Route 1

Milepost 8 to 14.5

From CR 533 (Quakerbridge Rd) to Ridge Rd

2019 NJ Asphalt Paving Conference

VAHID GANJI, Ph.D., P.E.

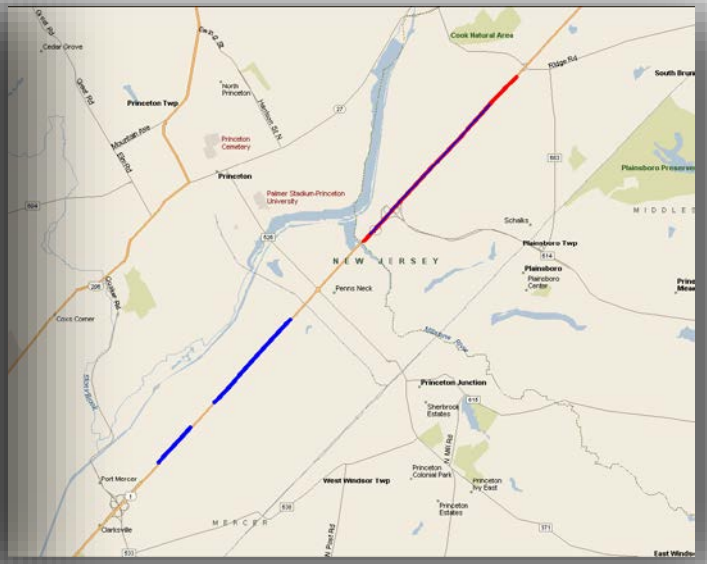
YASHVI PATEL, P.E.

Pavement Designer:	Vahid Ganji, Ph.D., P.E., Michael Baker International
Pavement Designer:	Yashvi Patel, P.E., NJDOT
Field Manager:	George Carroll
Resident Engineer:	Rajesh Kabaria
Assistant RE:	Yashvi Patel, P.E.
Prime Contractor:	Della Pello Paving
Subcontractor:	Trap Rock Industries

Pavement Evaluation

Pavement Evaluation Scope of Work

- Ground Penetrating Radar (GPR) Testing
- Coring
- Falling Weight Deflectometer (FWD) Testing
- Visual Pavement Distress Survey
- As-Built Review
- Roadway Geometry Survey
- Pavement Design Recommendation
- Project Cost Estimate



GPR Testing

Benefits of GPR Testing:

