



Bridge Asset Management

Adam Post, Erich Hart, & Darryl Wineinger
Bridge Asset Management

Bridge Design Conference
2/21/2023



INDOT CO Bridge Asset Team



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INDOT - Bridge Management

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Bridge Asset
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INDOT District Bridge Asset



■ 6 District Bridge Asset Engineers

- Work in Technical Services under Systems Asset Manager (SAM)
- Crawfordsville – Chris Wheeler
- Fort Wayne – Keith Lytton
- Greenfield – Darryl Wineinger
- LaPorte – Chris Vergon
- Vincennes – Jason Heile
- Seymour - Adam Pyle



INDOT Agency Goals (Next Level)



INDOT



AGENCY GOALS

Taking INDOT to the Next Level

Execute 20-Year Road and Bridge Plan

- Deliver the Next Level Roads plan to improve pavement and bridge quality, safety and mobility
 - Priority given to construction zone safety for workers and motorists
 - Focus on engineering, education, enforcement and emergency response
- Identify continuous improvements of the Asset Management process
 - Strive for improved collaborations with all stakeholders – internal and external
- Convey Next Level construction projects through effective and efficient communication strategies

How are we doing?



**Indiana Named #1
in the Nation for Infrastructure**

**in the 2022 CNBC America's Top States
for Business ranking**



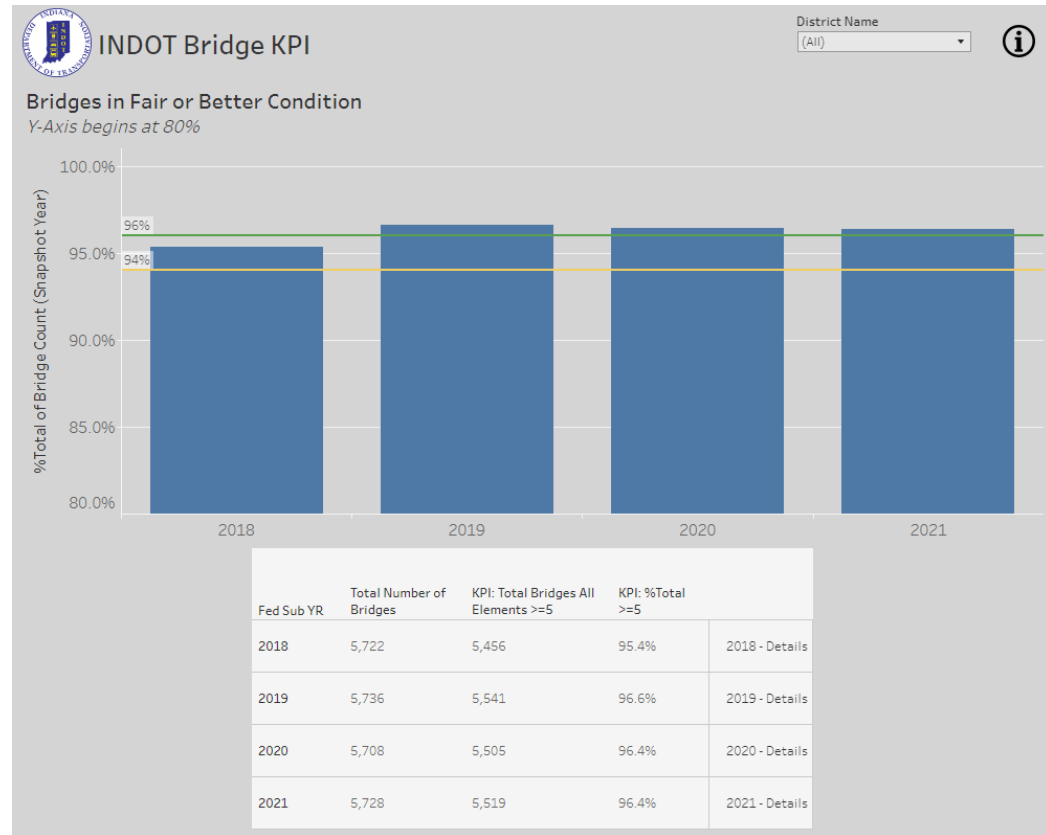
AMERICA'S TOP STATES FOR BUSINESS



How are we doing?



