I-70 Extended Life Pavement Performance

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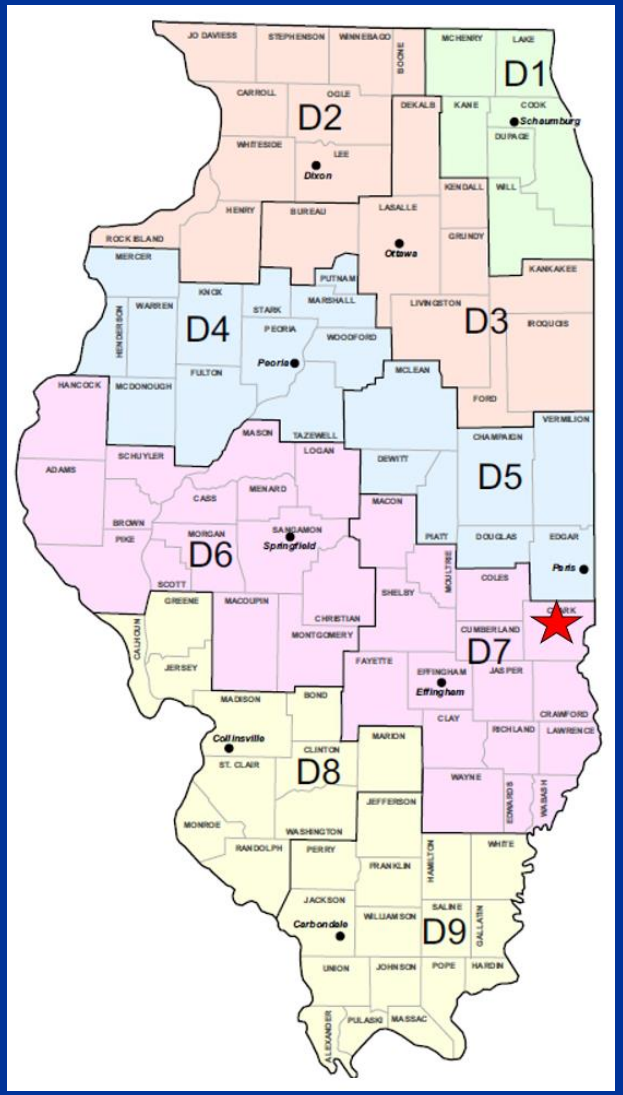
2019 IAPA Annual Meeting

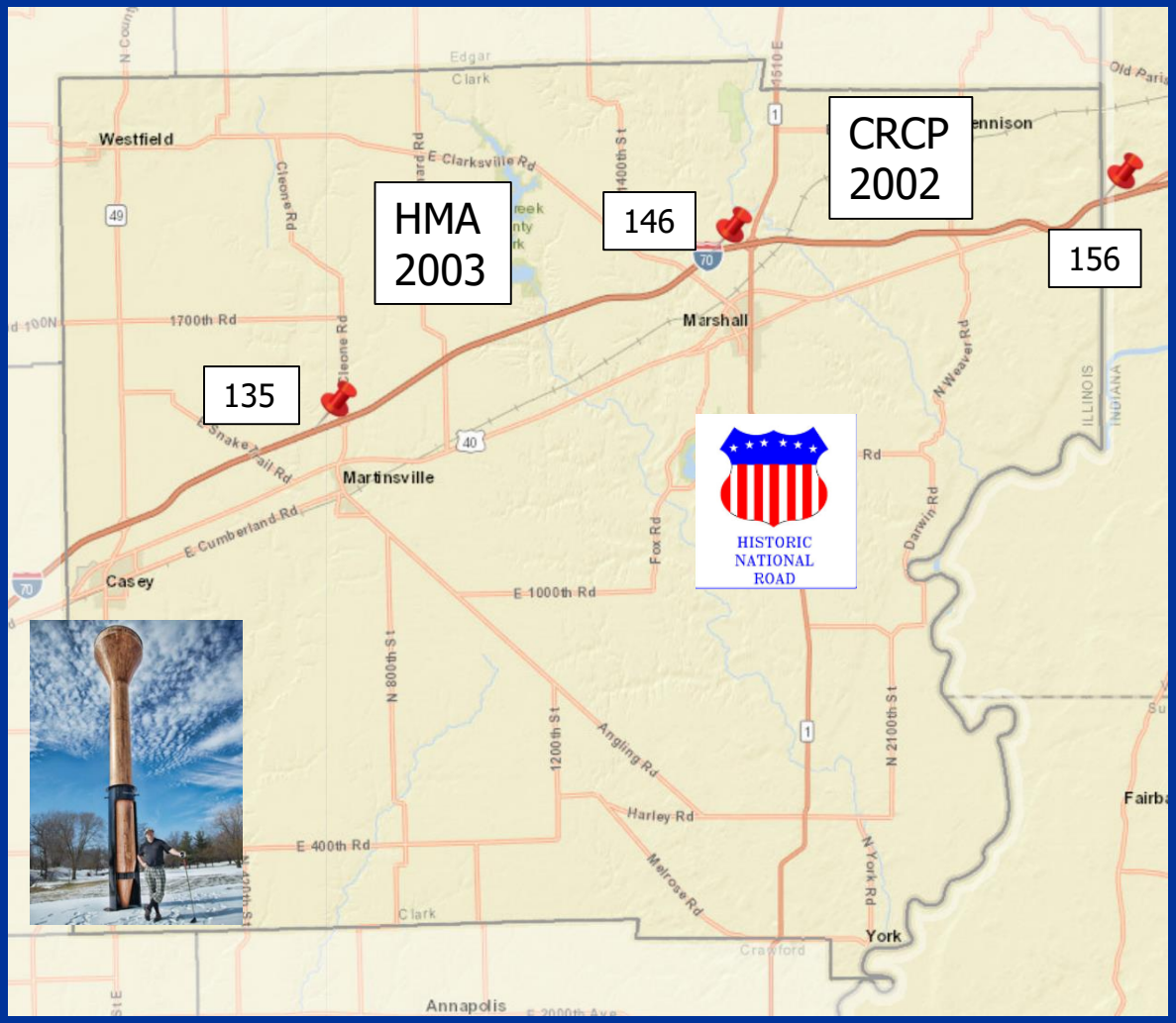
Illinois Department of Transportation

I-70 Project Location

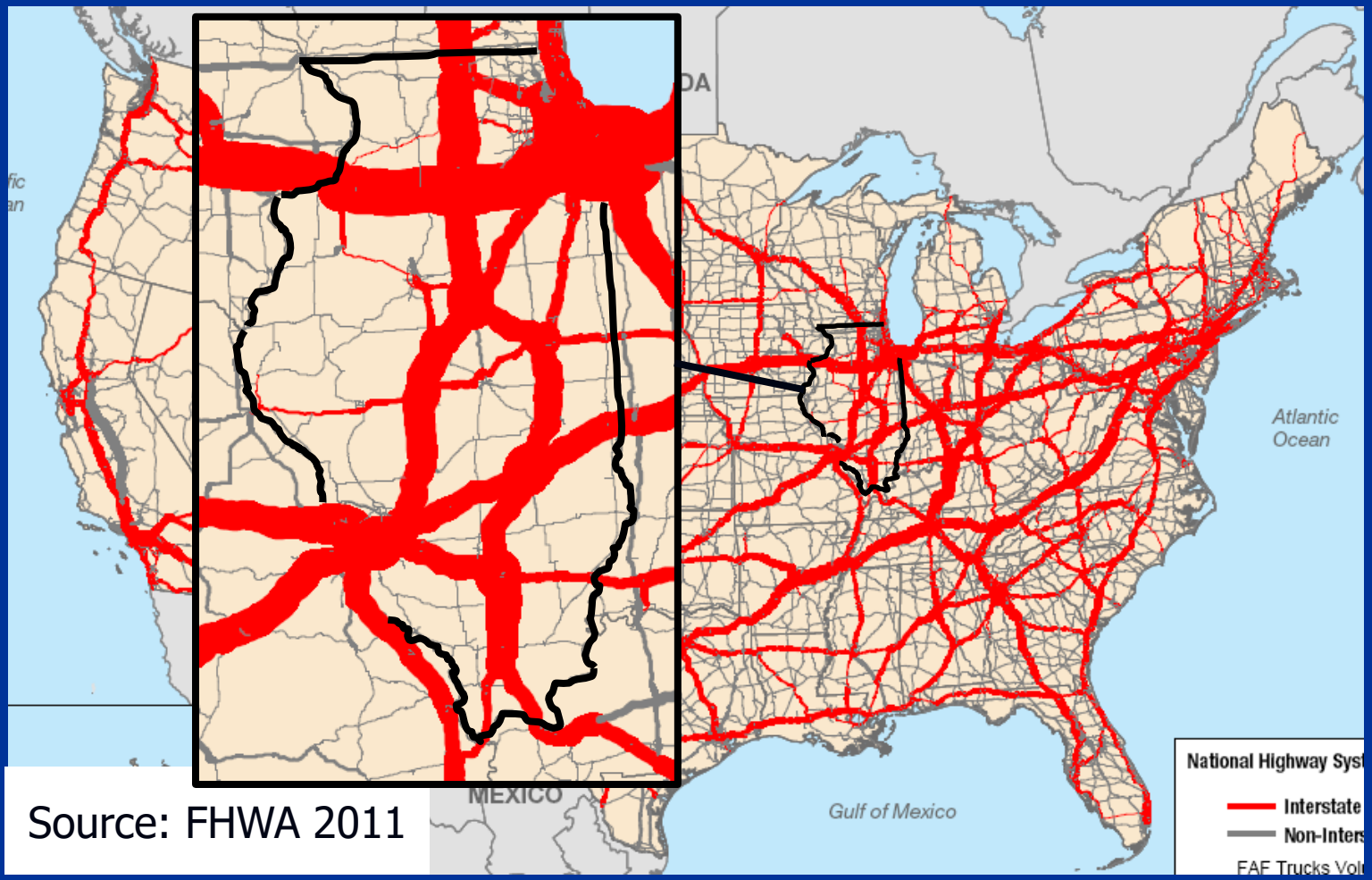
- **District 7 Clark County (Constructed by District 5)**