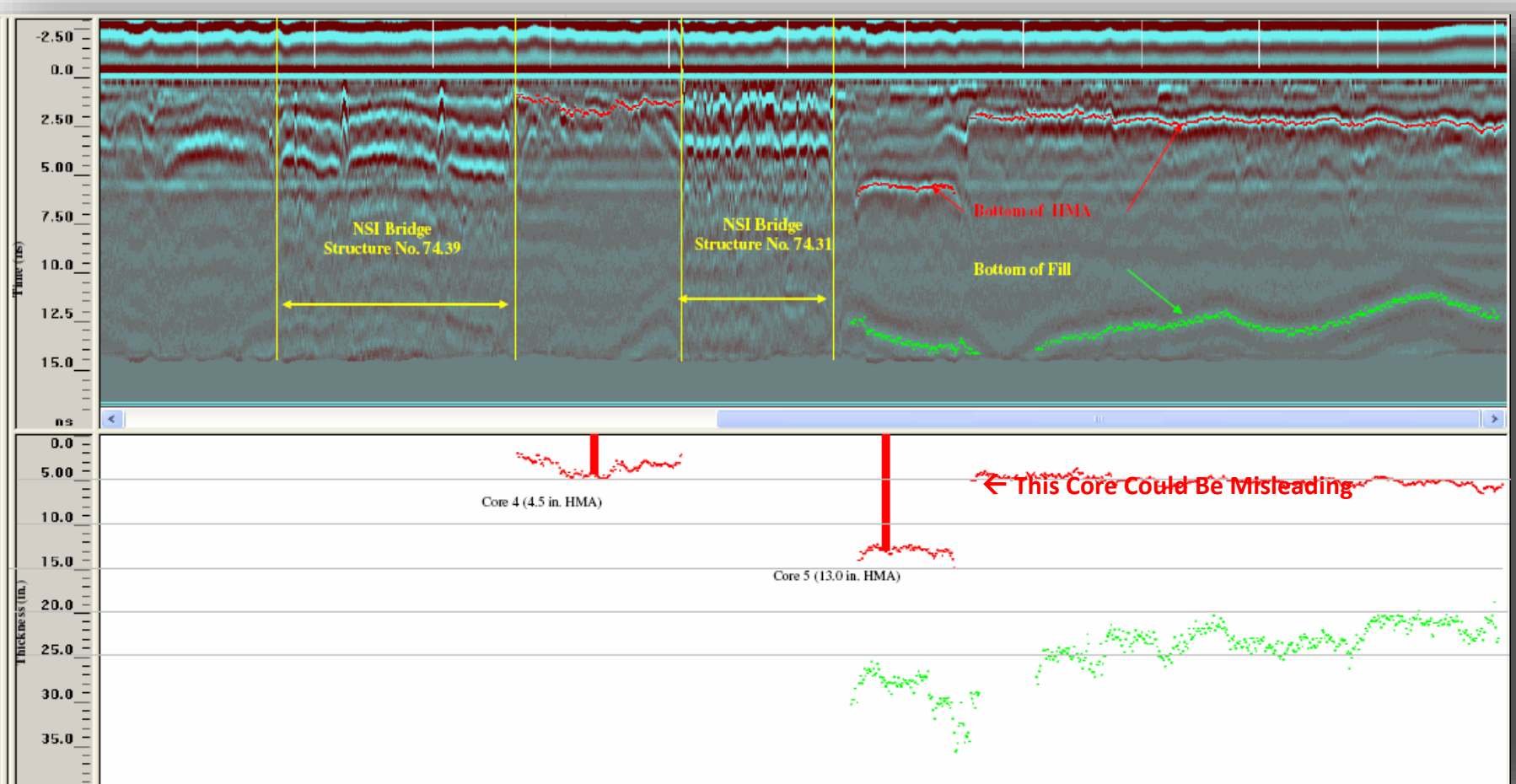
Increased Safety

No Interruptions to Traffic

Cost-Savings

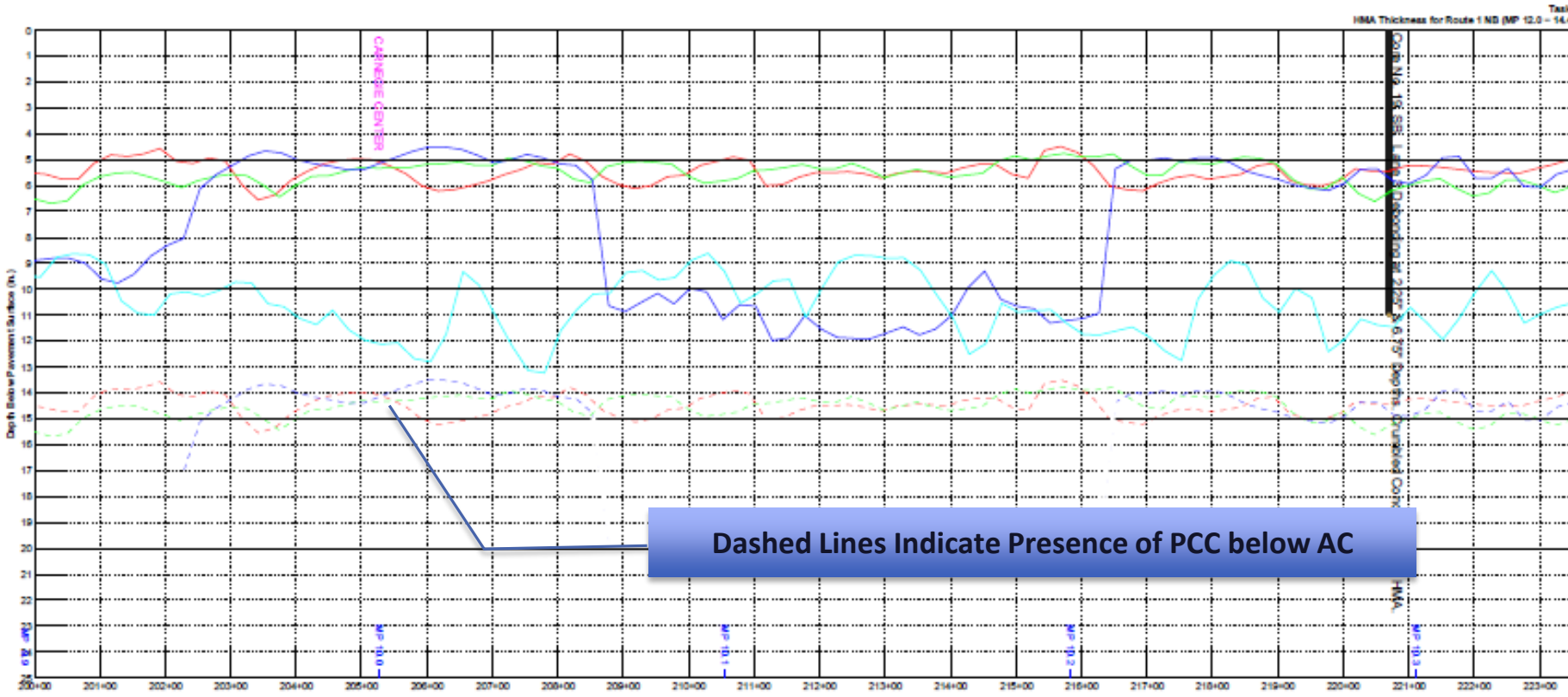
Continuous Data

Continuous Pavement Layer Thicknesses Compared to Individual Cores



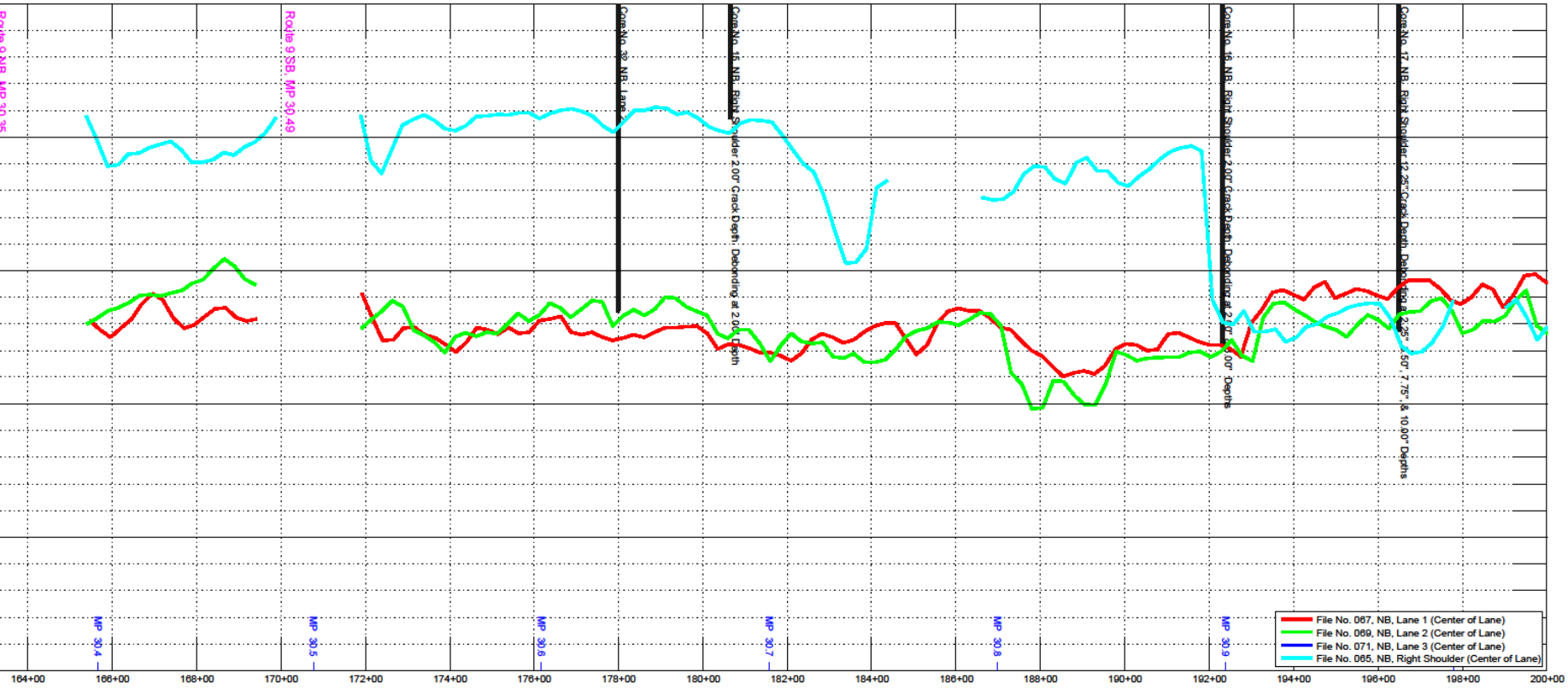
GPR Testing

Typical GPR Results



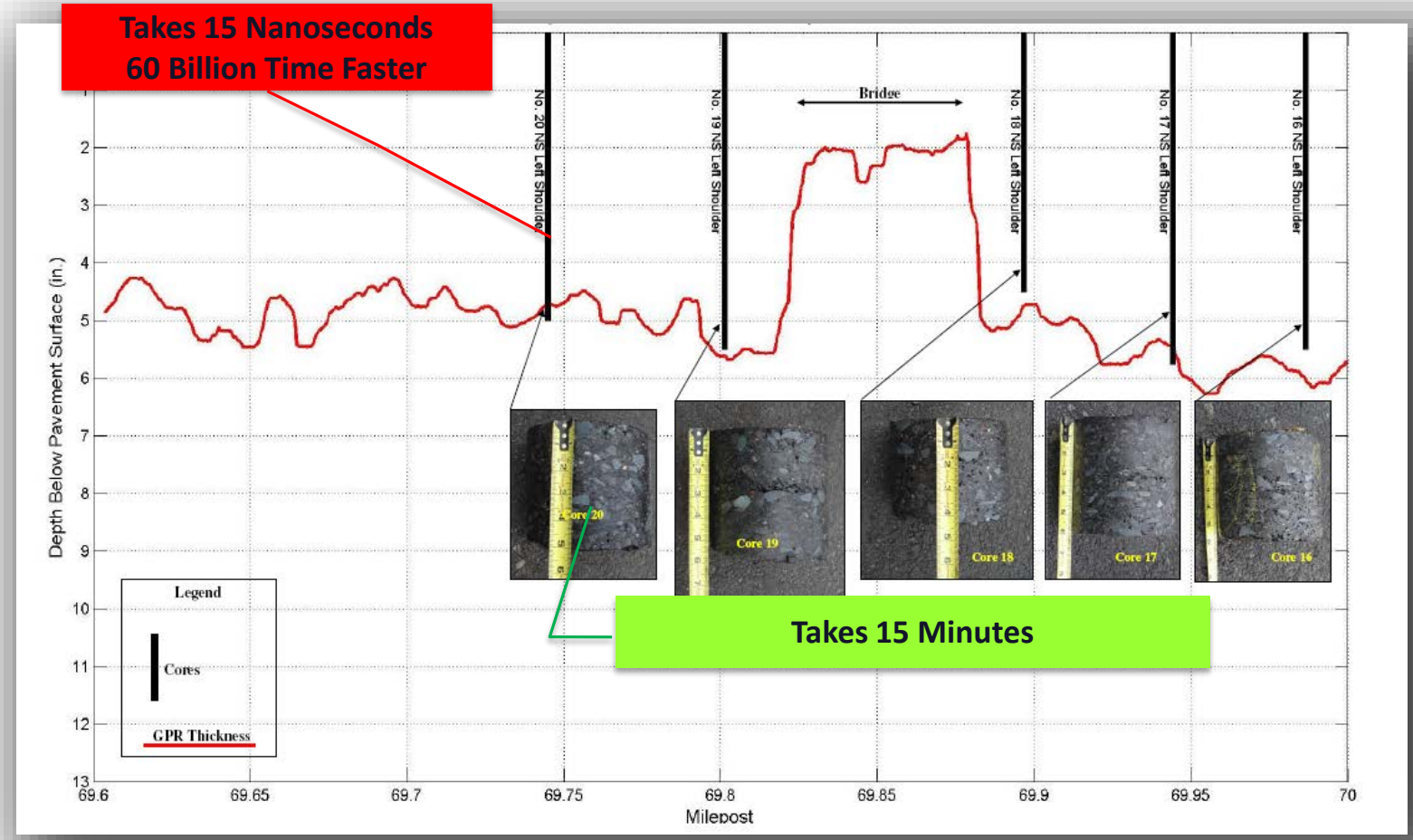
GPR Testing

Typical GPR Results



