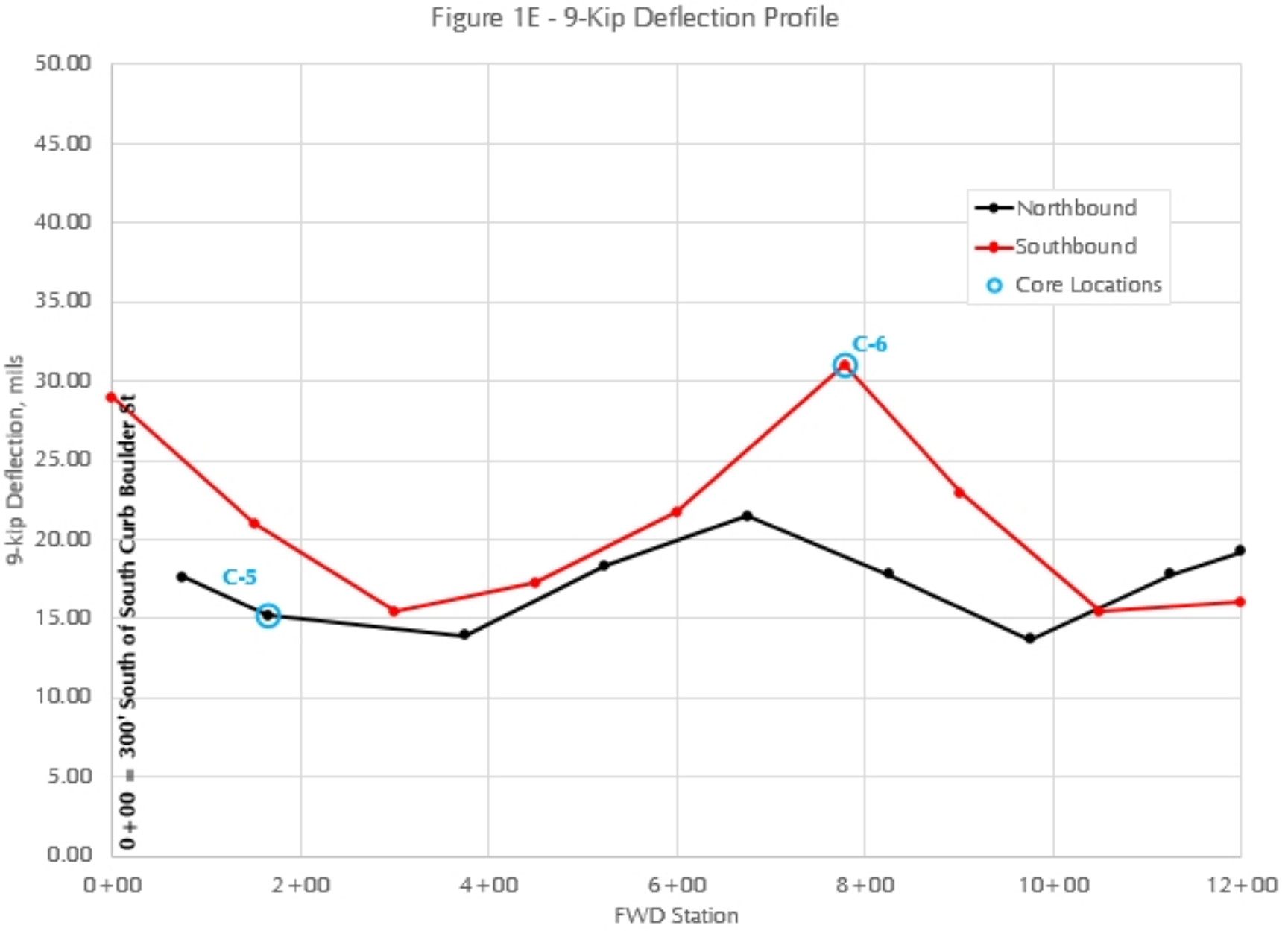
Project Level Evaluation - Edenbower

FWD Testing - Edenbower

FWD Results - Edenbower



FWD Analysis - Edenbower

Test No.	Test Station	Dir	Unit	D0, mils	Controlling Overlay, in.	Controlling Overlay above the Milled Surface with 2-in. of Milling, in.
1	0+00	SB	Repair	28.93	4.57	5.77
2	1+50	SB	Repair	21.03	2.32	3.98
3	3+00	SB	1	15.41	0.63	2.49
4	4+50	SB	1	17.29	0.90	2.40
5	6+00	SB	1	21.76	1.85	3.33
6	7+79	SB	Repair	31.02	4.40	5.66
7	9+01	SB	1	22.92	3.07	4.49
8	10+50	SB	2	15.49	0.28	2.36
9	12+00	SB	2	16.01	0.60	2.79