I-70 Clark County



Average Daily Truck Traffic



Source: FHWA 2011

Why Use Extended Life Pavement Design?

- Warranty demonstration project mandated by Illinois FIRST legislation in 1999
  - "The Department shall implement a demonstration project, under which 20 of the contracts ... for fiscal years 2000 through 2004 shall have a performance-based warranty of at least 5 years..."
- Also required extended life designs
  - "10 of those contracts shall be designed for a 30-year life cycle."
- Asphalt industry wished to compete on "30-year life cycle" warranty projects

What Is An Extended Life HMA Design?

- Built to last longer than the standard 20-year design
- Will not require major rehabilitation or patching
- Surface is sacrificial and is replaced at some frequency

I-70 Project Details

- IL 1 to Indiana Border – Contract 70044
  - Unbonded CRCP Overlay (2002)
- Martinsville to IL 1 – Contract 70059
  - HMA / Rubblized CRCP (2003)
- 5-year warranties on both projects (pavement and bridges)
- 20-year warranties were considered (at IAPA's request)

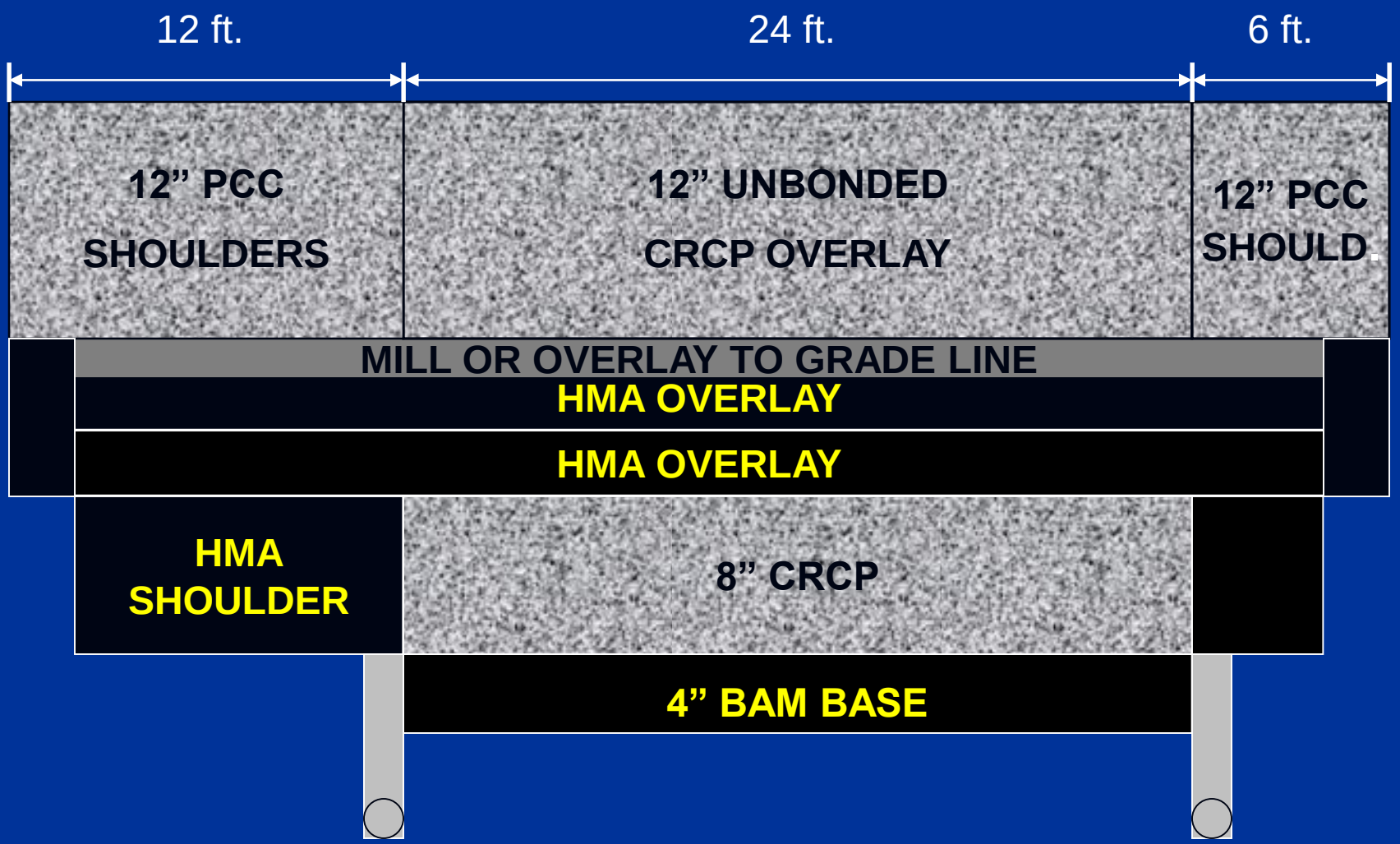
I-70 Project Details (cont.)

- Alternate bidding was considered
- Zero blanking band used for surface testing of pavement
- Bridge decks constructed 1/4 inch high and diamond ground for smoothness

Unbonded CRCP Overlay – Design Details

- Existing 8-in. CRCP (1969) with D-cracking susceptible aggregates and 2 prior asphalt overlays
- 30-year (extended life) design period
- 12.0-in. unbonded CRCP overlay of existing (after mill to profile)