GPR Testing

Continuous Pavement Layer Thicknesses Compared to Individual Cores (Literally at Speed of Light)



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FWD Testing

Benefits of FWD Testing:

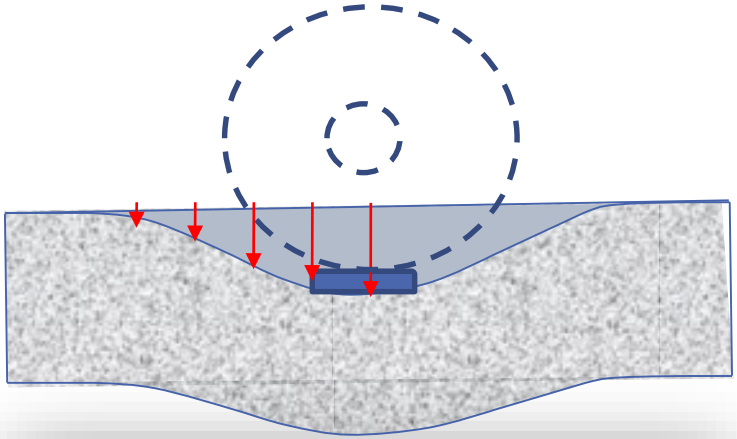
Nondestructive

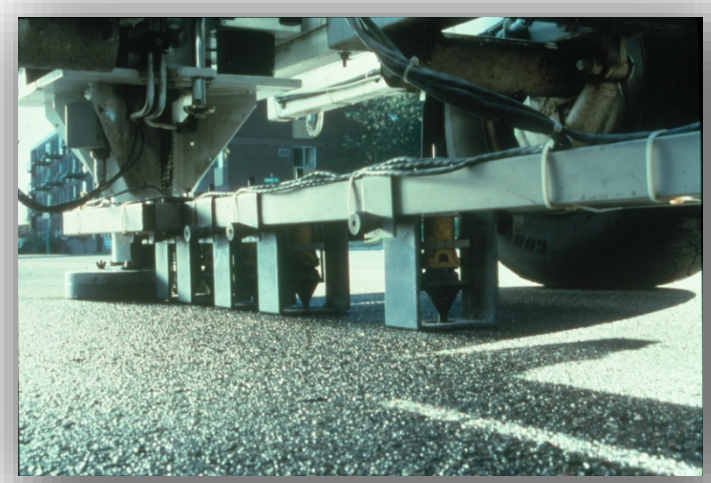
Simulates Wheel Loads

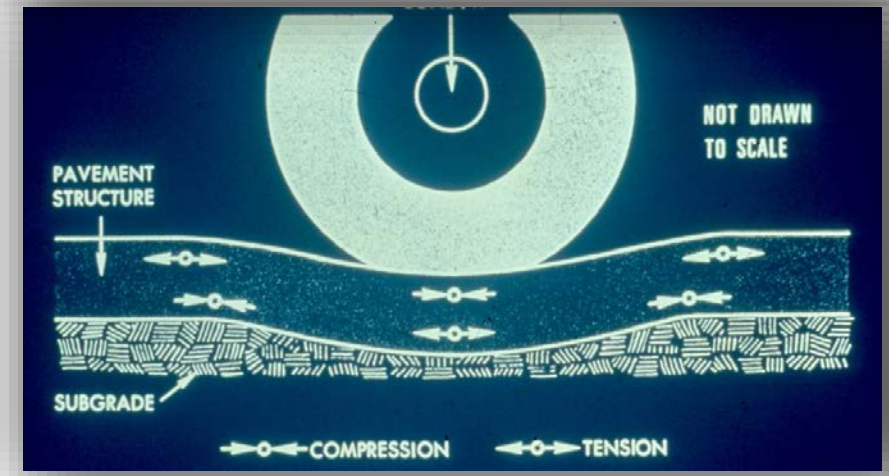
Fast (1 min/test)

