



# KYTC BrM Optimization Experience

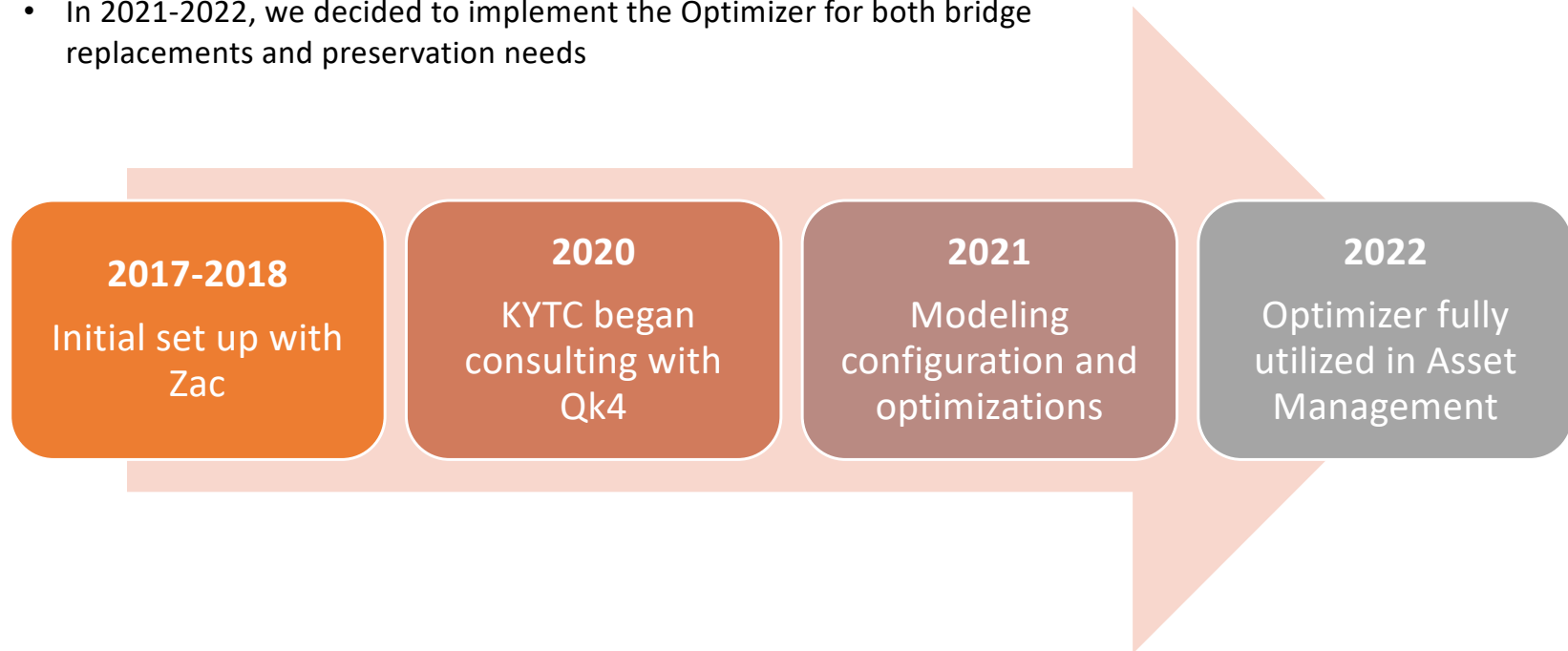
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Katherine Caldwell, Asset Manager,  
Bridge Maintenance



# History and Timeline

- KYTC initial vision in 2017 was a complete preservation approach
- Our vision shifted towards recommending bridge replacements in 2020
- In 2021-2022, we decided to implement the Optimizer for both bridge replacements and preservation needs