FWD Analysis - Edenbower

Statistical Summary					
Structural Unit #	From	To	Average D0, mils	Average Controlling Overlay, in.	Average Controlling Overlay above the Milled Surface with 2-in. Mill Depth, in.
Repair	0+00	12+00	25.05	3.18	4.59
1	0+75	9+75	18.04	1.64	3.31
2	10+50	12+00	16.44	0.59	2.40

Rehabilitation Recommendation

- Localized Dig Out Repairs
  - 5” AC
- 2” Mill
  - Tapered from 2” at the edge of travel lane to 3” at the curb
- 3” Overlay – This will raise the grade 1” in the travel lanes

Project level Evaluation - Alameda

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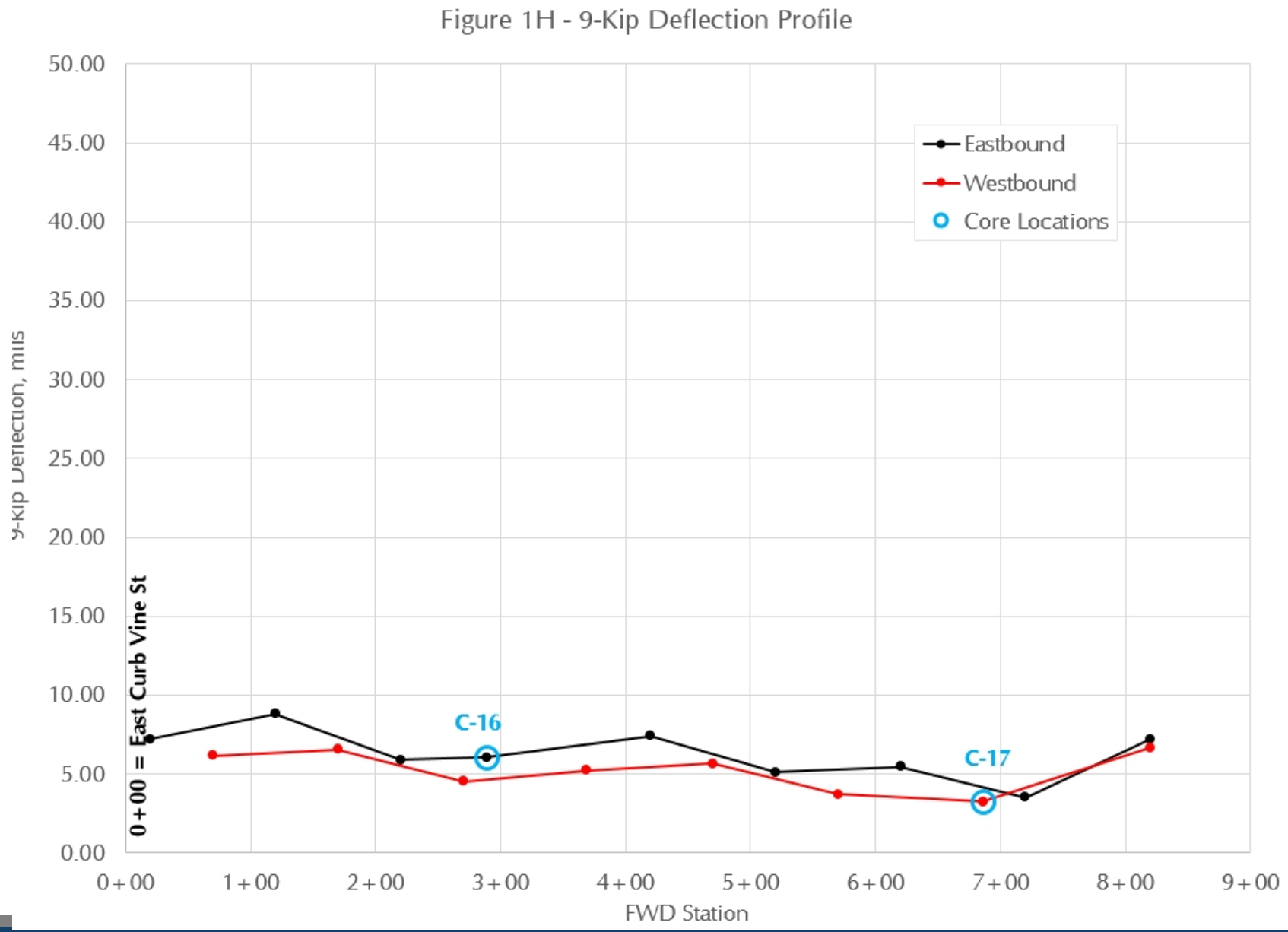
Project level Evaluation - Alameda