- **5,728 Total Bridge Count**
- **5,519 Total Bridges in Good or Fair Condition (2021 Fed tape)**
- **96.4% Bridges in Good or Fair Condition**

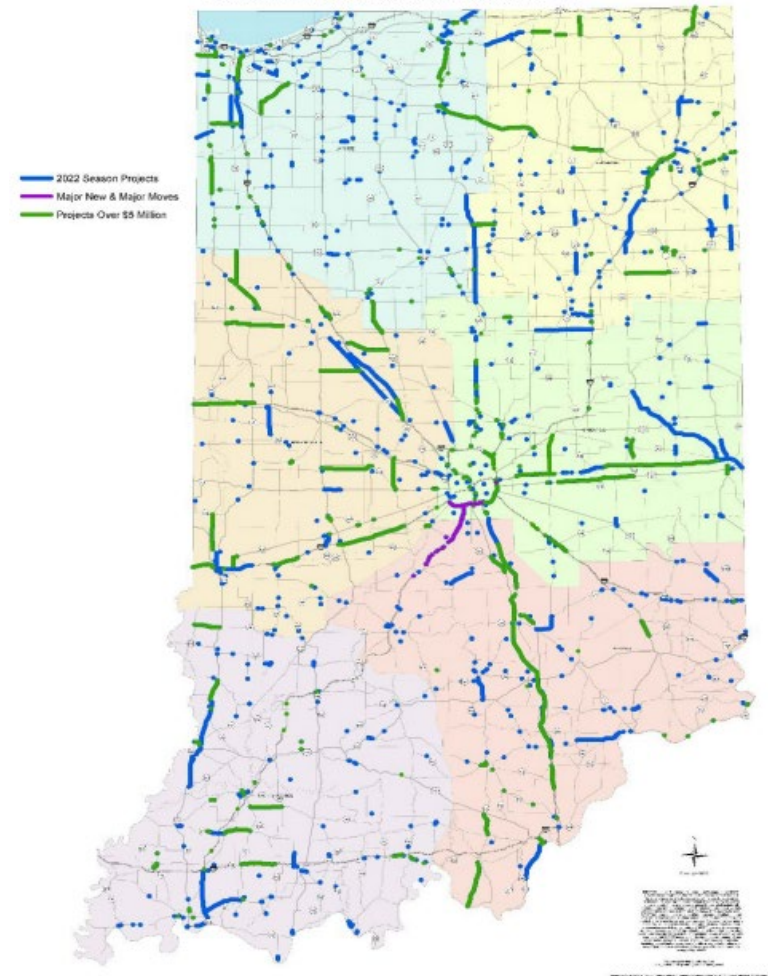


Capital Program Investment



- **For FY 2022, we obligated over \$2.5 billion for state construction and preservation projects**
- **During FY 2021 & 2022 we rehabbed, replaced, built or maintained 1,365 state owned bridges**
- **Local funding – Community Crossings**
 - 2022-1 Awards - \$107.8M to 224 separate communities for 1,535 road and bridge projects
 - 2022-2 Awards - \$119.2M to 229 separate communities for 1,396 road and bridge projects

2022 Construction Season



Capital Programs



■ **INDOT Preservation Assets**

- Bridge
 - Roadway/Pavement
 - Includes Small Towns
 - Safety
 - Mobility
- Programs can fluctuate depending on need due to bridge/roadway conditions and major projects. Local program may also affect.



Capital Bridge Program



- **INDOT Bridge Preservation**
 - Bridge (approx. \$500M budget)
 - Major/Minor Call (\$400M +/- annually)
 - BCPMA (\$18M annually)
 - Border Bridge (\$20M +/- annually)
 - Large Culvert (\$55M-\$60M annually)
 - Small Culvert (\$147M annually)



Challenges



■ Inflation and supply chain issues

Commodity Index	2020-Q3 to 2022-Q2 % change
Structural Steel	118%
Hot Dipped Galvanized Steel	143%
Steel Rebar	98%
INDOT Asphalt Binder Index	72%
Concrete Pipe	20%
Portland Cement	11%
Sand Gravel and Crushed Stone	13%
Construction Machinery	14%
Equipment Rental and Leasing	8%
Plastic Materials and Resins	45%
Paints and Coatings	33%
Aluminum Sheet Plate and Foil	49%
Indiana Gasoline (Retail)	110%
Indiana Diesel (Retail)	121%
Inputs to Construction	43%

Sources:

Retail Gasoline and Diesel prices sourced from AAA.

