NCHRP 23-07: Effective Methods for Setting Transportation Performance Targets

TPM Webinar Series

Bridges. June 23, 2022

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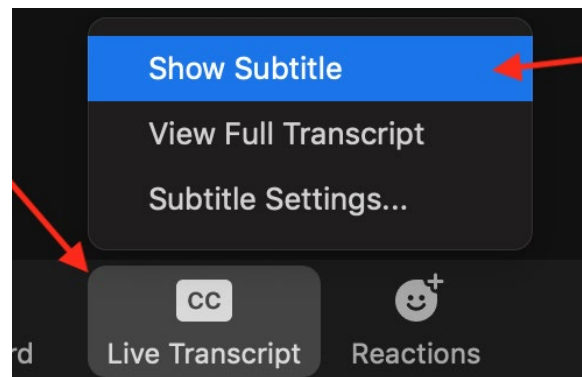**applied pavement TECHNOLOGY**

Agenda

Welcome & Overview of Methods

Presentation by Connecticut DOT + Q&A

Presentation by Pennsylvania DOT + Q&A

Discussion

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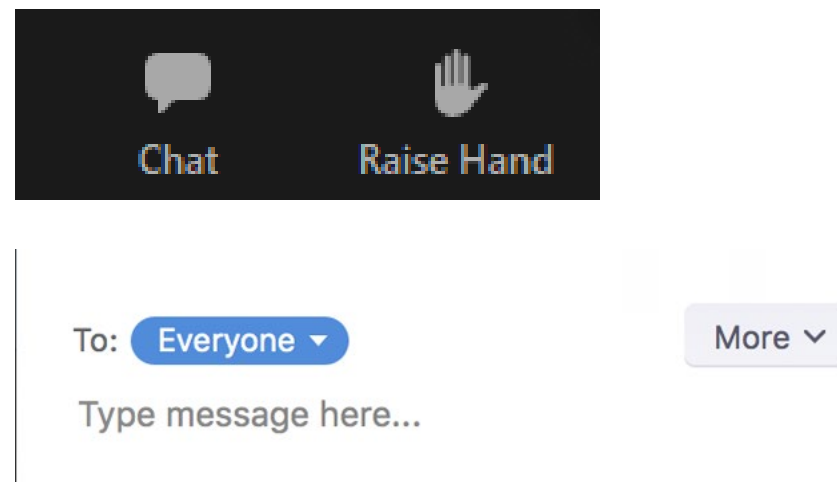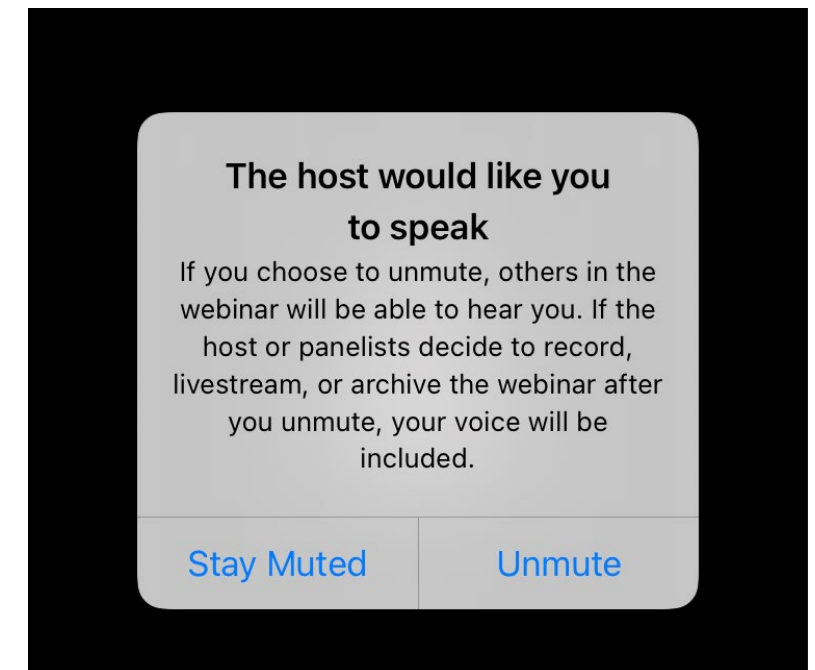
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Navigating Zoom

To view captions, look for CC at the bottom of the screen.