FWD Testing - Alameda

FWD Testing - Alameda



FWD Analysis - Alameda

Test No.	Test Station	Dir	Unit	D0, mils	Overlay Thickness above Existing Pavement, in.	Overlay Thickness above the Milled surface with 3.5-inch milling Depth
1	0+20	EB	1	7.23	zero	zero
2	1+20	EB	1	8.81	zero	zero
3	2+20	EB	1	5.9	zero	zero
4	2+89	EB	1	6.03	zero	zero
5	4+20	EB	1	7.42	zero	zero
6	5+20	EB	1	5.1	zero	zero
7	6+20	EB	1	5.45	zero	zero
8	7+20	EB	1	3.52	zero	zero
9	8+20	EB	1	7.21	zero	zero
10	8+20	WB	1	6.68	zero	zero

FWD Analysis - Alameda

Statistical Summary

Structural Unit #	From	To	Dir	Average D0, mils	Average Overlay , in.	Average Overlay above the Milled Surface (3.5-in. Mill Depth), in.
1	0+20	8+20	Both	5.79	zero	zero

Rehabilitation Recommendation

- No Strengthening Required
- Surface Rehabilitation Required due to Extensive Top-Down Random Cracking
- 4” Mill
- 4” Inlay
  - 2- 2” LIfts

Case Study

Applying Reasonableness in Your Project Recommendations

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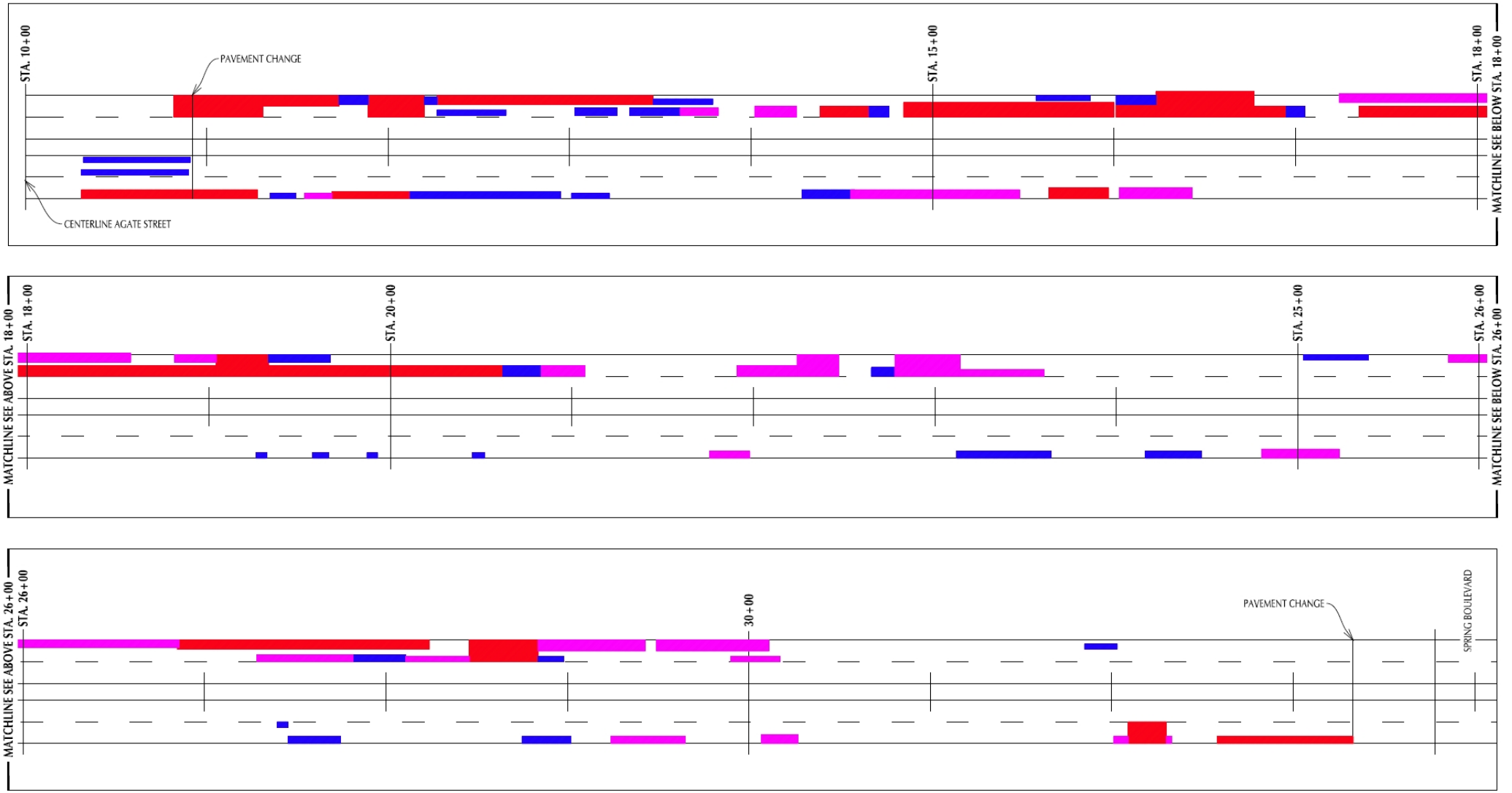
30th Ave