Asphalt Binder Index from INDOT

All Other Indices from S&P Global



Capital Bridge Program



■ Programming Steps (5 year Call)

■ Call for Projects

- Old way – Project rankings by score
- New way – Use of defined budget targets for each district
 - Districts submit candidates from 20 Year plan

■ 20 Year Plan

- Network Level – Bridge Modeling Software (BMS)
- Project Level – Bridge Asset Engineer
- Scoping Level – Detailed scopes and estimates



Bridge Asset Management



Bridge Asset Management



■ Introduction

- Erich Hart
- Bridge Asset Engineer, Central office

■ Role

- Network Optimization Model
- Data Research
- Assist with 20-YR Plan

■ Discussion

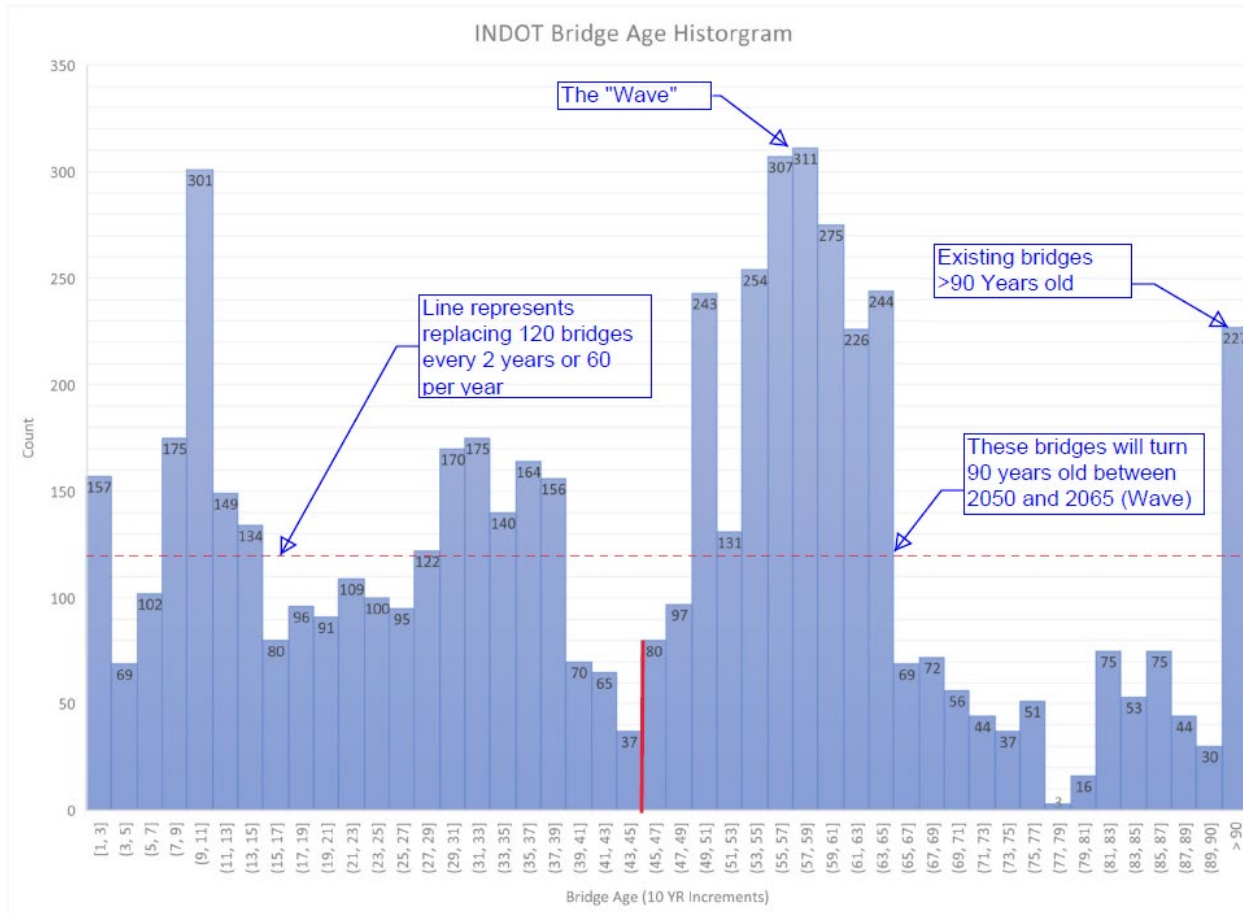
- Aging inventory and tools to address



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■ INDOT Bridge Network Age



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- Deighton Total Infrastructure Management System - Business Analytics (dTIMS BA)**