To ask a question, type the question in the chat or click "Raise Hand" to be called on.

If your hand is raised, we will give you the capability to unmute and ask a question.

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Guidebook Purpose

> To help State DOTs and MPOs identify effective methods for setting transportation performance targets.

Guidebook Contents

- Part I. Target Setting Overview and Tips
  - Introduction to Guidebook
  - Target Setting Foundations
  - Practical Application Tips

- Part II. A Menu of Target Setting Methods
  - Target Setting Methods for Safety
  - Target Setting Methods for Infrastructure Condition
  - Target Setting Methods for Reliability
  - Target Setting Methods for Traffic Congestion

- Part III. Target Setting for Non-Required Measures
  - Why Use and Set Targets for Other Measures?
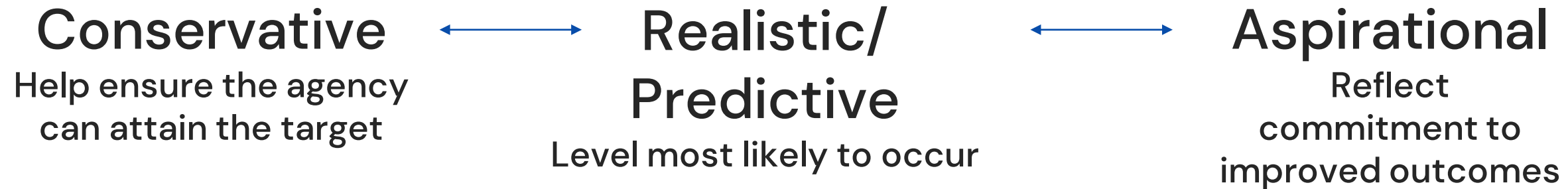 - Examples of Performance Measures and Targets

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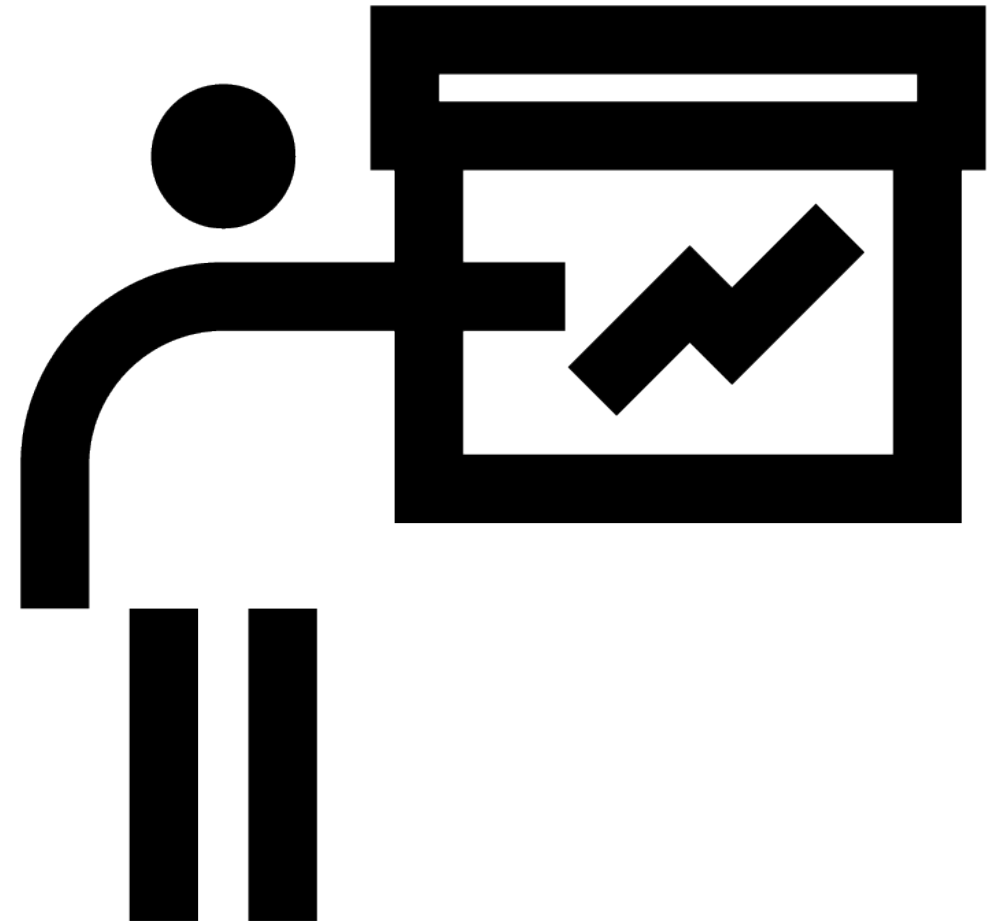
Types of Target Setting Methods Used