4- Lane, 2-Way AC Surface Roadway

Eastbound Lane

30th Ave

Visual Survey



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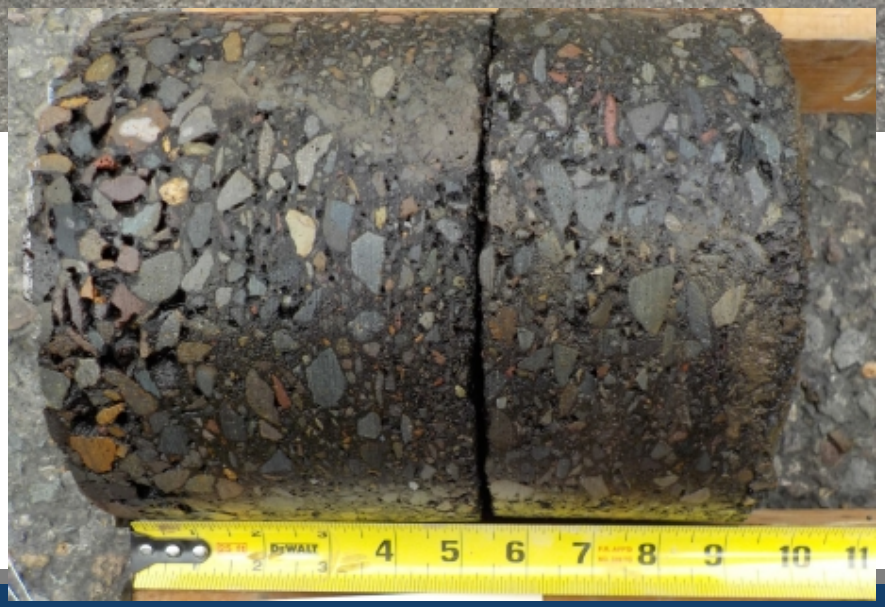
FWD & Coring