Object	20YR Model	40-YR Model
Treatments	484,700 approx. 84/asset	9,350,000 Approx 1,630/asset
Strategies	290,500 approx. 50/asset	3,675,000 approx. 640/asset
Model Run Time	2.5 hr	40 hr

- INDOT has gone with five (5) treatment types shown on next slide
- Longer analysis will provide better results.
- Would like to go with 50-YR or longer analysis but cannot handle increase in time and table size.
- Model provides INDOT with recommended plan. While we may only follow some of the recommendations, we use all as a benchmark for final submitted plan.



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■ INDOT Business Rules – Triggers & Resets

Work type	TRIGGERS				RESETS			
	WS	DC	SP	SB	WS	DC	SP	SB
Thin Deck Overlay (only 2 allowed)	>= 6	>= 6	>=5	>=5	+1 (6/7) Hold 8 Years (8)	Hold 8 Years		
Rigid Overlay (only 2 allowed)	<= 7	>= 5	>= 5	>= 5	9	+2 (5) +1 (6/7)		
Deck Replacement		<5	>= 5	>= 5	9	9		
Replace Superstructure			< 5	>= 5	9	9	9	
Bridge Replacement			* = 5	< 5 * = 5	9	9	9	9

Green: Alternate Trigger for Bridge Replacement



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DTIMS Cost Function

$$\text{Total Cost (\$)} = \text{MOT}(\text{LSUM}) + \text{Approach Road}(\text{LSUM}) + \text{Bridge} \left(\frac{\text{DOL}}{\text{SFT}} \right)$$

Treatment	Deck Area	Interstate	Maintenance of Traffic (MOT) [LSUM]	Approach Roadway [LSUM]	Bridge Items [DOL/SFT]
Bridge Thin Deck Overlay	<= 4590 SFT	Yes	\$100,000	\$100,000	\$11
	> 4590 SFT		\$110,000	\$110,000	
Bridge Thin Deck Overlay	<= 4590 SFT	No	\$60,000	\$60,000	\$11
	> 4590 SFT		\$75,000	\$75,000	
Bridge Deck Overlay	<= 4590 SFT	Yes	\$300,000	\$490,000	\$50
	> 4590 SFT		\$365,000	\$575,000	
Bridge Deck Overlay	<= 4590 SFT	No	\$180,000	\$340,000	\$50
	> 4590 SFT		\$200,000	\$390,000	
Bridge Deck Replacement	<= 4590 SFT	Yes	\$500,000	\$700,000	\$98
	> 4590 SFT		\$575,000	\$800,000	
Bridge Deck Replacement	<= 4590 SFT	No	\$300,000	\$600,000	\$98
	> 4590 SFT		\$350,000	\$700,000	
Replace Superstructure	<= 4590 SFT	Yes	\$725,000	\$850,000	\$155
	> 4590 SFT		\$835,000	\$975,000	
Replace Superstructure	<= 4590 SFT	No	\$300,000	\$750,000	\$155
	> 4590 SFT		\$350,000	\$850,000	
Bridge Replacement	<= 4590 SFT	Yes	\$725,000	\$2,000,000	\$225
	> 4590 SFT		\$825,000	\$2,000,000	
Bridge Replacement	<= 4590 SFT	No	\$300,000	\$800,000	\$230
	> 4590 SFT		\$350,000	\$1,000,000	

Error averaging – balancing stand-alone projects with bundled



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■ dTIMS Benefit/Objective Function

- dTIMS maximizes INDOT Bridge Quality Index (BQI)
- A.K.A. Bridge Health Index (BHI) in FHWA documentation
- INDOT BQI: Function that aggregates and normalizes six (6) factors
 - Each factor with 1/6th of 100 points
 - Factors:
 - Wear Surface (WS) Condition (NBI 058.01)
 - Deck (DC) Condition (NBI 058)
 - Superstructure (SP) Condition (NBI 059)
 - Substructure (SB) Condition (NBI 060)
 - Bridge Function (Minimum of NBI 068 & 069)
 - Minimum condition rating for Deck Geometry and Under Clearance
 - Strength (NBI 066)