- Policy-Based
  - E.g., no more than 5% of pavement in *Poor* condition

- Historical Trends
  - E.g., based on trends over past 5 years

- Probabilistic and Risk-Based Approaches
  - E.g., considering potential variability in performance

- Statistical Models that Account for Explanatory Factors
  - E.g., regression model

- Other Tools and Models
  - E.g., asset management management systems

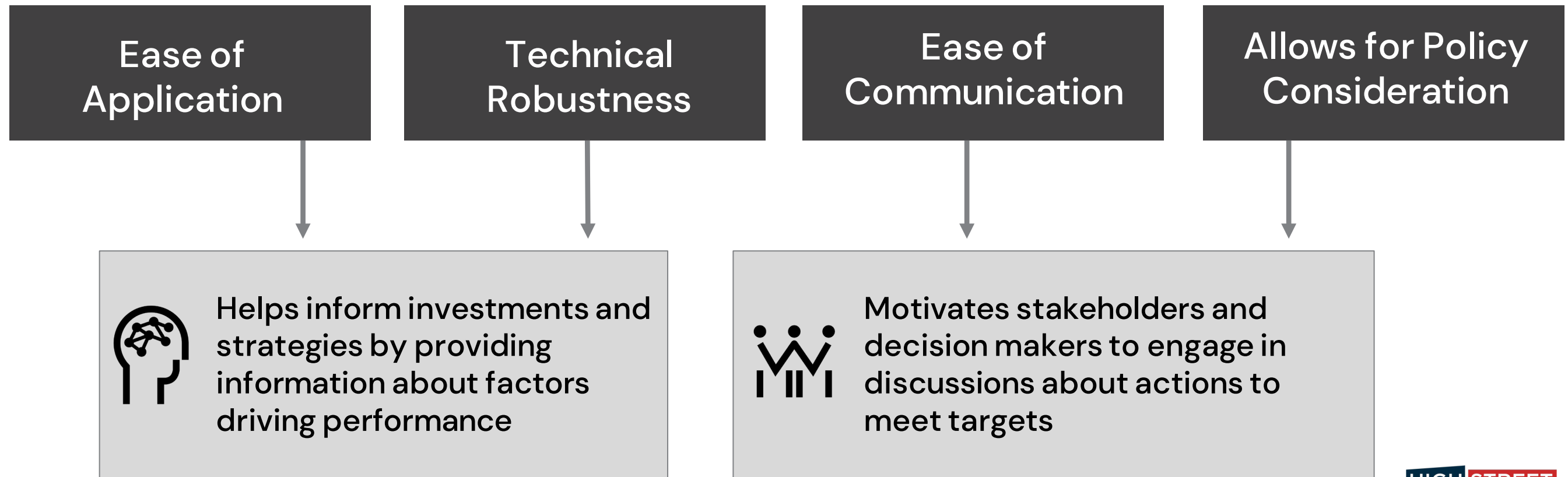With support from

Target Setting Philosophies

Conservative
Help ensure the agency can attain the target

←→

**Realistic/
Predictive**
Level most likely to occur

←→

Aspirational
Reflect commitment to improved outcomes

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Guidebook Part I: Target Setting Overview and Tips

What Makes a Target Setting Method Effective?