Cost-Savings

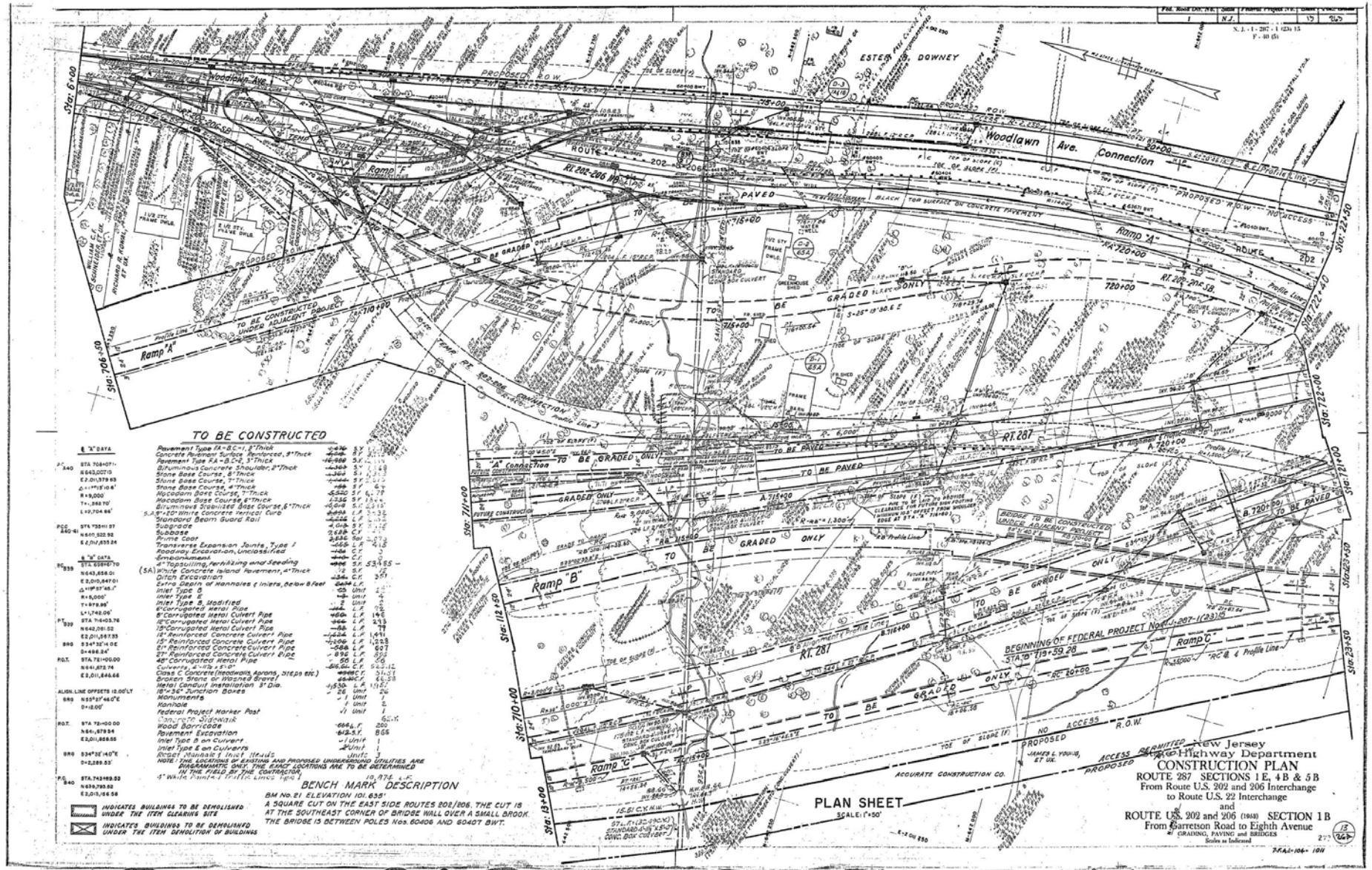
Objective Data Highly Recommended by FHWA







As-Built Review



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Visual Pavement Distress Survey

Remaining Service Life Analysis and Pavement Design

Pavement Sectionalization

Minimum 10 years Required

Baker

Task Order 2, Pavement Project Scoping and Design
Route 1 NB (MP 12.0 - 14.4) and Route 1 SB (MP 8.5 - 9.2, MP 9.6 - 10.8, and MP 12.1 - 14.0)

Prepared By: V. Ganji 09/24/13
Checked By: M. Graubart 09/30/13

Table 1. Summary of Pavement Evaluation and Service Life Analysis for Route 1 Northbound

Section No.	Pavement Type	Milepost From	Milepost To	Approximate HMA Thickness (in)	Approximate PCC Thickness (in)	Normalized Pavement Deflection (mils)	Average HMA Modulus (ksi)	Slab Performance: Average PCC Modulus (ksi)	Slab Performance: Modulus of Subgrade Reaction (psi/in)	Joint Performance: Normalized Joint Deflection (mils)	Joint Performance: Load Transfer (%)	Joint Performance: Joint Intercept (mils)	Flexible Pavements: Effective Structural Number	Flexible Pavements: Subgrade Resilient Modulus (psi)	General Pavement Conditions	Main Distresses[1]	Expected Service Life (Years) after Mill 2.0 in & Overlay: 2.0 in HMA	2.5 in HMA	3.0 in HMA	3.5 in HMA	4.0 in HMA	Mill 3.0 in & Overlay: 3.0 in HMA	3.5 in HMA	4.0 in HMA	4.5 in HMA	5.0 in HMA	Mill 4.0 in & Overlay: 4.0 in HMA	4.5 in HMA	5.0 in HMA	5.5 in HMA	6.0 in HMA	Reconstruct	Comments
01	Flexible	309+30 MP 11.98	315+60 MP 12.10	14	0	3.1	600	---	---	---	---	---	9.7	12000	Good	16L	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20		Not part of project. Resurfaced circa 2010
02	Flexible	315+60 MP 12.10	391+00 MP 13.53	9	0	9.9	140	---	---	---	---	---	4.8	9600	Poor	Lane(s): 1L, 13L-H, 16M, 4M, 5M-H, 7M, 8M-H; Shoulder: 13L, 2L, 4L	6	8	10	13	17	8	10	13	16	>20	10	13	16	>20	>20		Resurfaced Circa 2005
03	Composite	391+00 MP 13.53	410+00 MP 13.89	7	9	4.3	280	8900	80	8.0	79	1.00	---	---	Poor	Lane(s): 5M-H; Shoulder: 13L, 4L	7	9	10	12	14	8	9	11	13	15	8	10	12	14	17		Resurfaced Circa 2005
04	Composite	410+00 MP 13.89	421+50 MP 14.10	7	9	3.5	270	11700	90	6.0	100	0.00	---	---	Poor	Lane(s): 13L, 16H, 5H, 9L; Shoulder: 13L	13	15	18	>20	>20	14	17	20	>20	>20	15	18	>20	>20	>20		Resurfaced Circa 2005
05	Composite	421+50 MP 14.10	439+15 MP 14.43	5	9	3.8	280	11200	90	5.0	87	0.00	---	---	Poor	Lane(s): 1L, 13L-M, 5H, 8M-H, 9L; Shoulder: 13L	7	8	10	12	14	7	9	11	13	15	8	10	12	14	17		Resurfaced circa 2005.

General Notes: Perform pavement repairs with HMA patch after milling if deteriorated pavement is observed. This will be an incidental "If & Where Directed" item.