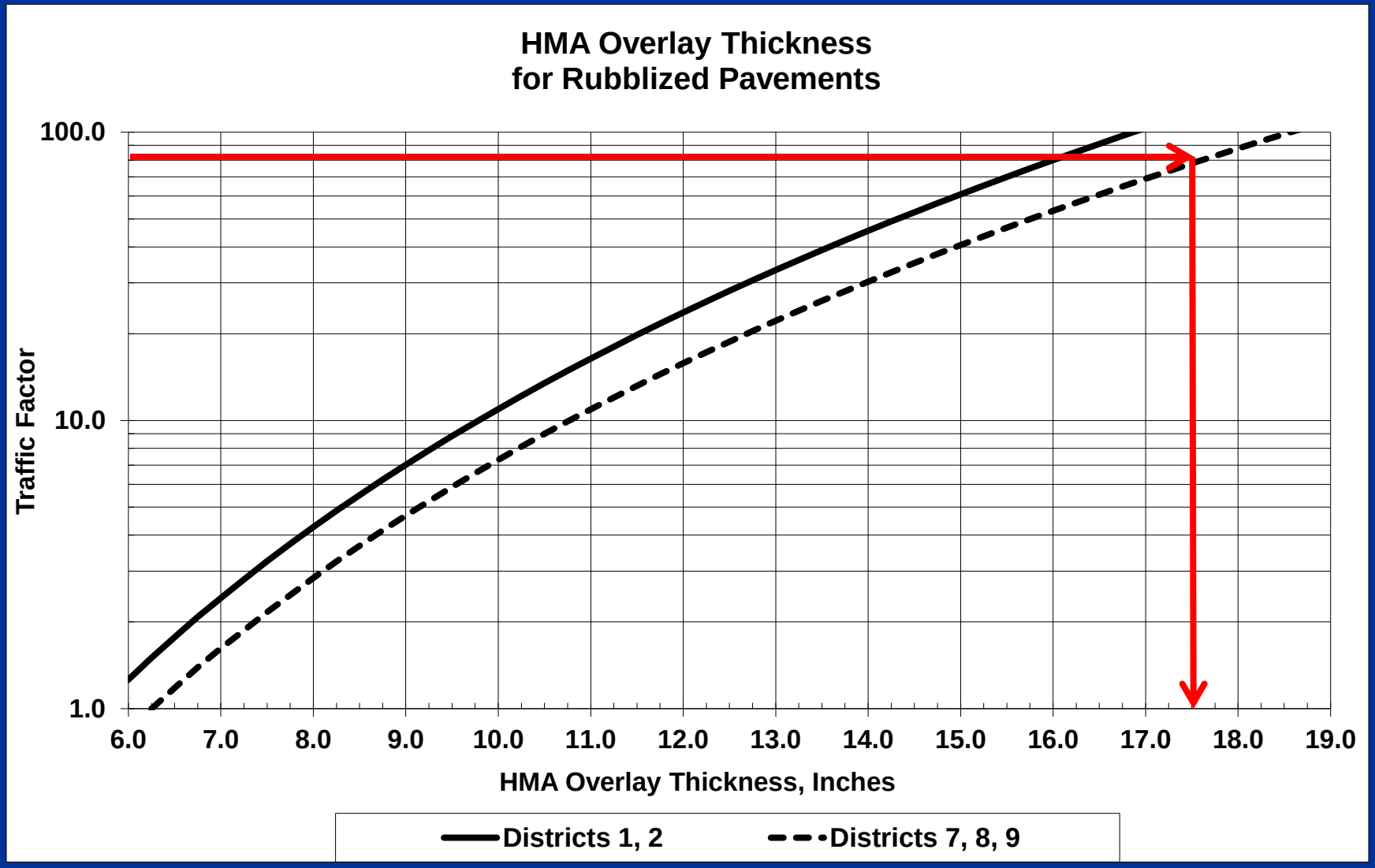
UBOL Construction Sequence



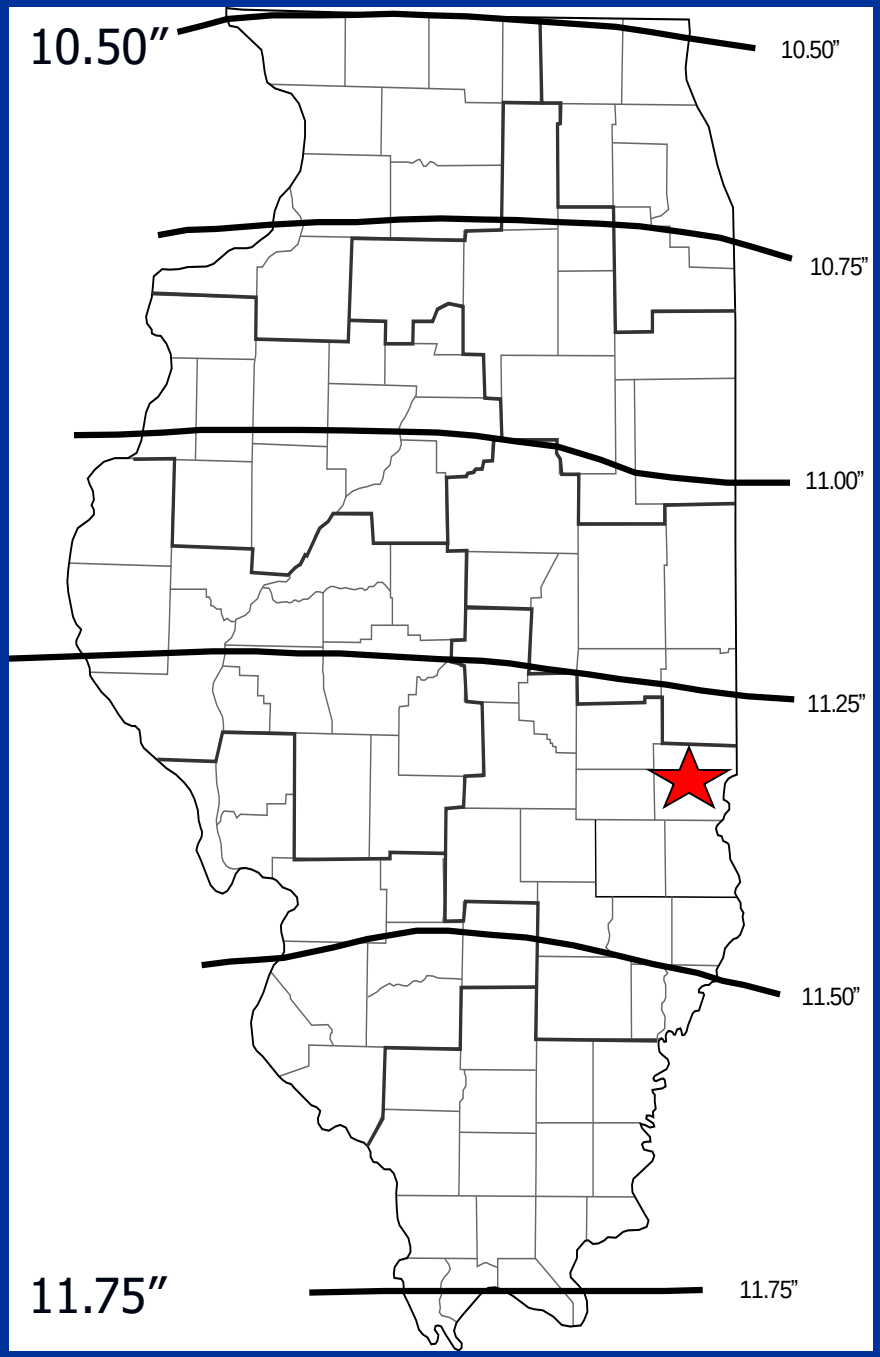
HMA / Rubblized CRCP – Design Details

- Existing 8-in. CRCP (1971) with D-cracking susceptible aggregates and 2 prior asphalt overlays
- 30-year (extended life) design period
- 17.5-in. HMA on rubblized CRCP
- 5.25-in. overlay of existing CRCP (control)