# 2022 TAMP Modeling Overview

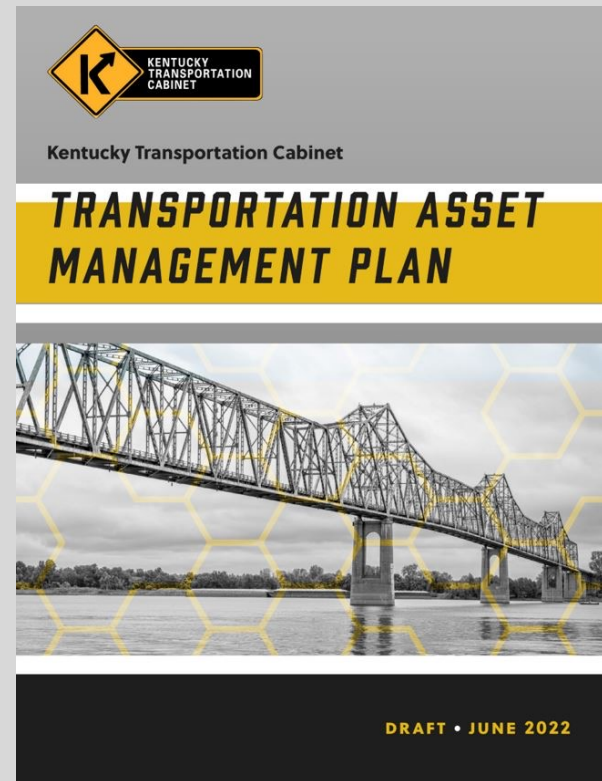
## LCP Strategies: Worst First and Optimized Preservation

### Worst First:

Bridges are allowed to deteriorate to the lowest tolerable condition before being rehabilitated or replaced. It contains no preservation work, only rehabilitation and replacement, and gives no considerations for future costs.

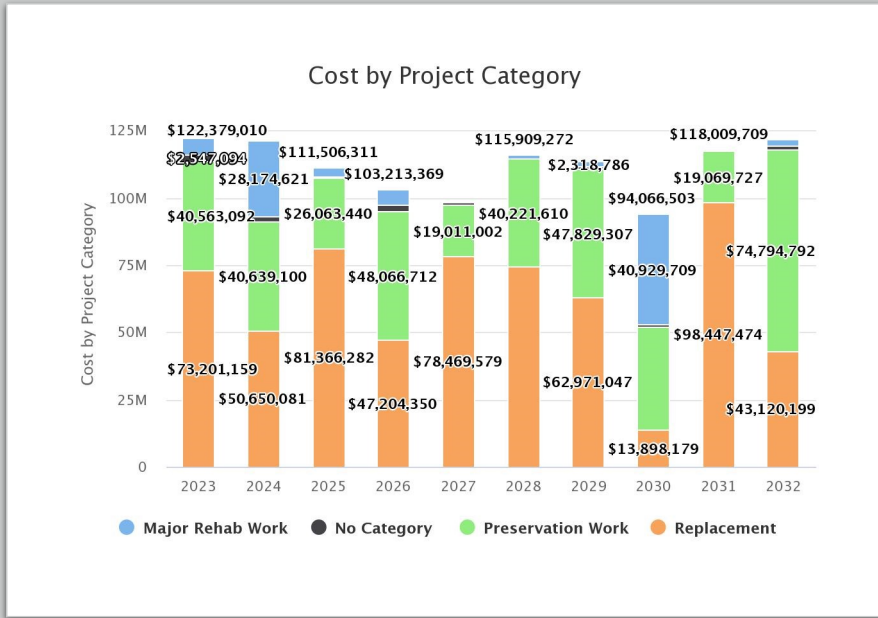
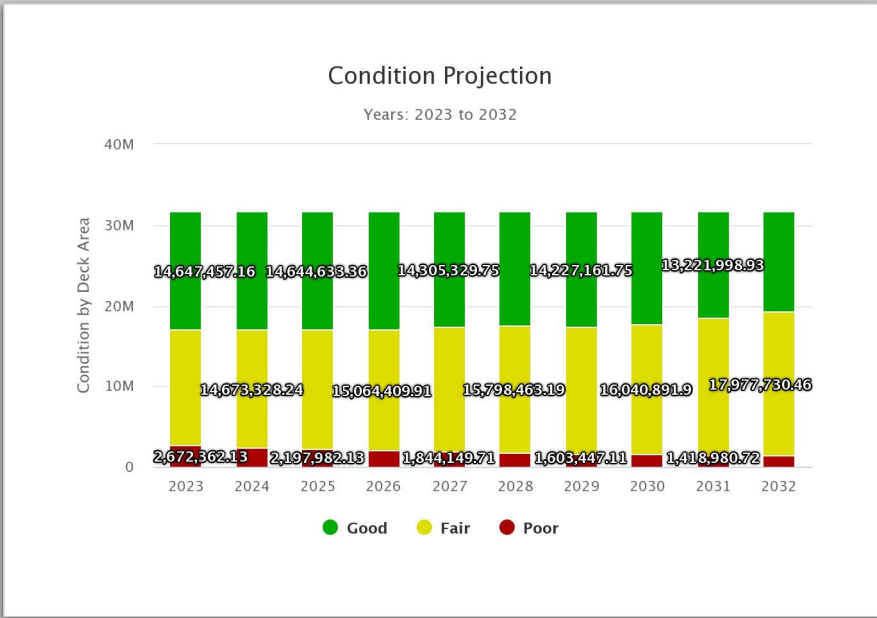
### Optimized Preservation:

Contains a sound preservation policy that ensures that the right amount of preservation work is completed in a timely manner.



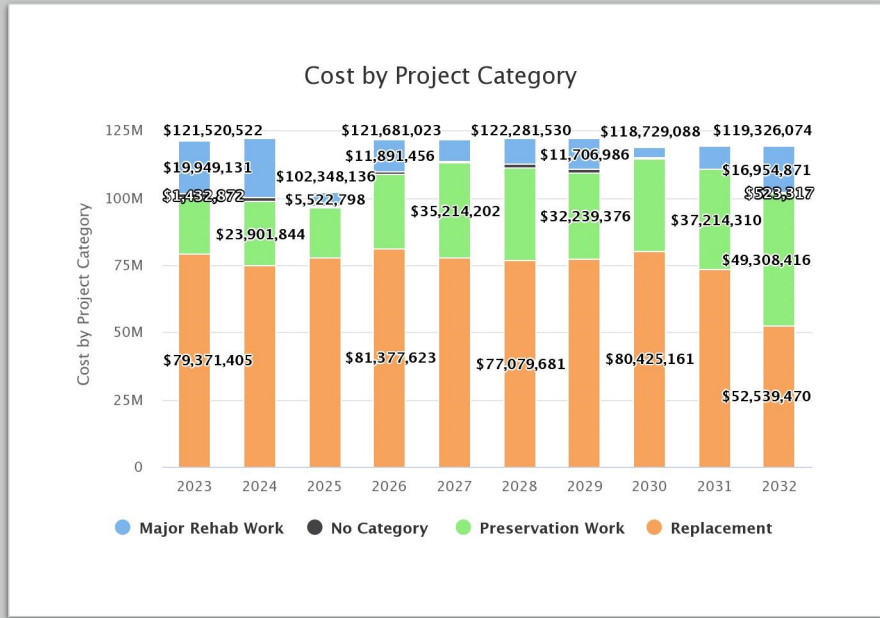
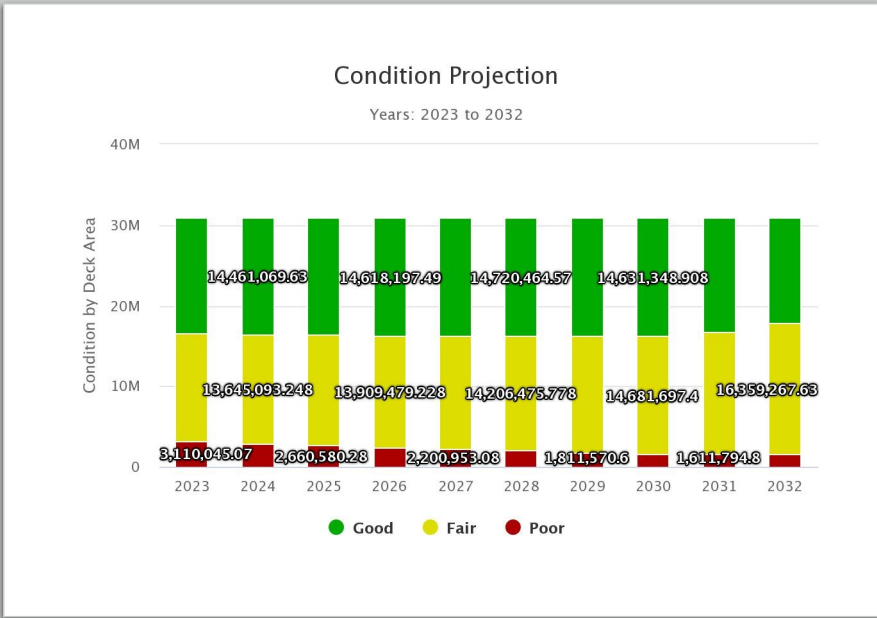
# Raw Results: Bridges on the NHS, Optimized Preservation