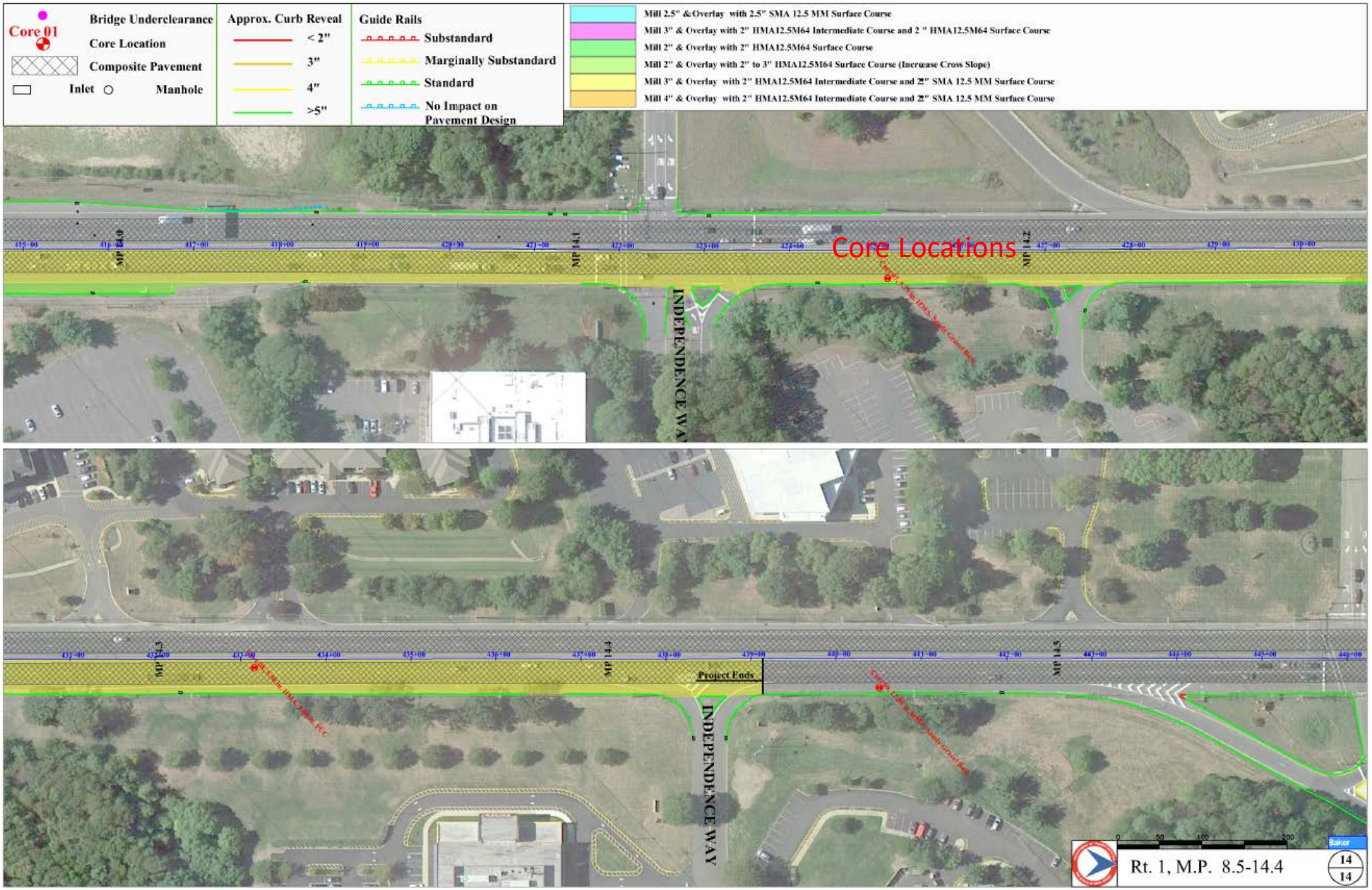
Notes: Average 20-Year Design Flexible and Rigid ESAL's is 22,460,000 and 34,830,000, respectively.

SHRP LTPP Distress Codes:

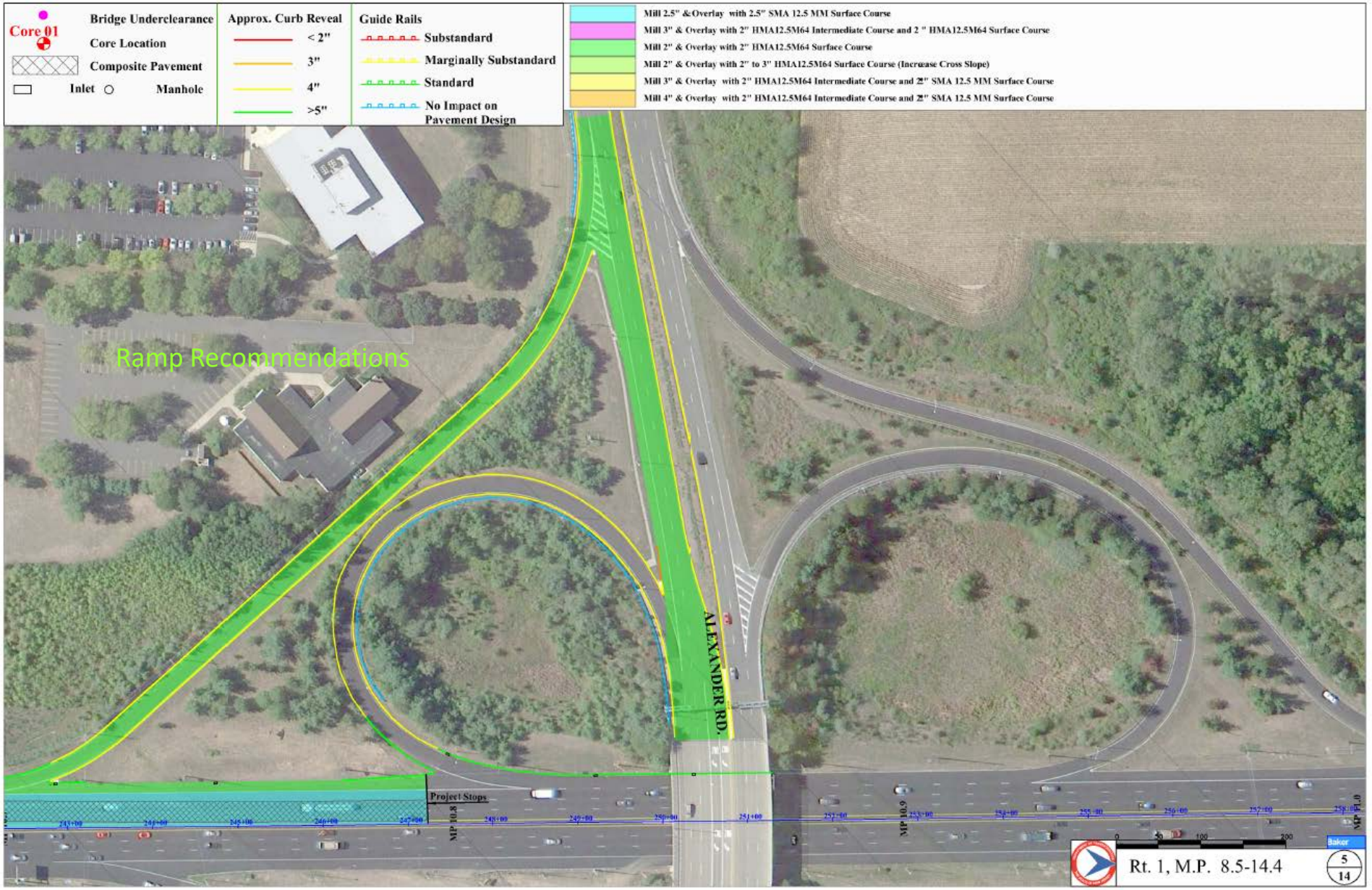
* 1: Fatigue Cracking, 2: Block Cracking, 3:Edge Cracking, 4: Longitudinal Cracking, 5: Reflection Cracking, 6: Transverse Cracking, 7: Patches, 8: Potholes, 9: Rutting, 10: Shoving, 13: Raveling, 14: Lane-to-Shoulder Dropoff
16: Construction Joint Deterioration (Not a SHRP LTPP Code), 17: Topdown Cracking (Not a SHRP LTPP Code), 18: Joint/Slab Blowup (Not a SHRP LTPP Code)
L: Low Severity, M: Medium Severity, H: High Severity