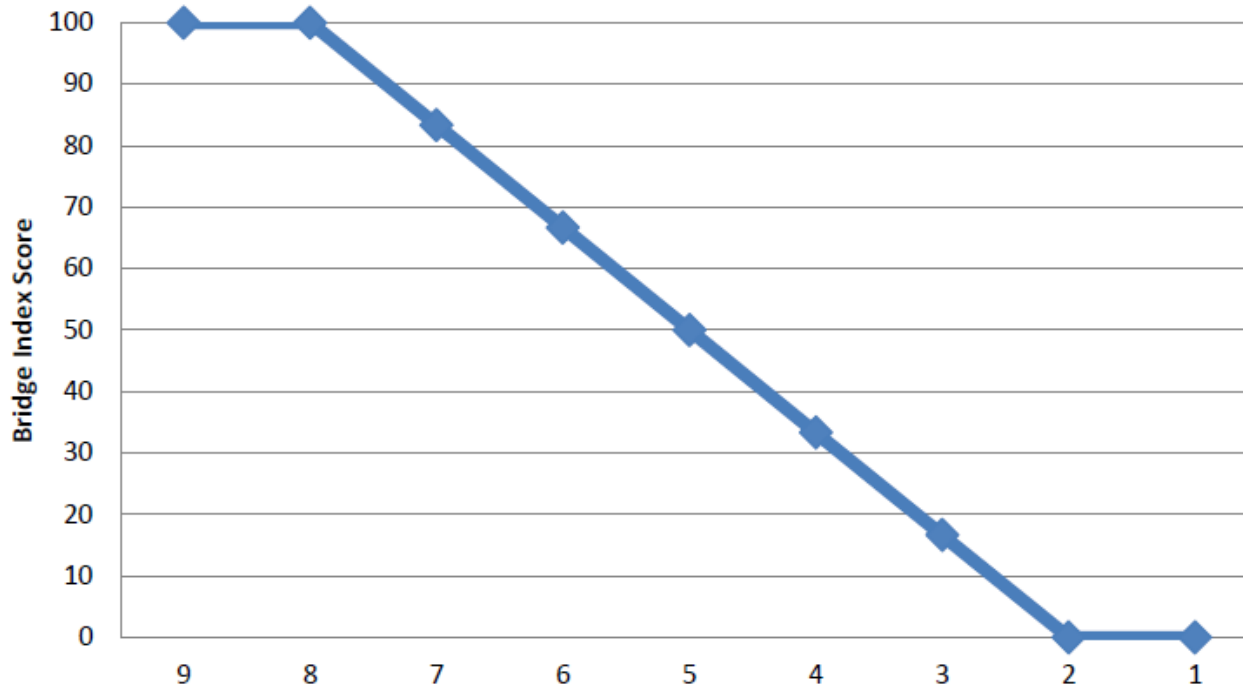


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■ Bridge Quality Index (BQI)