Ease of Application	Technical Robustness	Ease of Communication	Allows for Policy Consideration

Helps inform investments and strategies by providing information about factors driving performance

Motivates stakeholders and decision makers to engage in discussions about actions to meet targets
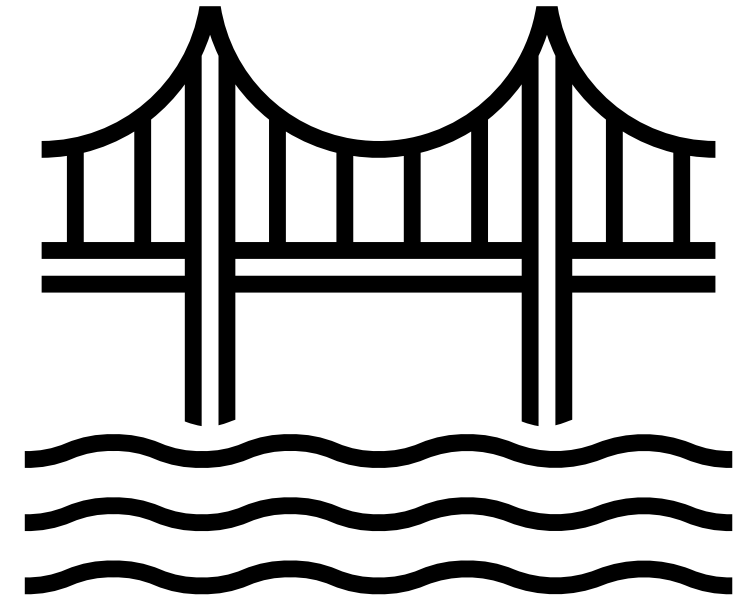
Bridge Performance Measures

- **Bridges**
  - **The percentage of NHS bridges classified in _Poor_ Condition**

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Simpler to implement & communicate ↑

More data-heavy ↓

Method

Targeted Change

Select to use the baseline figures or selected value

Time–Series Trend

Forecast based on historical performance trend

Time–Series Trend Plus Future Funding

Accounts for anticipated funding levels

Model/System–Based

Asset management system based (uses pavement or bridge management system)

Scenario Analysis

Uses an asset management system to predict conditions, but analyzes multiple funding levels or strategies for prioritizing funding

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Targeted Change

Strengths	Limitations	Other Considerations
Simplest approach. Allows agencies to establish targets when data confidence is not sufficient to support other methods	No insights into causes of outcomes	–

Time-Series Trend

Strengths	Limitations	Other Considerations
Simple approach. Does not require special analysis tools	Quality historic data is needed to establish reasonable trends. Assumes investment decisions will remain consistent	–

$$y = -10.5x + 419.2$$
$$R^2 = 0.975$$

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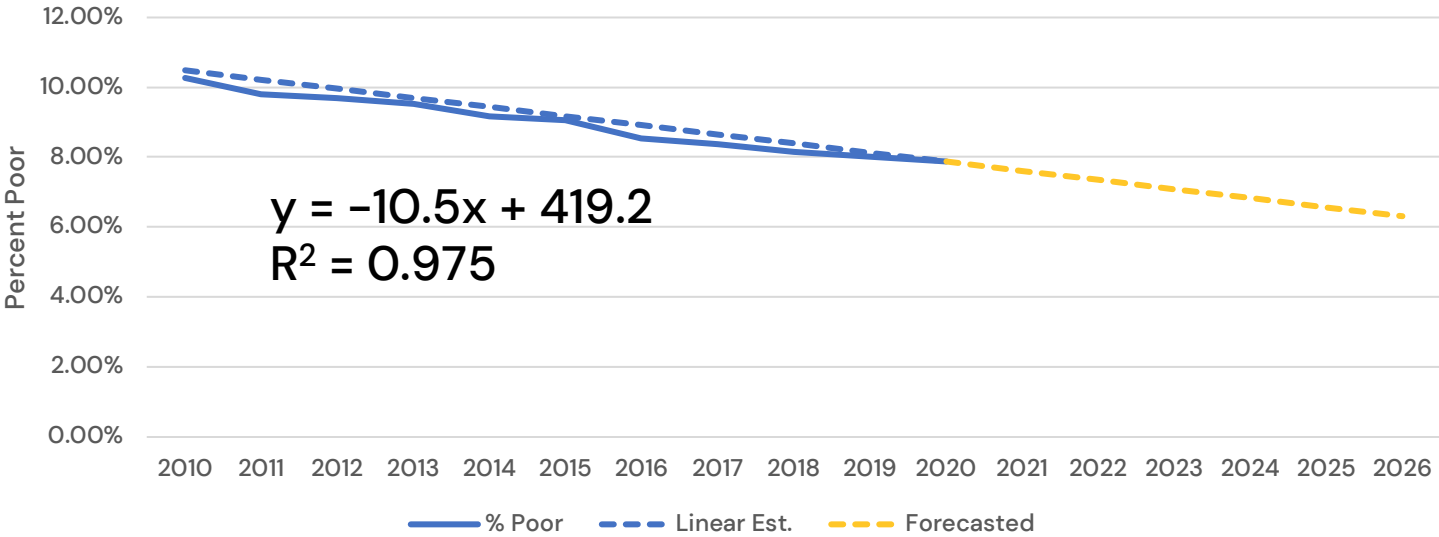
Time-Series Trend Plus Future Funding