Pavement sectionalization involves analytical sections – sections with uniform pavement type and thickness, traffic loading, and pavement condition. For practical reasons and constructability, the analyzed sections are combined for pavement rehabilitations. Other factors such as schedule, geometry constraints, project needs other than pavement, and budget during PE and FE need to be considered before final pavement design recommendation.

Pavement Design Recommendations Summary



Pavement Design Recommendations Summary



Cost Estimate

Baker

Task Order 2, Pavement Project Scoping and Design
Route 1 NB (MP 12.0 - 14.4) and Route 1 SB (MP 8.5 - 9.2, MP 9.6 - 10.8, and MP 12.1 - 14.0)

Prepared BY: V. Ganji Date: 5/29/2013
Checked By: M. Graubart Date: 5/30/2013

Table 5. Cost Estimate for Route 1 NB (MP 12.0 - 14.4) and Route 1 SB (MP 8.5 - 9.2, MP 9.6 - 10.8, and MP 12.1 - 14.0)

Analysis Period= 10 Base Year= 2014
Discount Rate Applied= 2.7% Region= North
Project Length= 35,537 (6.73 Miles) (One Directional Length)

Alternative 1: Mill and Overlay

ACTIVITY YEAR 2014 / PERFORMANCE 20 YEARS	ITEM	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NPV
Initial Rehabilitation: Mill and Overlay		**Project Classification:**	**4. Resurfacing**		**Project Cost Category:**		**$5 to $10 Million**
	401009P	HMA MILLING, 3" OR LESS	SY	$3.50	215,000	$753,000	
	401012P	HMA MILLING, MORE THAN 3" TO 6"	SY	$4.20	38,000	$160,000	
	404006M	STONE MATRIX ASPHALT 12.5 MM SURFACE COURSE	T	$100.00	21,000	$2,100,000	
	401054M	HOT MIX ASPHALT 12.5 M 64 SURFACE COURSE	T	$80.00	11,000	$880,000	
	401072M	HOT MIX ASPHALT 12.5 M 64 INTERMEDIATE COURSE	T	$70.00	10,000	$700,000	
	401030M	TACK COAT	GAL	$3.25	24,000	$78,000	
	401021M	HOT MIX ASPHALT PAVEMENT REPAIR	SY	$80.00	100	$8,000	
	453006M	FULL DEPTH CONCRETE PAVEMENT REPAIR, HMA	SY	$170.00	250	$43,000	
	610003M	TRAFFIC STRIPES, LONG LIFE, EPOXY RESIN 4"	LF	$0.60	95,000	$57,000	
	652432M	RESET MANHOLE, SANITARY SEWER, USING EXISTING CASTING	U	$500.00	30	$15,000	
	401027M	POLYMERIZED JOINT ADHESIVE	LF	$0.55	180,000	$99,000	
	020011C21E	PERFORMANCE BOND AND PAYMENT BOND	LS	$42,500.00	1	$43,000	
	020011D21C	FINAL CLEANUP	LS	$10,000.00	1	$10,000	
	020011E21C	CONSTRUCTION LAYOUT	LS	$50,000.00	1	$50,000	
	020011G13I	OWNER'S AND CONTRACTOR'S PROTECTIVE LIABILITY INSURANCE	LS	$10,000.00	1	$10,000	
	020011H21C	PROGRESS SCHEDULE	LS	$10,000.00	1	$10,000	
	020011F21D	FUEL PRICE ADJUSTMENT	LS	$32,000.00	1	$32,000	
	020014D21E	ASPHALT PRICE ADJUSTMENT	LS	$138,000.00	1	$138,000	
	020012A21C	CLEARING SITE	LS	$50,000.00	1	$50,000	
	020011H21D	MOBILIZATION					
				Year 2014 Subtotal		**$5,300,000**	
				7 % Maintenace & Protection of Traffic		**$380,000**	
				12 % Mobilization		**$690,000**	
				5 % Contingency		**$320,000**	
				Year 2014 Total Cost		**$6,700,000**	
				Net Present Value			**$6,700,000**

Estimated Pavement Cost $6.7 Million (Pavement Only)