Condition Score



Rating	Score
9	100
8	100
7	83
6	67
5	50
4	33
3	17
2	0
1	0

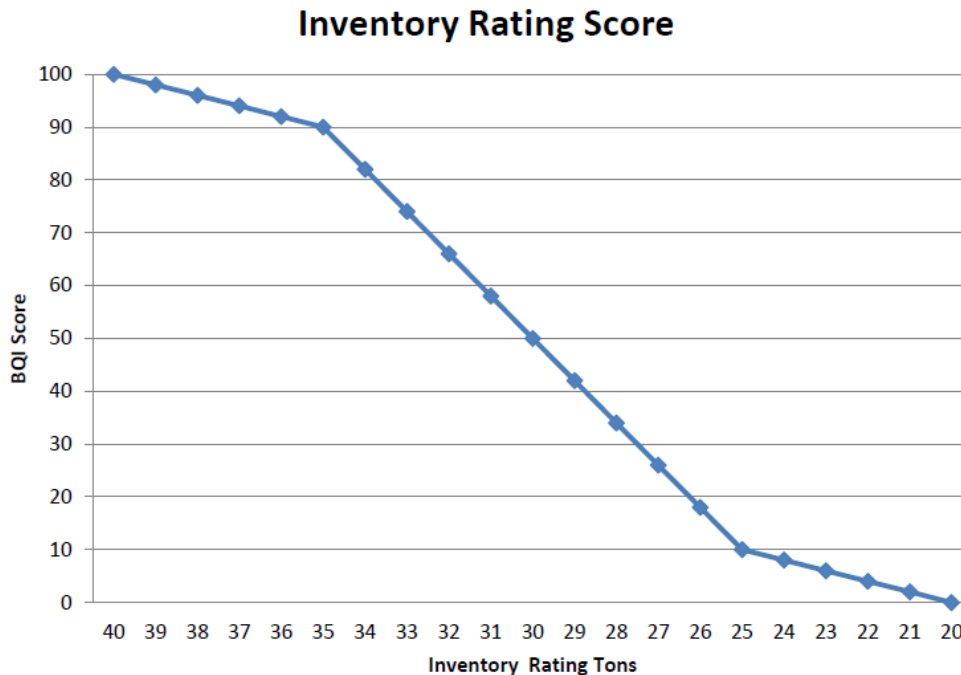


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■ Bridge Quality Index (BQI)

Inventory Rating in tons converted to 100 scale



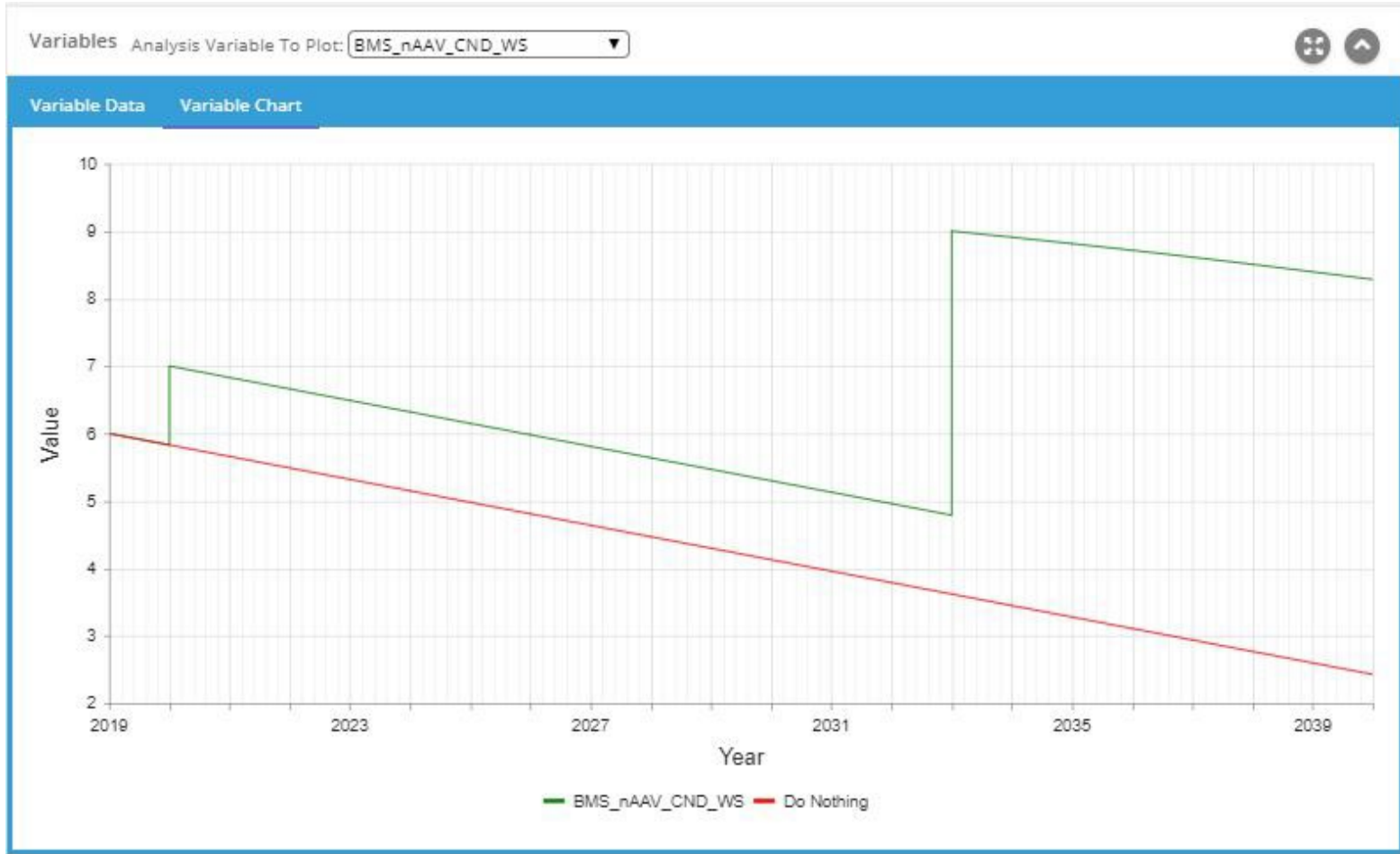
Inventory Rating	Score
40	100
39	98
38	96
37	94
36	92
35	90
34	82
33	74
32	66
31	58
30	50
29	42
28	34
27	26
26	18
25	10
24	8
23	6
22	4
21	2
20	0