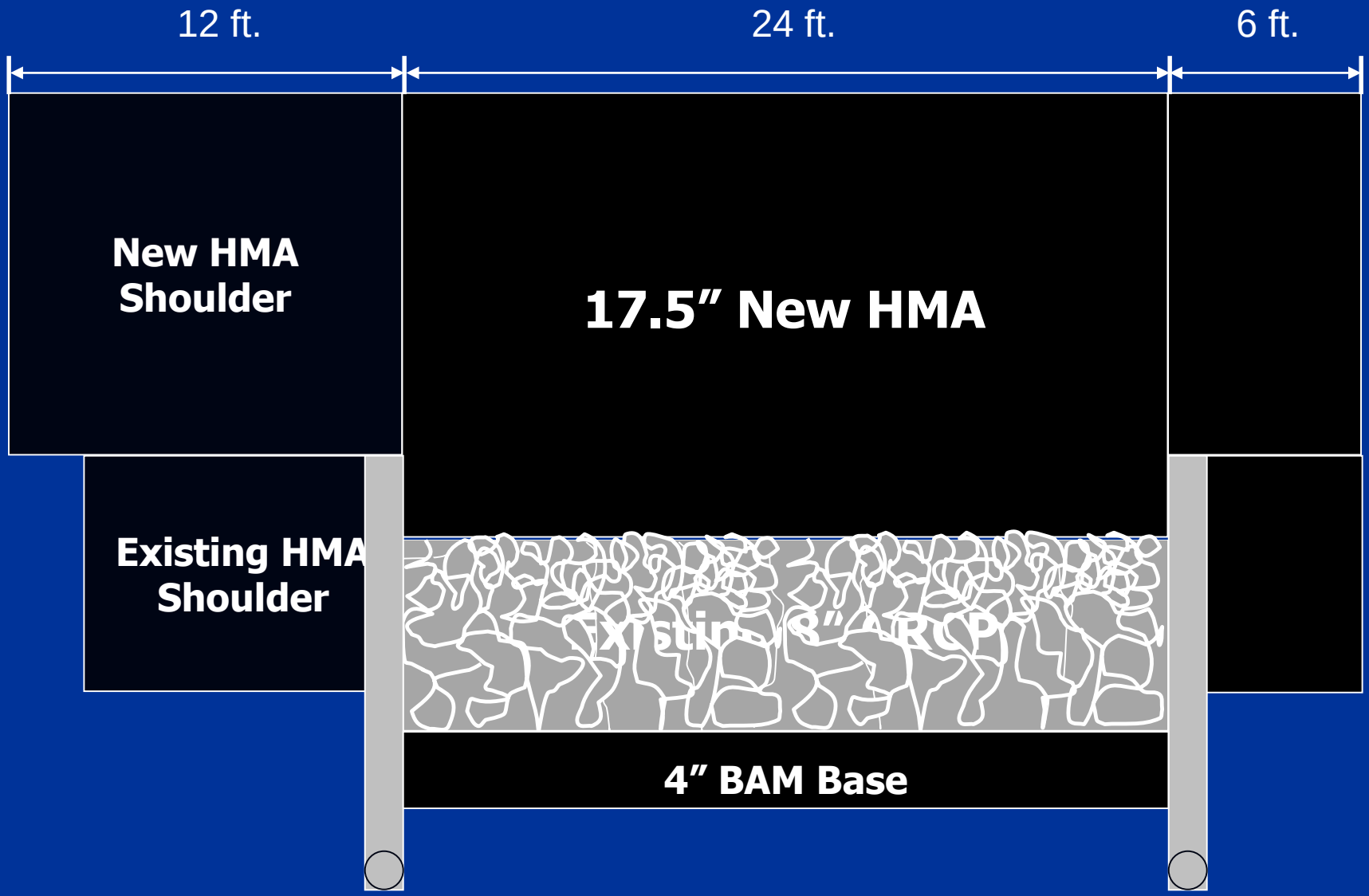
Design Curve Used in 2001



Limiting Strain Criterion (Maximum) Thickness – 11.50 inches



Rubb. Construction Sequence



Extended Life HMA Elements

- Steel slag SMA surface
- Polymer used in all lifts
- 1.0% hydrated lime (dry) anti-strip in all lifts
- Polymer tack coat between lifts
- Extra tack coat on longitudinal joints
- Material transfer device on all lifts
- Did not use rich bottom base layer

Rubblization and HMA Construction

Multi-Head Breaker

Broken Pavement Behind Multi-Head Breaker

Z-Grid Roller

Rubblized Pavement Ready for HMA Overlay

HMA Lifts

Lift Thickness (in)	Mix Information	Binder Grade
2.00	N80 SMA 12.5 Surface Course	SBS PG 76-28
2.50	N105 19.0 Binder Course	SBS PG 76-28
3.00	N105 19.0 Binder Course	SBS PG 76-28
10.00 (2 lifts)	N90 19.0 Binder Course	SBS PG 70-22