- Percent Preservation: 36.3%



# Raw Results: Bridges not on the NHS, Optimized Preservation

- Percent Preservation: 27.0%



# Finalized Results

“Considering a range of fiscal scenarios, a 1% increase in the state-owned bridges in *Good* condition would require an additional annual investment of about \$17 million per year for 10 years. Funding to address this improvement in condition is possible due to KYTC’s transition from a Worst First strategy to an Optimized Preservation strategy. This change reduced the annual cost of bridge preservation by about \$75 million per year. This enables KYTC to shift bridge funding to better benefit the people of Kentucky by improving bridge conditions. About half of this benefit accrues to the National Highway System (NHS), and half to the non-NHS state network. In the Optimized Preservation strategy, approximately 32 percent of the available bridge funding is spent on maintenance and preservation, yielding a return on investment of 92 percent. *KYTC’s BMS can evaluate a wide variety of strategies to find the one that yields the best long-term value.*”

-Transportation Asset Management Plan, June 2022

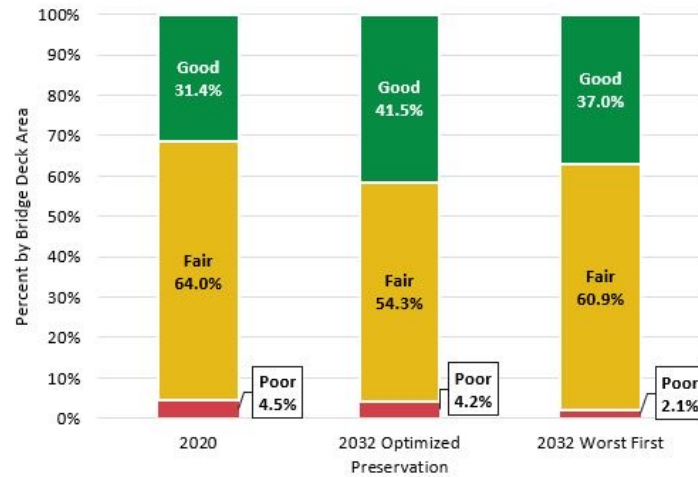


Figure 4-12. Initial and 10-year projected network bridge conditions

# Getting into the Details

- SYP, LRSTP, and TAMP modeling used the NBI Converter deterioration method to Optimize bridge projects.
- We wanted to include element condition states in the deterioration of bridges while also applying benefits to elements.
- Through much trail and error, NBI conversion profiles were established using the NBI Conversion report.

**Profile Details:**

Name:

Profile enabled

•  Generic  **Deck**  Superstructure  Substructure  Culvert

**Deck Specific CS Upper Limits**

Group enabled

Method of CS average

| NBI | Enabled                             | CS1 %                            | CS2 %                           | CS3 %                           | CS4 %                            |
|-----|-------------------------------------|----------------------------------|---------------------------------|---------------------------------|----------------------------------|
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# GCR verses NBI Converter

- GCR: General Condition Rating deterioration profiles determine the length of time, in years, that a component deteriorates from one NBI rating to the next. With GCR, we are only using the deck, superstructure, and substructure ratings.
- NBI Converter: before deteriorating, NBI converters take the percentage of each element, and based on which conversion profile is selected, it assigns an NBI rating. In other words, element condition state values determine the NBI component rating