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■ DTIMS BA – Deighton Associates Ltd.

Work Type	% - Current	% - 2050
Thin Deck Overlay (Polymeric)	11%	5%
Rigid Overlay	25%	5%
Deck Replacement	11%	5%
Superstructure Replacement	19%	25%
Bridge Replacement	34%	60%

- Trending towards heavy bridge replacement by 2050 by dollars spent. Would mean fewer, more expensive projects

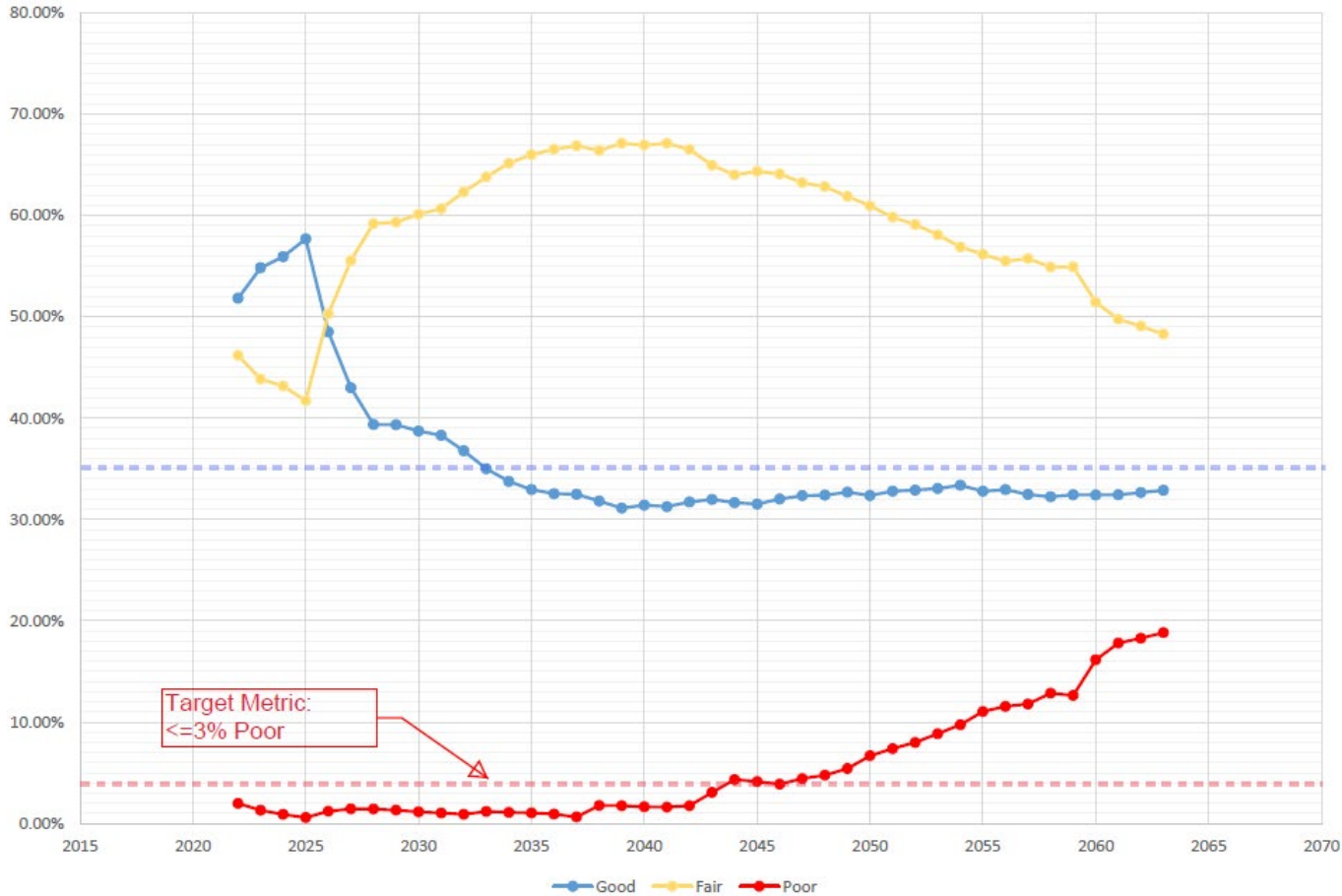


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■ Network Optimization

FHWA Index (% Good, Fair or Poor)



Target Metric:
≤3% Poor

● Good ● Fair ● Poor



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■ General Thoughts

- "Wave" is coming in 2050
- The combination of our District BAE's, and our long term plans and our integrated tools is starting to address the "Wave"
- Important to have a network plan and go thru the process of spending every dollar in every year of the plan to see the results and trade-offs



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■ Introduction

- Darryl Wineinger
- Bridge Asset Engineer, Greenfield District

■ Role

- Work with Maintenance, CPM, Construction, Inspection, and others regarding district bridge issues.
- Maintain and execute the 20-year plan and develop the Maintenance Work Plan



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■ Discussion

- 20-Year Plan vs Project Level Scoring.
 - Maintaining and executing the 20-year plan is different than identifying projects year to year. Both have shown to be effective, but the 20-year plan also has additional benefits
 - Provides a framework for all the network analysis performed by Central Office
 - It gives other departments confidence that something is coming for any particular bridge



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■ Maintenance

- Bridge inspectors submit work requests through the BAE's. BAE's check the appropriateness and resolve by sending to maintenance crews, making sure the work is added to an existing project or planned project, and/or discussing with inspection group about the requested work.
 - Ex. Tree/brush clearing, bridge deck patching, filling voids with flowable material
- Work with our subdistrict maintenance crews on the Maintenance Work Plan each year.
 - Ex. Bridge deck sealing, terminal joint retrofit, epoxy injection

■ Capital Program Management