I-70 HMA Core

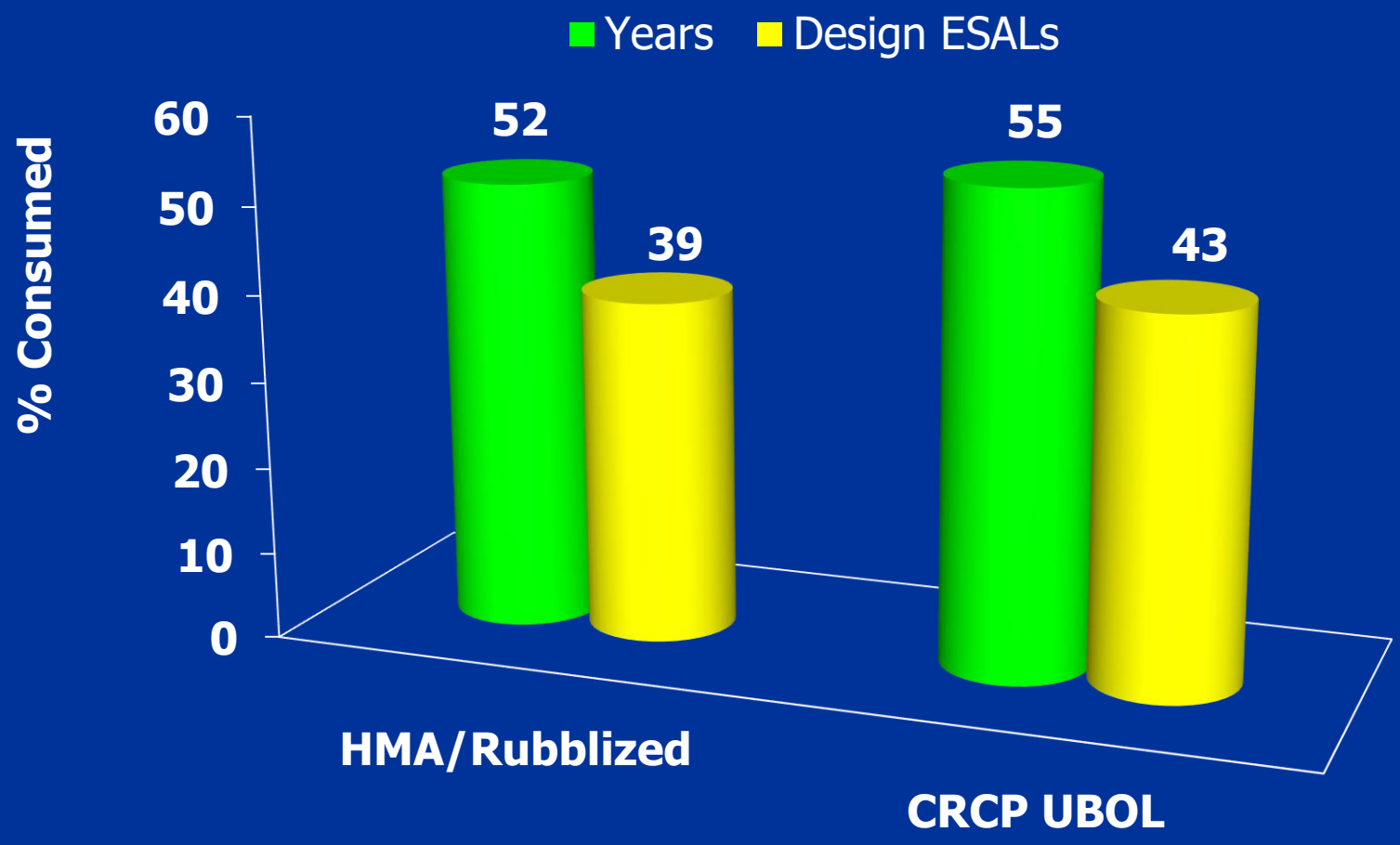
I-70 HMA Core

Open House

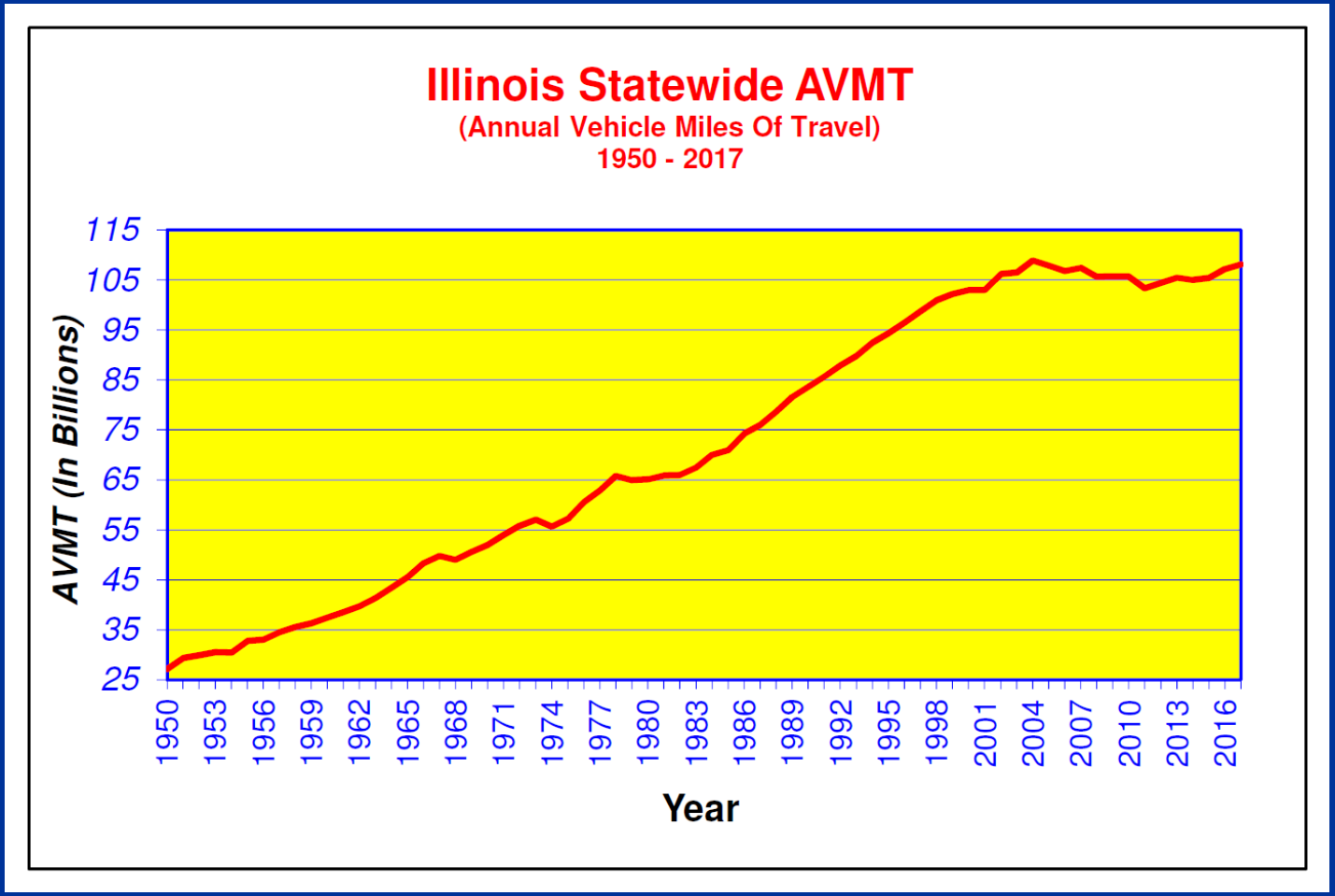
Project Monitoring

- Traffic
- Data collection vehicles
  - Digital imagery
  - International Roughness Index (IRI)
  - Rutting
- Distress surveys
- Falling weight deflectometer testing

Percent Consumed



Traffic Trends 1950-2017



Condition Rating Survey (CRS)

- CRS 9.0 – 7.6 = Excellent
- CRS 7.5 – 6.1 = Good
- CRS 6.0 – 4.6 = Fair
- CRS 4.5 – 1.0 = Poor

Unbonded CRCP Overlay – Performance

- 2018 CRS=7.7, IRI=75
- Centerline deterioration (low level)
- **Edge punchouts** (around 3 per mile) with (temporary) spray injection patching
- Permanent patching (very little)
- Some warranty repairs

2018 DCV Image

Edge Punchout

HMA / Rubblized CRCP – Performance

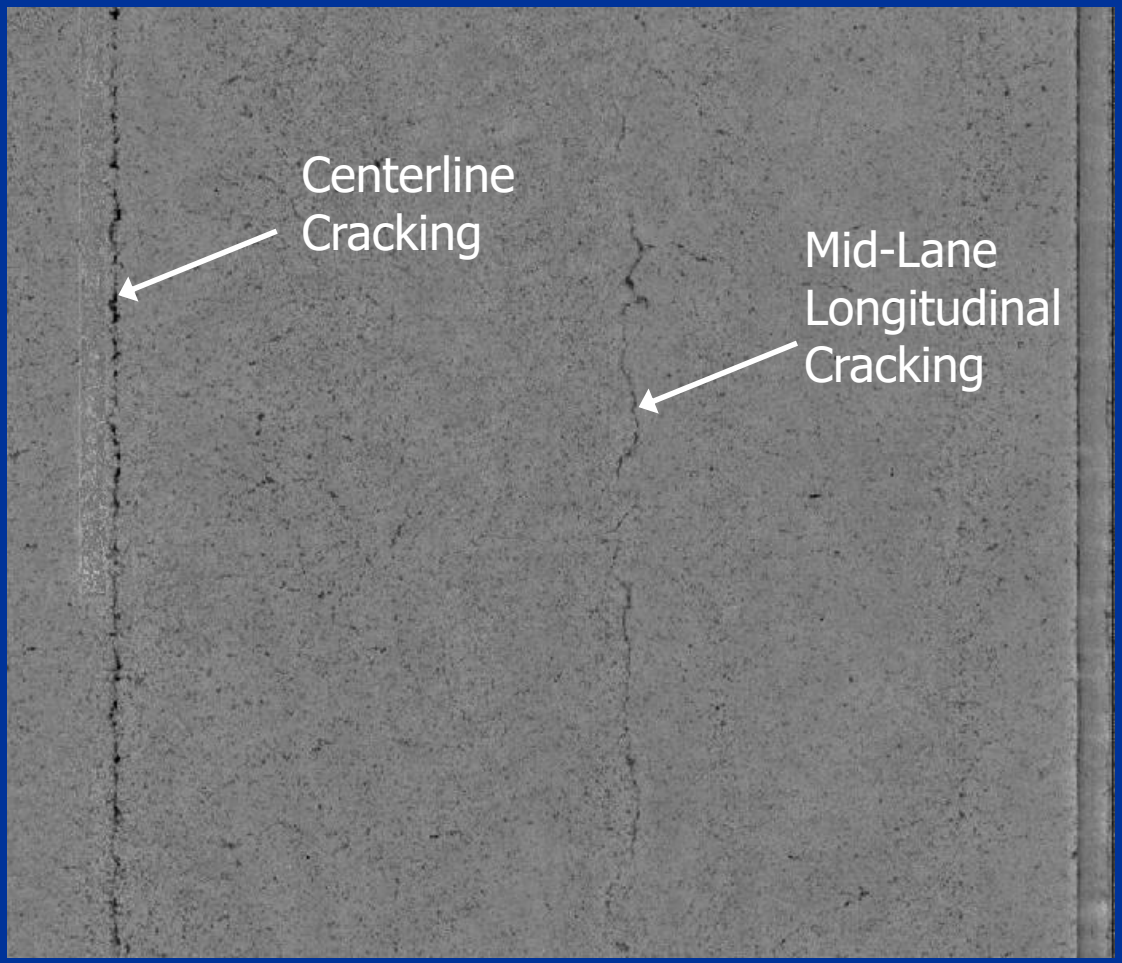
- 2018 CRS=8.0, IRI=48
- Rutting=0.11 in.
- Centerline deterioration is only recorded CRS distress
- No warranty repairs on pavement (some bridge deck repairs)