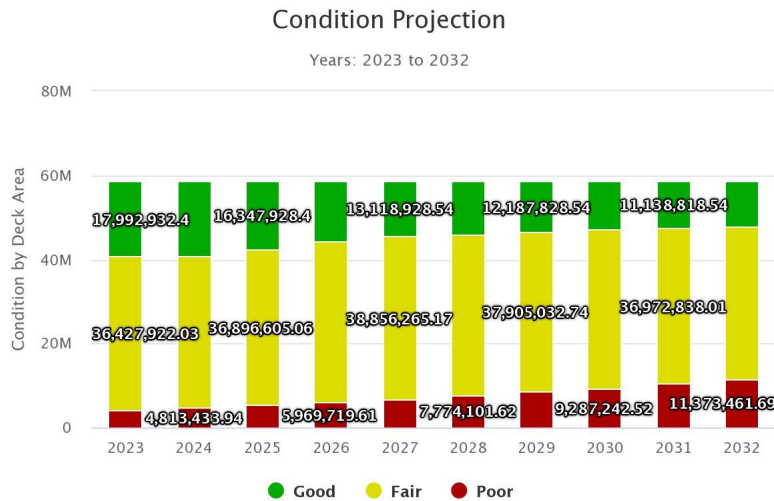


# General Condition Rating (GCR) Deterioration

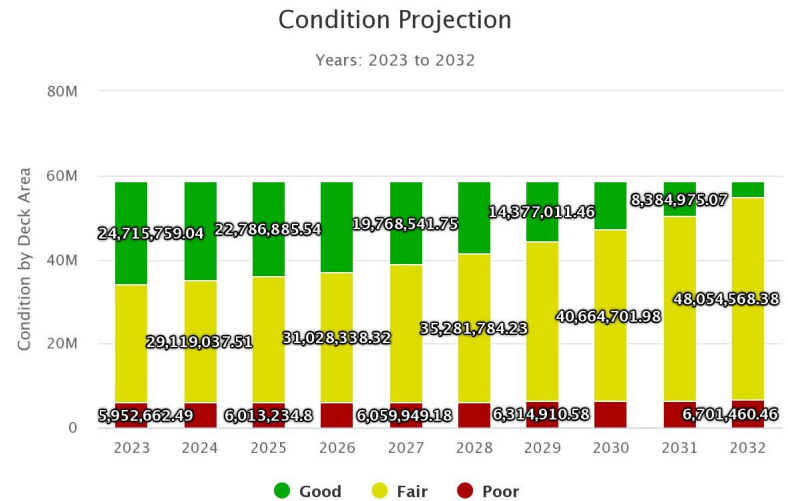
- Using GCR deterioration, I could not get condition improvement no matter what I threw at it.
- I checked and edited:
  - Network Policies
  - Actions and Benefits
  - Time-in-State Report for Deterioration Rates
  - Funding Allocation
- Still with no noteworthy improvement

# GCR Deterioration continued...

Results of Optimizing with a funding allocation of \$1/year



GCR Deterioration



NBI Converter

## GCR Deterioration continued...

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- GCR deterioration is much more aggressive than the NBI Converter
- Protective systems are in play and influence the rate of deterioration when using the NBI Converter

|      | GCR<br>Deterioration | NBI<br>Deterioration |
|------|----------------------|----------------------|
| 2023 | 7%                   | 10%                  |
| 2024 | 8%                   | 10%                  |
| 2025 | 9%                   | 10%                  |
| 2026 | 10%                  | 10%                  |
| 2027 | 11%                  | 10%                  |
| 2028 | 13%                  | 11%                  |
| 2029 | 15%                  | 11%                  |
| 2030 | 16%                  | 11%                  |
| 2031 | 18%                  | 11%                  |
| 2032 | 19%                  | 11%                  |

# Conclusions

- KYTC worked backwards by starting with NBI Converter
- We spent substantially less money to get the desired results
- NBI Converter benefits:
  - Considers each element
  - Considers protective systems
- BrM can produce complex models for a wide range of scenarios and can be tailored to state-specific needs
- The Optimizer is a great tool for making Asset Management decisions and communicating those needs through visual models

# QUESTIONS?

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Bridge between continents, Iceland

If there is a state who is satisfied with their results using GCR deterioration, I'd love to hear about it ☺

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