- Begin by submitting potential projects, working with scoping groups to package projects for consideration. Includes soliciting comments from all interested parties at INDOT. **BRING YOUR SCOPES TO YOUR FIELD CHECKS!!** We spend a lot of time and effort putting them together. Not saying we are not open to great ideas but at least have it because it might answer questions that come up.
- Work with CPM through project development, answering questions, providing district preferences.



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■ Capital Program Management - Continued

- If your project is over budget, asset concurrence from the BAE is required for the changed management before it is considered downtown.

■ Construction

- Participates with construction along with CPM during project development. What is executing well in the field and what is not.
- Provide support during construction as questions arise.

■ Inspection

- Works to address deficiency submitted by inspection
- We meet quarterly to discuss what our inspectors are seeing in the field and what we are planning to submit.



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■ Apps

- Utilize BATS and LCATS to keep 20-year plan up to date.
- SPMS, GIS, and now using PowerBI to join and analyze data.
- Every year after programming, we will work our plan
 - Find homes for projects that may have been late cuts
 - Use new NBI data to make sure we are not missing an asset condition issue
 - Compare dTIMS selected recommendations to our plan. We get a score from Erich that we can use to identify where dTIMS is not considering the corrects treatments, or where we as BAE's might not be considering the correct treatments. The treatment selected by through the network level analysis may not be the same treatment selected by analysis when considering each asset individually.
 - Work with other asset groups to identify corridor opportunities to partner asset treatments to make the best project.
 - Make sure our yearly budgets are met with our proposed projects which may involve moving and evaluating several years of proposed projects.



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- **Scour Projects are coming!!!**

- We are entering the home stretch in addressing theoretical scour issues. We will be looking for our designers to come up with some good ideas to address constructability issues.