Strengths	Limitations	Other Considerations
Still relatively simple. Accounts for changes in available funding or programming priorities	Quality historic data is needed to establish reasonable trends	–

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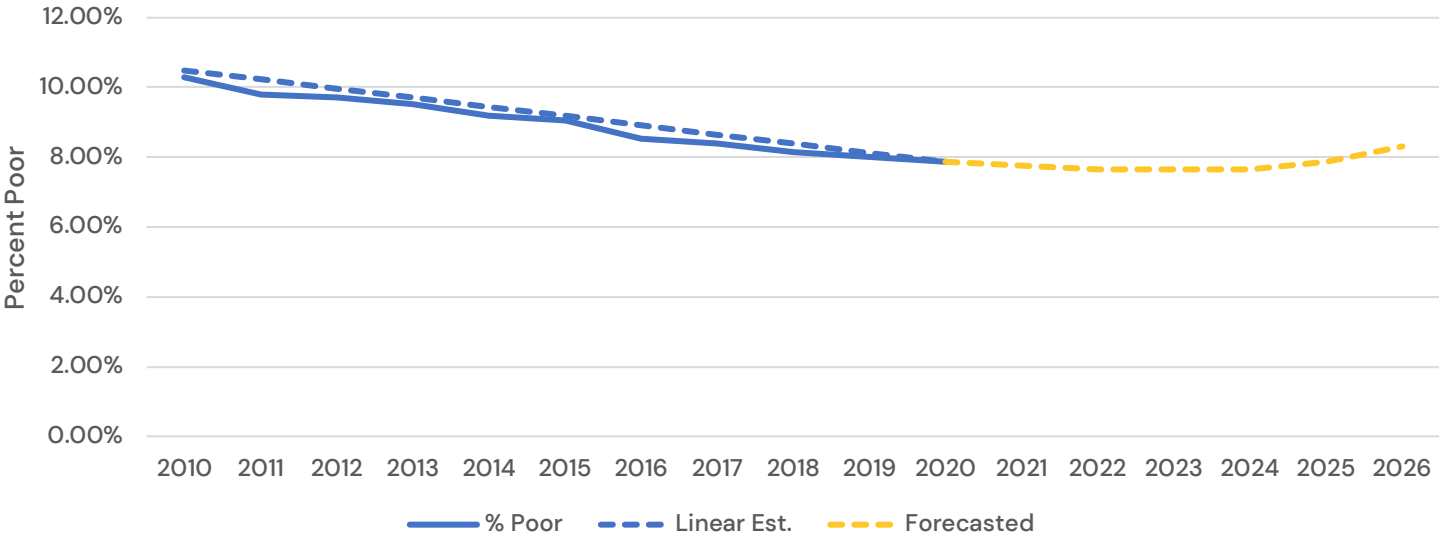
Model/System Based

Strengths	Limitations	Other Considerations
Forecasts asset conditions based on agency specific performance, costs, treatments, and priorities	Requires asset management systems to be configured and validated. Historic data is needed to establish accurate deterioration rates	Adjustments may need to be made to translate projected conditions from State measures to national performance measures. Not all NHS assets may be included in State databases

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Scenario Analysis

Strengths	Limitations	Other Considerations
Provides decision makers with information on the expected outcomes from different investment strategies. Can support integrated establishment of targets and investment strategies	Requires accurate models and the ability to vary funding inputs. Internal business processes may not support integrated decisions making between TPM and programming	–