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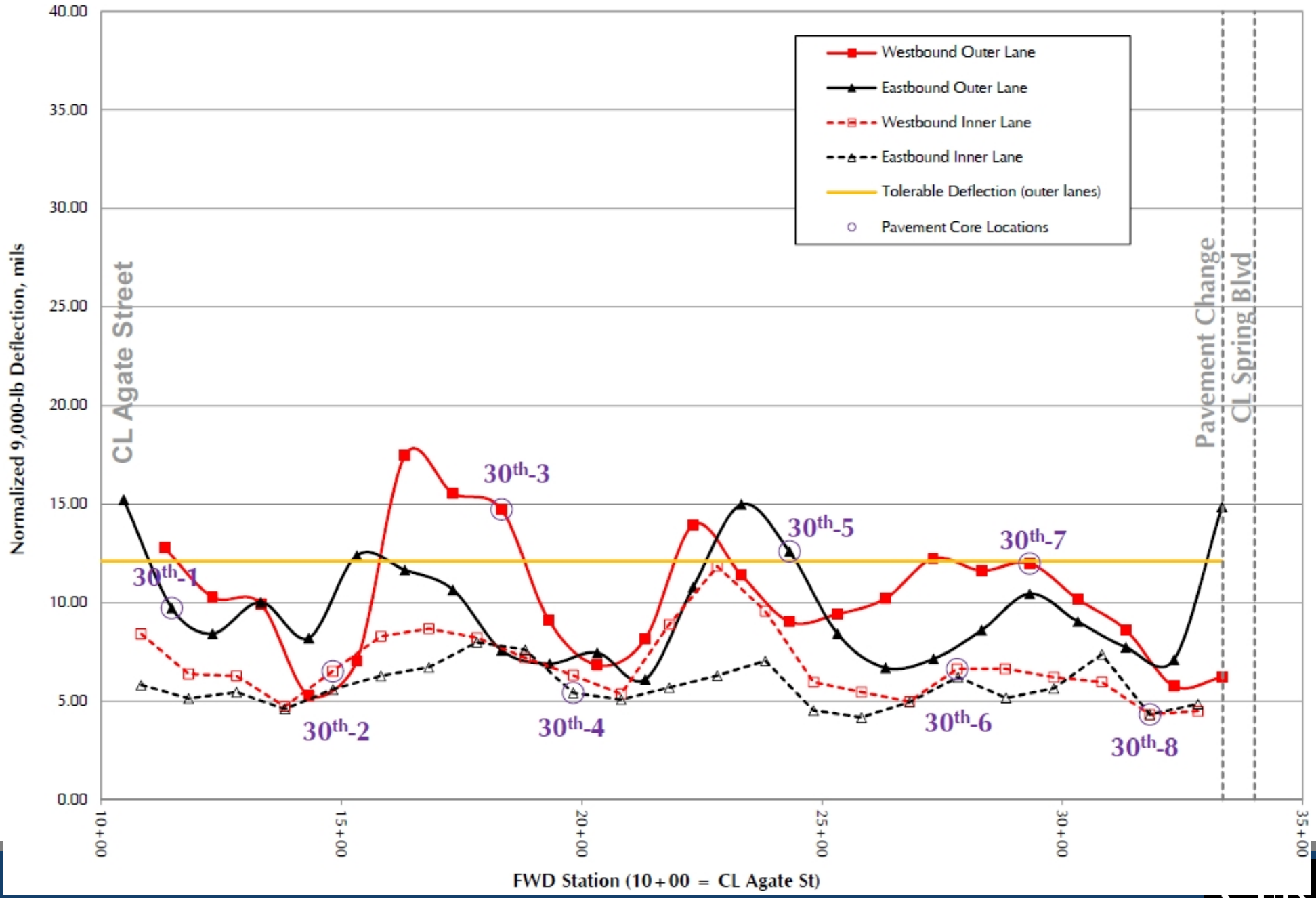
FWD Results


Westbound Outer Lane
Eastbound Outer Lane
Westbound Inner Lane
Eastbound Inner Lane
Tolerable Deflection (outer lanes)
Pavement Core Locations
CL Agate Street
Pavement Change
CL Spring Blvd
30th-1
30th-2
30th-3
30th-4
30th-5
30th-6
30th-7
30th-8
Normalized 9,000-lb Deflection, mils
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
10+00
15+00
20+00
25+00
30+00
35+00
FWD Station (10+00 = CL Agate St)