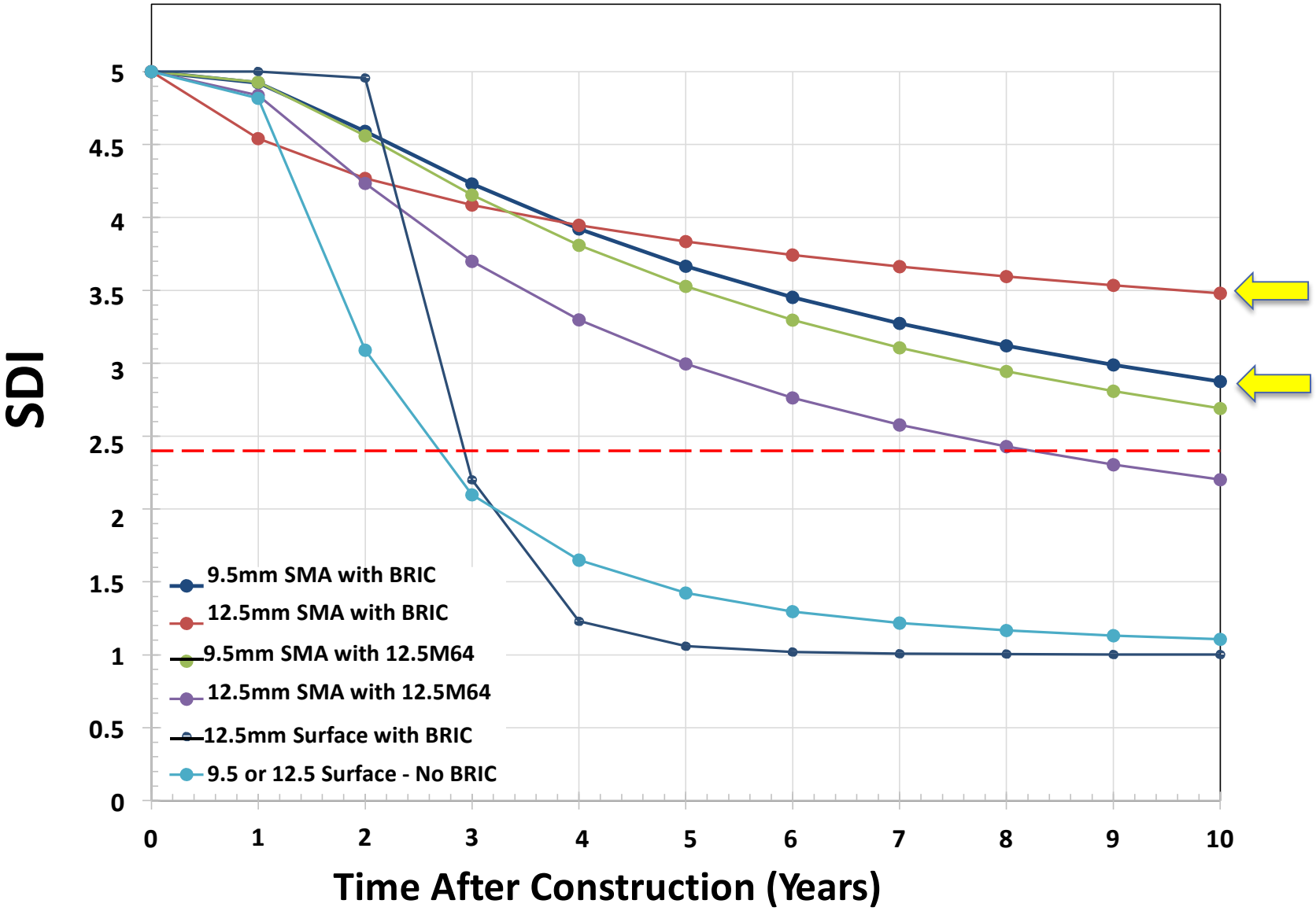
Pavement Recommendation

- Surface Distress Index (SDI): 1.84
- Existing International Roughness Index (IRI): 128 in/mile
- 20 years design ESAL's: ~ 34.93 million for composite pavement & 22.46 million for flexible pavement in the northbound direction and 28.57 million and 18.30 million in the southbound direction.
- Treatment Performance: last treatment performed on this section was mill 2" and pave 2" Surface Course in 2005
- Overlay Design consisted of milling 3" depth and resurfacing with:
  - 2" Stone Matrix Asphalt 12.5 MM Surface Course
  - 1" Binder Rich Intermediate Course, 4.75 MM

Binder Rich Intermediate Course, 4.75 MM

- Evaluated changes in SDI to evaluate performance of BRIC on New Jersey pavement sections
- BRIC analysis is difficult as it is always overlaid with a surface course
  - Compared performance with and without BRIC
  - Compared performance with different surface courses
  - Compared performance life for different scenarios
- Performance of BRIC material highly dependent on the surface course overlaying the BRIC

BRIC – Performance Analysis




UNDER
CONSTRUCTION

Surface Preparation & Issues

- Full Depth HMA Repair
- Manhole Reset
- Milling
- Tack Coat
- Forestdale Road Bridge

Test Strip

BRIC

- Location: Trap Rock Plant
- Number of rollers

SMA

- Location: Route 1
- Number of rollers

Material Usage

- BRIC
  - Total: 13349 T
  - Average Night: 785 T
  - Number of Nights: 17
- SMA
  - Total: 25826 T
  - Average Night: 1614 T
  - Number of Nights: 16