Federal Requirements for deck area for 1,785 NHS-NBI bridges

% NHS Good (by Deck area)
- - - Preferred Funding ($650M)
——— Current Funding ($375M)
· · · · No Funding ($0M)
Includes routine bridge maintenance with other funding
——— Goal

% NHS Poor (by Deck Area)
- - - Preferred Funding ($650M)
——— Current Funding ($375M)
· · · · No Funding ($0M)
Includes routine bridge maintenance with other funding
——— Goal

Based on funding as of 12/31/18

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Presenters

- Justin Bruner
  - Pennsylvania DOT

- Jacob Booth
  - Connecticut DOT

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Description

- CTDOT inspects 5,433 roadway bridges, 1,822 of which are National Bridge Inventory (NBI) structures on the National Highway System (NHS).
- 4,058 of these bridges are state maintained; the remaining 1,375 are maintained locally or under another jurisdiction
- CTDOT defines a bridge as a crossing of at least six feet in length, including culverts. The Federal Highway Administration (FHWA) defines an NBI bridge as a structure measuring more than 20 feet in length.
- CTDOT has a distinct Major Bridge Program for large or expensive-to-replace bridges. 60 structures are currently categorized as Major Bridges.
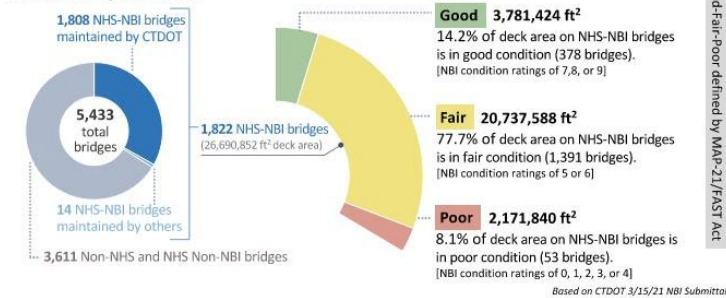
State of Good Repair (SOGR)

A bridge for which the condition rating for each of the three major components for a span bridge (Substructure, Deck, and Superstructure) or the structural condition of a culvert is rated at least a 5 on a 0-9 condition scale is classified as being in a SOGR.

Bridge Age

The average NHS-NBI bridge in Connecticut is 55 years old, which is 7 years older than the national average of 48 years. The state has a higher percentage of Poor bridges (by deck area) compared to the national average.

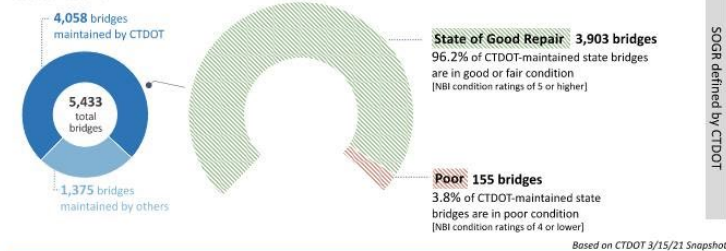## NHS-NBI Inventory and Condition
Federal Requirements

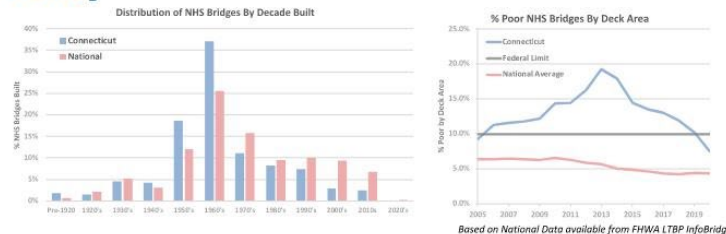Good-Fair-Poor defined by MAP-21/FAST Act

5,433 total bridges

1,808 NHS-NBI bridges maintained by CTDOT

14 NHS-NBI bridges maintained by others

3,611 Non-NHS and NHS Non-NBI bridges

1,822 NHS-NBI bridges (26,690,852 ft² deck area)

Good 3,781,424 ft²
14.2% of deck area on NHS-NBI bridges is in good condition (378 bridges).
[NBI condition ratings of 7,8, or 9]