Rehabilitation Recommendation

Outer Lanes

- Partial Depth Reconstruction due to Significant % of Fatigue Cracking

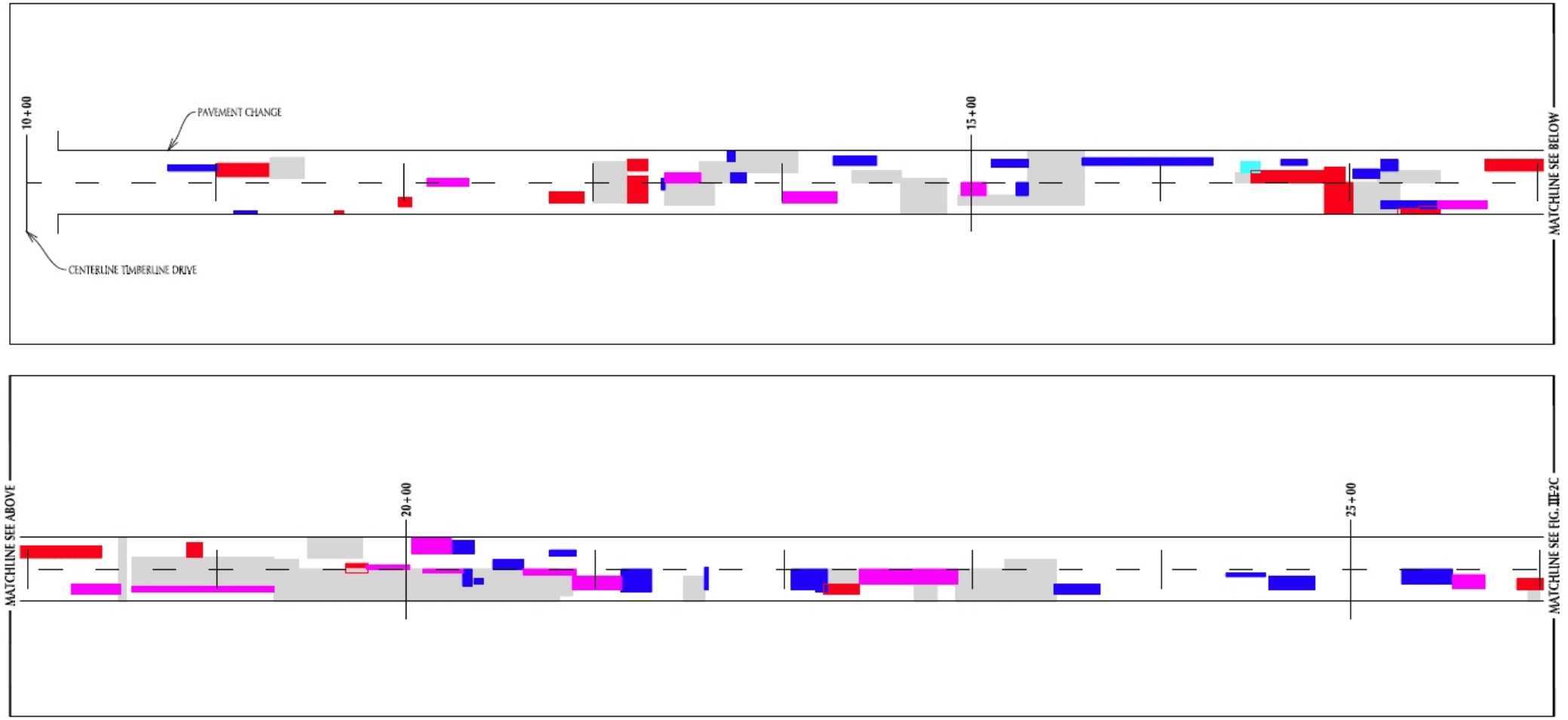
Inner Lanes

- No Strengthening Required
- 2” Overlay/Inlay to Rehabilitate the Surface

Wilshire Dr.

Wilshire Dr.

Visual Survey



LEGEND

- HIGH SEVERITY ALLIGATOR CRACKING
- MEDIUM TO HIGH SEVERITY ALLIGATOR CRACKING
- MEDIUM SEVERITY ALLIGATOR CRACKING
- MEDIUM SEVERITY PATCH
- LOW SEVERITY PATCH