2018 DCV Image

Mechanical Damage

Car Fire Damage

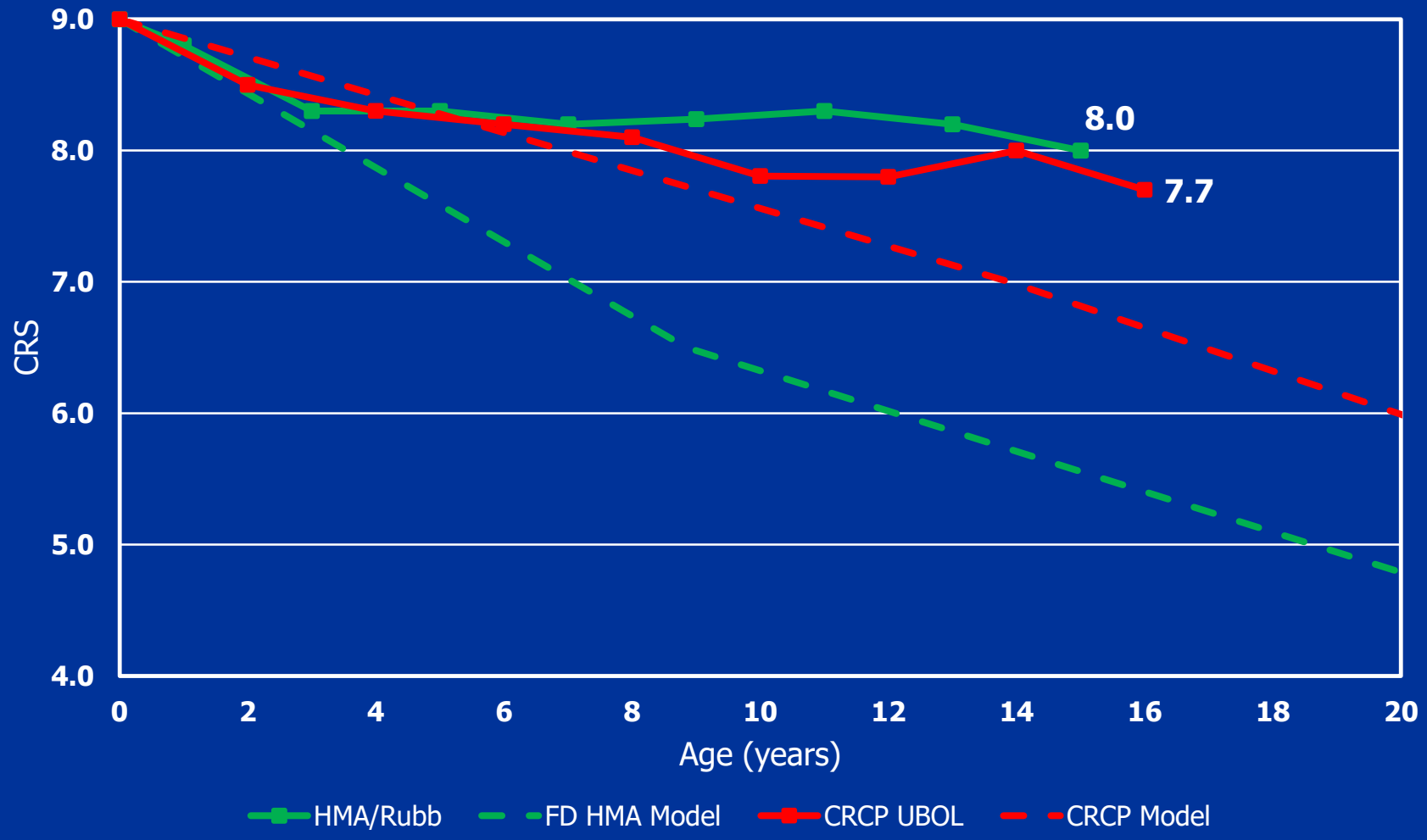
Down Image (3D)