Fair 20,737,588 ft²
77.7% of deck area on NHS-NBI bridges is in fair condition (1,391 bridges).
[NBI condition ratings of 5 or 6]

Poor 2,171,840 ft²
8.1% of deck area on NHS-NBI bridges is in poor condition (53 bridges).
[NBI condition ratings of 0, 1, 2, 3, or 4]

Based on CTDOT 3/15/21 NBI Submittal

CTDOT-Maintained Inventory and Condition
State Goals

SOGR defined by CTDOT

4,058 bridges maintained by CTDOT

5,433 total bridges

1,375 bridges maintained by others

State of Good Repair 3,903 bridges
96.2% of CTDOT-maintained state bridges are in good or fair condition
[NBI condition ratings of 5 or higher]

Poor 155 bridges
3.8% of CTDOT-maintained state bridges are in poor condition
[NBI condition ratings of 4 or lower]

Based on CTDOT 3/15/21 Snapshot

History

Distribution of NHS Bridges By Decade Built
- Connecticut
- National

% Poor NHS Bridges By Deck Area
- Connecticut
- Federal Limit
- National Average

Based on National Data available from FHWA LTBP InfoBridge

NHS-NBI Bridge Performance Projections
Federal Requirements for deck area for 1,822 NHS-NBI bridges
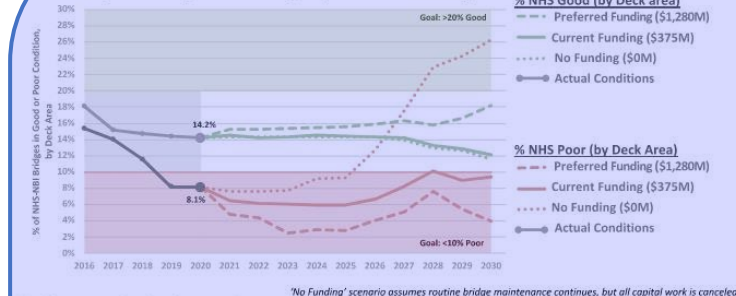
% NHS Good (by Deck area)
- Preferred Funding ($1,280M)
- Current Funding ($375M)
- No Funding ($0M)
- Actual Conditions

Goal: >20% Good

14.2%

% NHS Poor (by Deck Area)
- Preferred Funding ($1,280M)
- Current Funding ($375M)
- No Funding ($0M)
- Actual Conditions

8.1%

Goal: <10% Poor

'No Funding' scenario assumes routine bridge maintenance continues, but all capital work is canceled

Performance Projections at Current Funding Level ($375M Budget)

End of Year	2021	2022	2023	2024	2025	Goal
NHS Good (by deck area)	14.5%	14.2%	14.4%	14.5%	14.4%	>20.0%
NHS Poor (by deck area)	6.5%	6.2%	6.1%	6.0%	6.0%	<10.0%

CTDOT-Maintained Bridge Performance Projections
State Goals by number of bridges for 4,058 CTDOT-maintained bridges
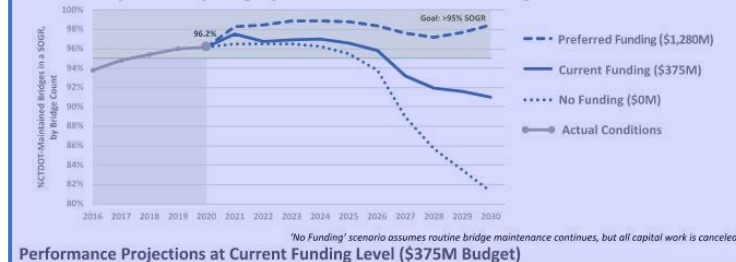
Goal: >95% SOGR

96.2%

- Preferred Funding ($1,280M)
- Current Funding ($375M)
- No Funding ($0M)
- Actual Conditions

'No Funding' scenario assumes routine bridge maintenance continues, but all capital work is canceled

Performance Projections at Current Funding Level ($375M Budget)

End of Year	2021	2022	2023	2024	2025	Goal
SOGR	97.5%	96.8%	96.9%	97.0%	96.6%	95.0%

Performance Projections

The chart on the left depicts bridge condition for various funding scenarios. These were developed through an analysis program using CTDOT bridge condition data, as of February 2021.