North

0 50 100 FT

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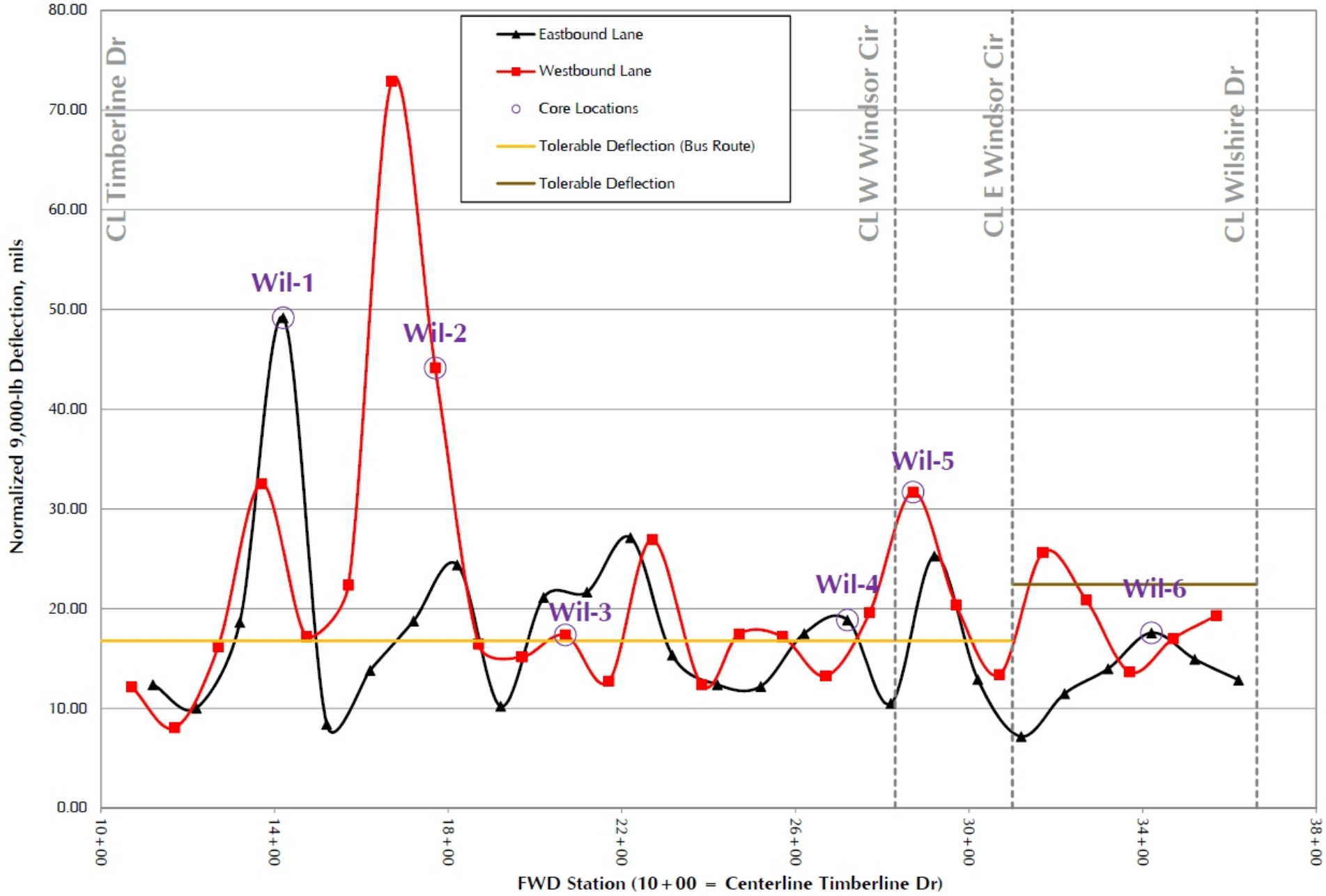
PAVEMENT CONDITION MAP
(WILSHIRE LANE)

Coring

FWD Results


Eastbound Lane
Westbound Lane
Core Locations
Tolerable Deflection (Bus Route)
Tolerable Deflection
CL Timberline Dr
CL W Windsor Cir
CL E Windsor Cir
CL Wilshire Dr
Wil-1
Wil-2
Wil-3
Wil-4
Wil-5
Wil-6
Normalized 9,000-lb Deflection, mils
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
10+00
14+00
18+00
22+00
26+00
30+00
34+00
38+00
FWD Station (10+00 = Centerline Timberline Dr)

Rehabilitation Recommendation

Western Portion

- Reconstruction due to Significant % of Fatigue Cracking and Patching

Eastern Portion

- 2” Mill
  - Tapered from 2” at the edge of travel lane to 3” at the curb
- 3” Overlay – This will raise the grade 1” in the travel lanes

Thank You!

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