Ride Quality

- Before Paving

  SDI: 1.84

  Existing IRI: 128 inch/mile

  Target IRI: 63 inch/mile

  Required improvement: ~ 50%

- After Paving

  SDI: 5.0

  IRI: 43.8 Inch/mile

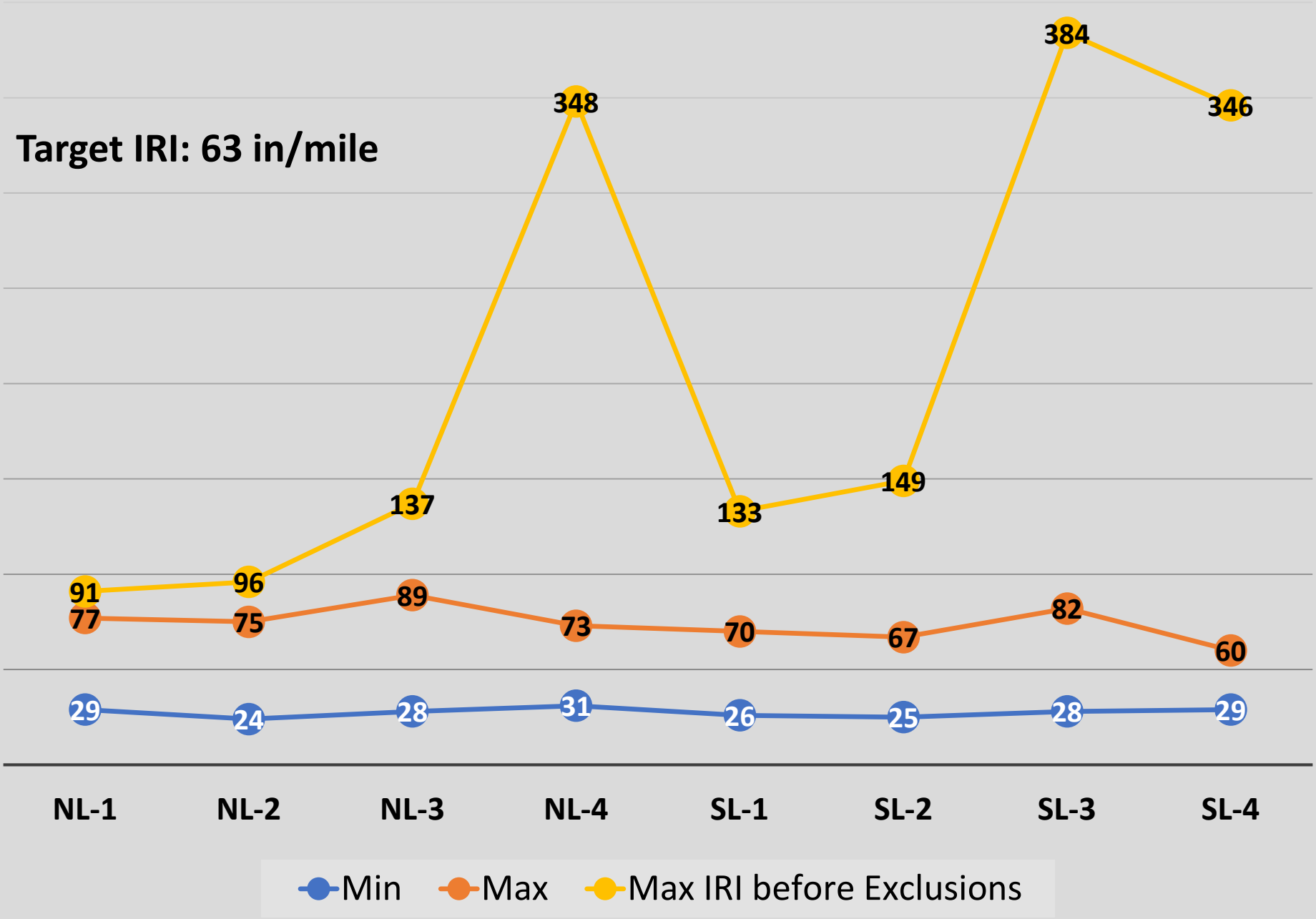
  Provided Improvement: ~ 66%

Exclusions

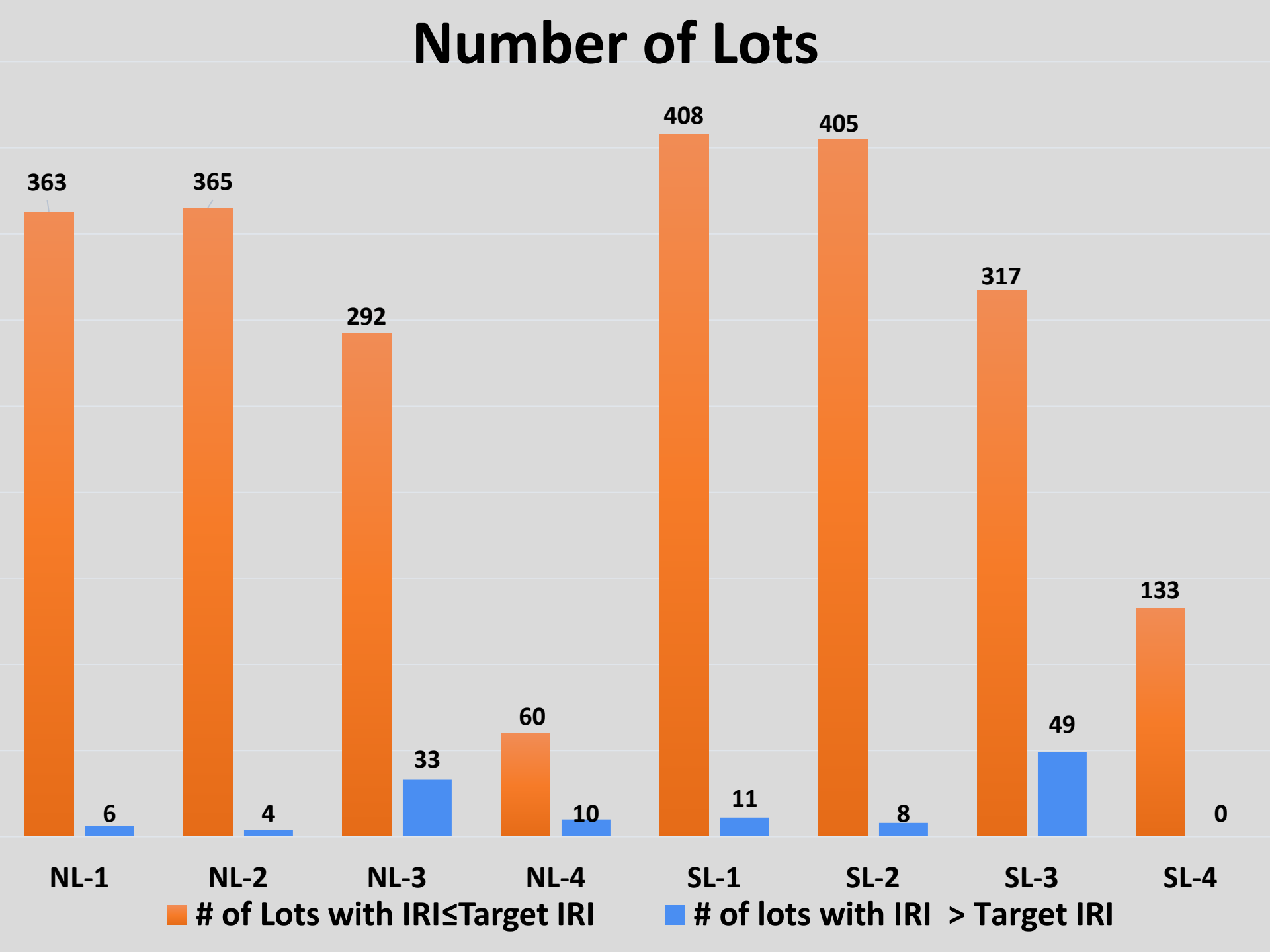
- NB Lane 1 - 2
- NB Lane 2 - 2
- NB Lane 3 - 10
- NB Lane 4 - 35

- SB Lane 1 - 13
- SB Lane 2 - 19
- SB Lane 3 - 26
- SB Lane 4 - 56

IRI

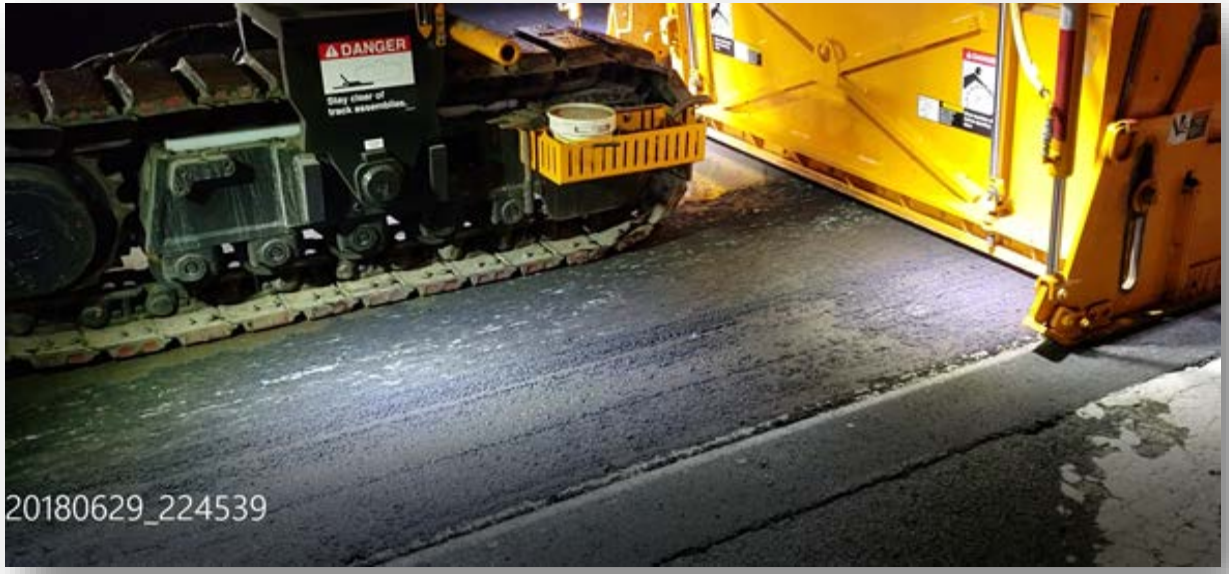

Target IRI: 63 in/mile
91
96
137
348
133
149
384
346
77
75
89
73
70
67
82
60
29
24
28
31
26
25
28
29
NL-1
NL-2
NL-3
NL-4
SL-1
SL-2
SL-3
SL-4
Min
Max
Max IRI before Exclusions

Number of Lots



Air voids

- BRIC
  - Requirement: 0-6%
  - Achieved: 3.49% (avg)
  - Achieved rang: 1.4-7.4%
  - Bonus: 0.78%
- SMA
  - Requirement: 1-7%
  - Achieved: 3.88% (avg)
  - Achieved rang: 2.4-6%
  - Bonus: 4% (Maximum)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