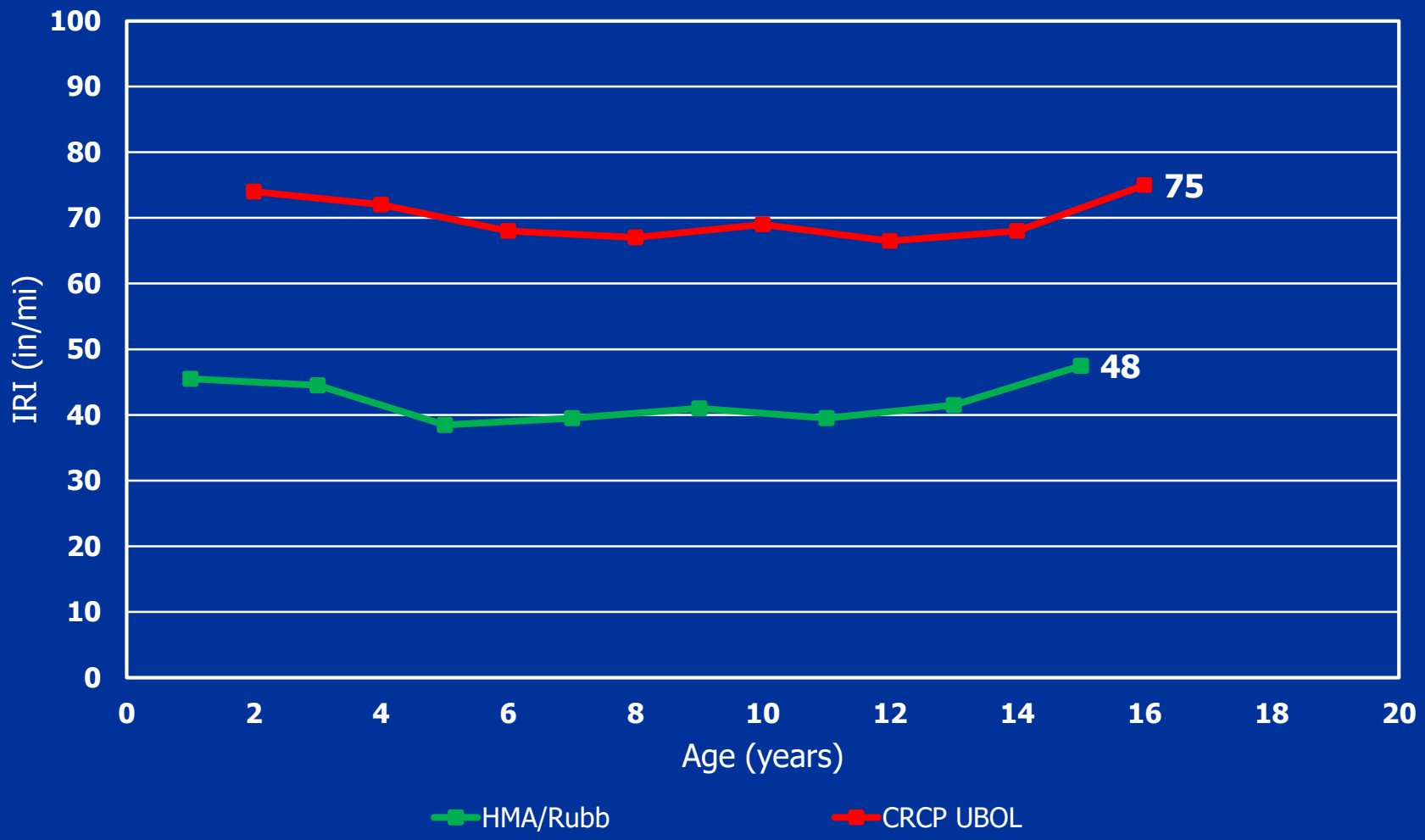
Mill and Overlay

Reflective D-Cracking

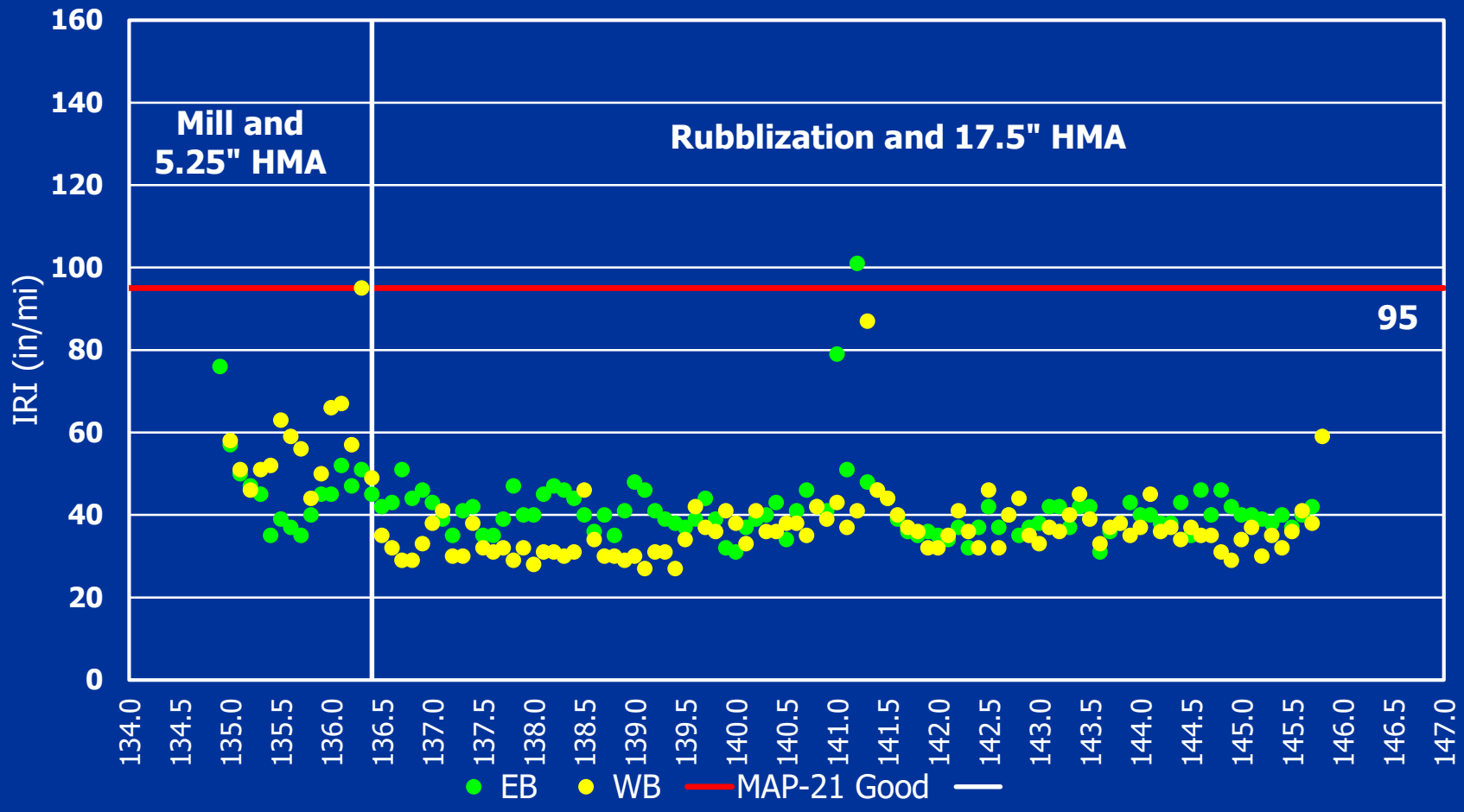
CRS vs Age


9.0
8.0
7.0
6.0
5.0
4.0
CRS
0
2
4
6
8
10
12
14
16
18
20
Age (years)
8.0
7.7
HMA/Rubb
FD HMA Model
CRCP UBOL
CRCP Model

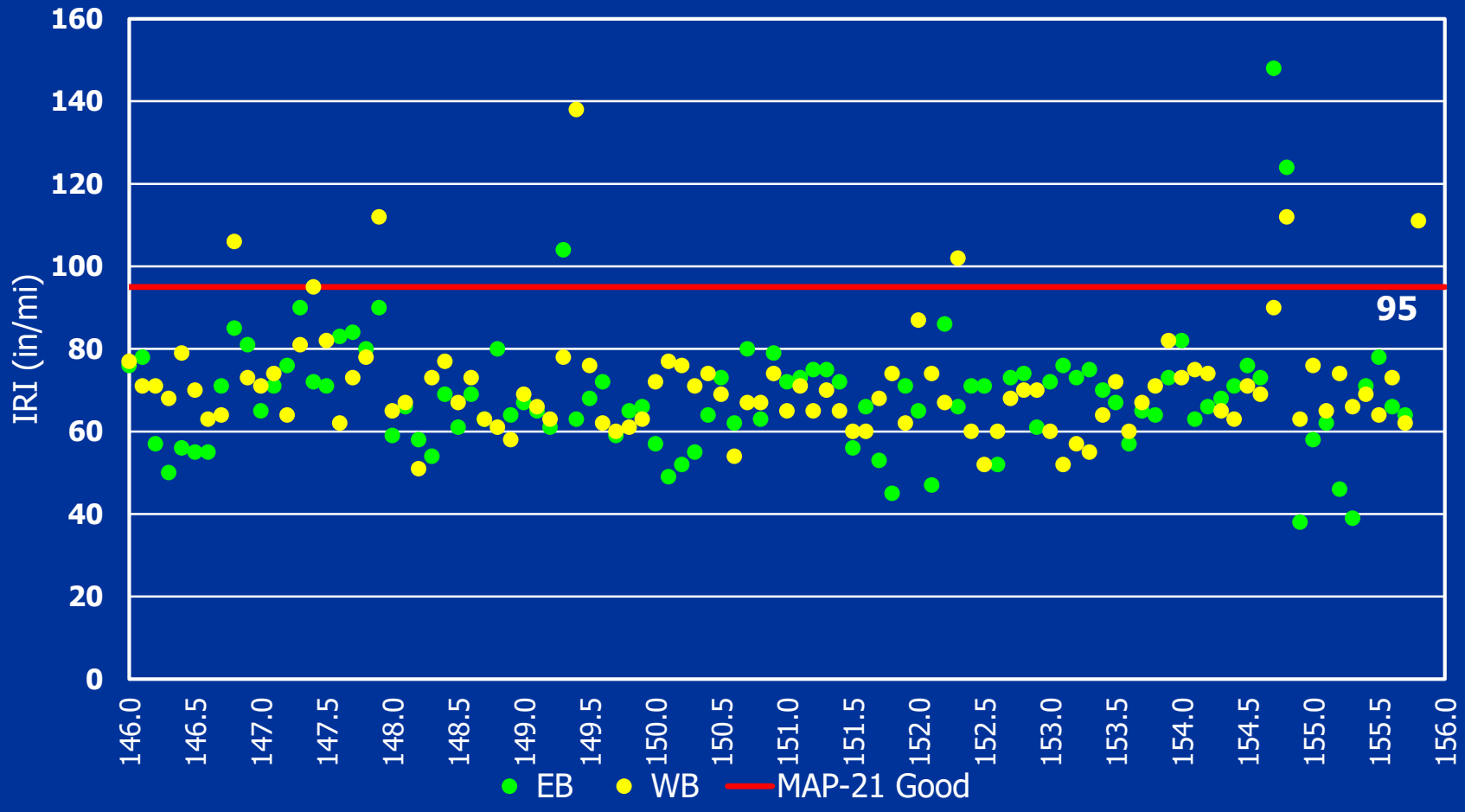
IRI vs Age


100
90
80
70
60
50
40
30
20
10
0
IRI (in/mi)
0
2
4
6
8
10
12
14
16
18
20
Age (years)
75
48
HMA/Rubb
CRCP UBOL

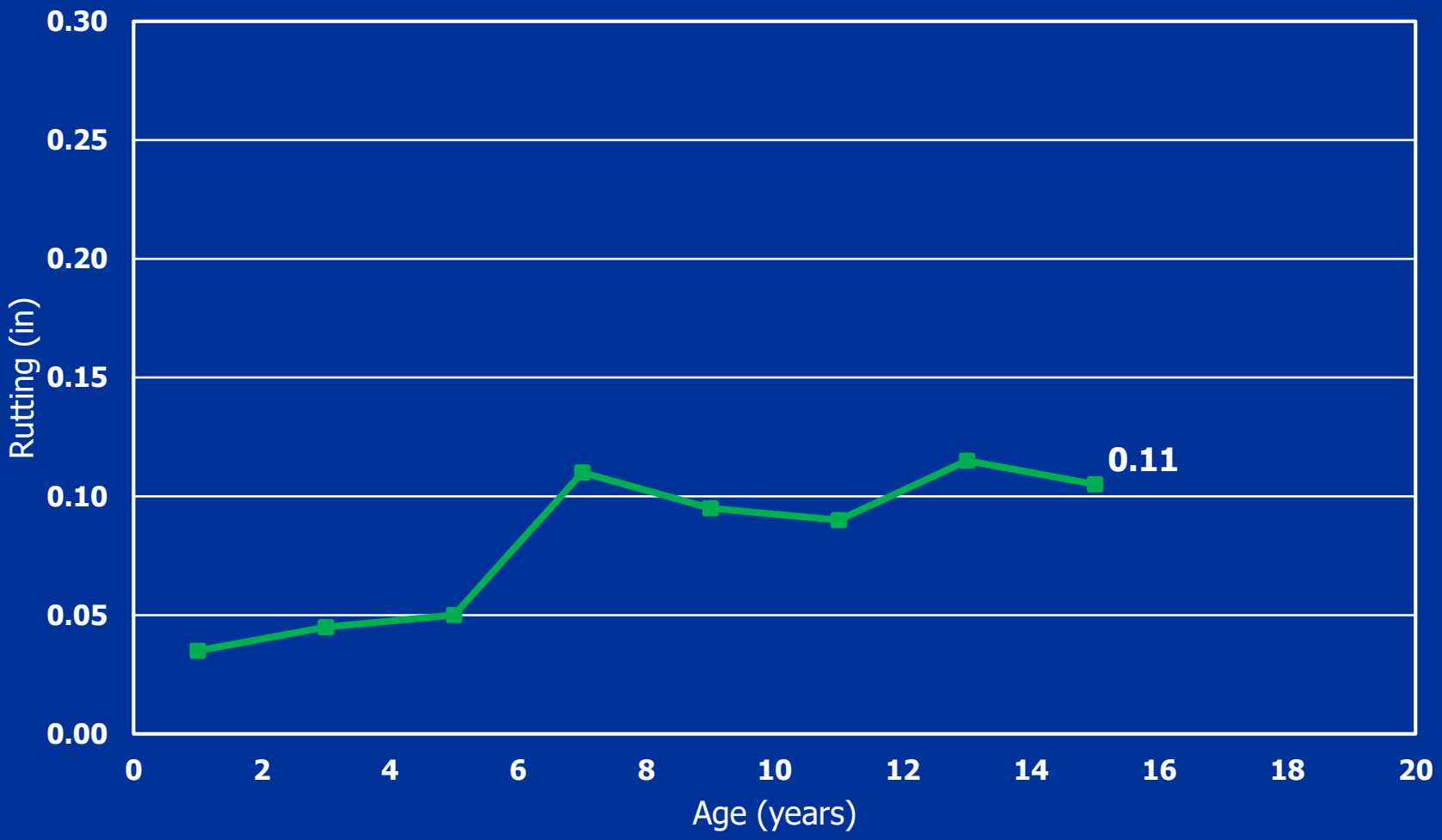
2018 IRI by 0.1-mile (HMA)



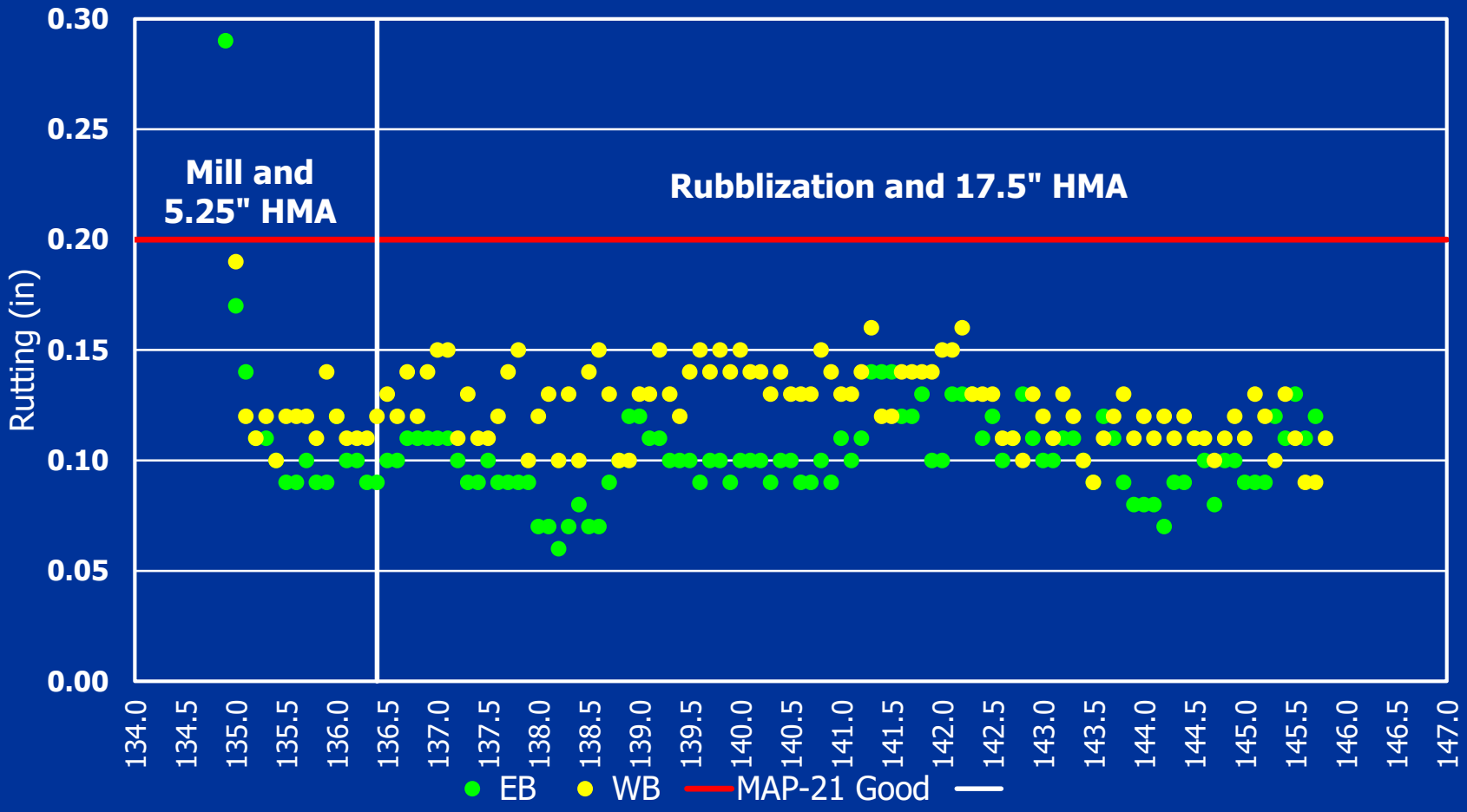
2018 IRI by 0.1-mile (CRCP)



Rutting vs Age



2018 Rutting by 0.1-mile



Warranted Distresses (5-yr.)

Parameter	Extent	Severity	Warranty Work
Fatigue Cracking	50 sq. ft.	Moderate	Patch 150% of Distressed Area
	Any within section	High	
Block Cracking	100 sq. ft.	Moderate	Mill & Replace
	Any within section	High	
Transverse Cracking	10 lin. ft.	Moderate	Seal
	Any within section	High	

Warranted Distresses (5-yr.)

Longitudinal Cracking

Location	Extent	Severity	Warranty Work
Within the Lane	10 lin. ft.	Moderate	Seal
	Any within section	High	
Centerline Deterioration	10 lin. ft.	High	
Edgeline	10 lin. ft.	High	

Warranted Distresses (5-yr.)

Parameter	Extent	Severity	Warranty Work
IRI	Within Section	Avg. 110 in./mi.	Mill & Replace
Potholes & Shoving	Any within section	All severity levels	Patch 150% of Distressed Area
Bleeding, Flushing, & Raveling	500 sq. ft.	Moderate	Mill & Replace
	Any within section	High	
Rut Depth	Any within section	0.30 in.	Mill & Replace

Performance Summary

- Overall performance has been excellent on both projects
- CRCP UBOL has experienced edge punchouts that have required maintenance
- SMA surface has been maintenance free for 15+ years with minimal rutting

Performance Summary (cont.)

- IRI values on HMA/Rubb. have been consistently lower than those on CRCP UBOL
- Rubblized section performed much better than the mill and overlay control section

Acknowledgements

- David Lippert, IDOT (retired)
- Steve Robinson, IDOT District 5
- Tom Zehr, Central Bureau of Materials
- Marshall Thompson, Univ. of Illinois

Questions?

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