Asset Valuation

$17,065,712,000

Asset value is estimated using the replacement value. For bridges, replacement value is the product of deck area and unit construction cost. For 4,058 bridges: 34,827,984 sqft * $490/sqft = $17.1 billion.

Measures and Goals

CTDOT has set the following bridge condition goals:

Federal Requirements:
- 10% or less Poor by deck area on NHS-NBI bridges (Federal minimum is less than 10% Poor)
- 20% or more Good by deck area on NHS-NBI bridges. (Percent Good is established by each state; no Federal minimum for this goal)
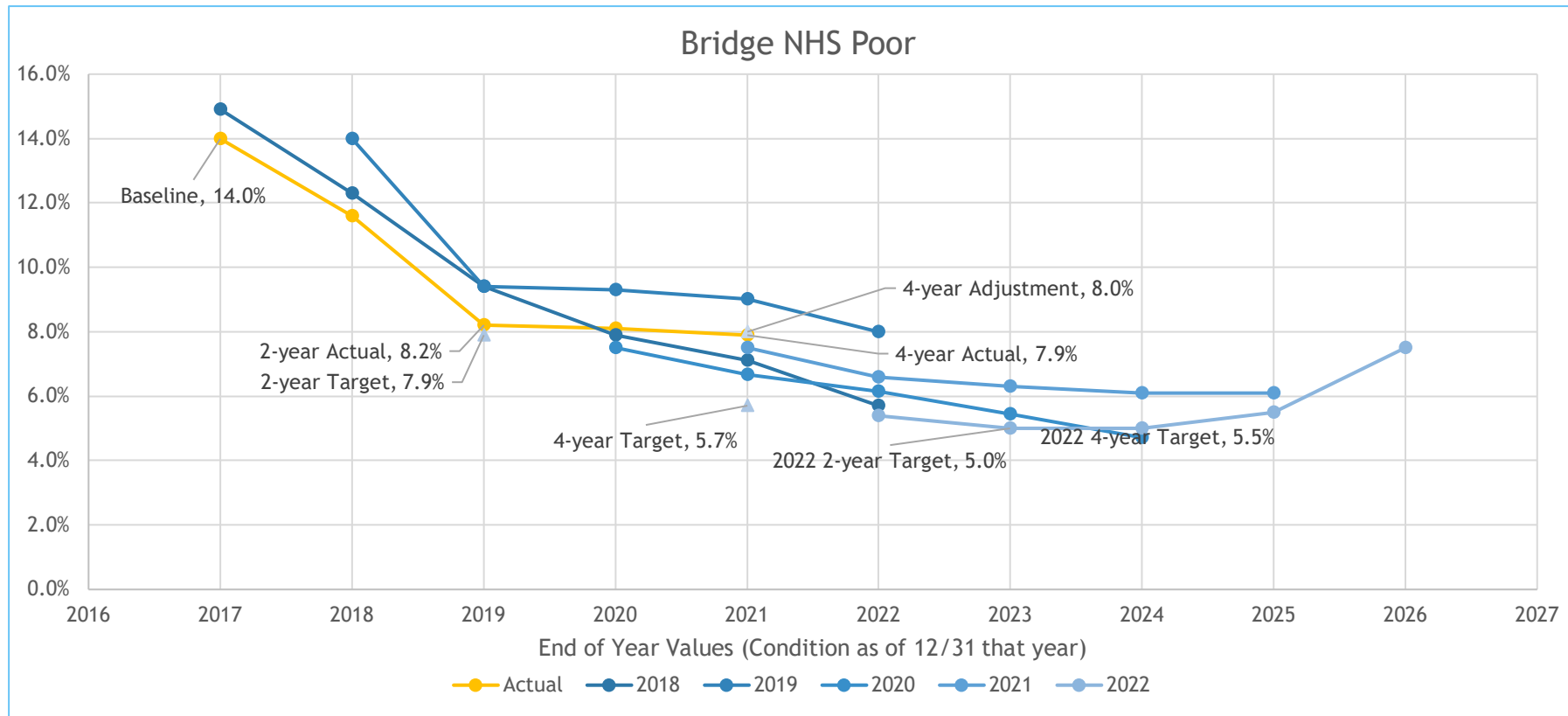
State Goal:
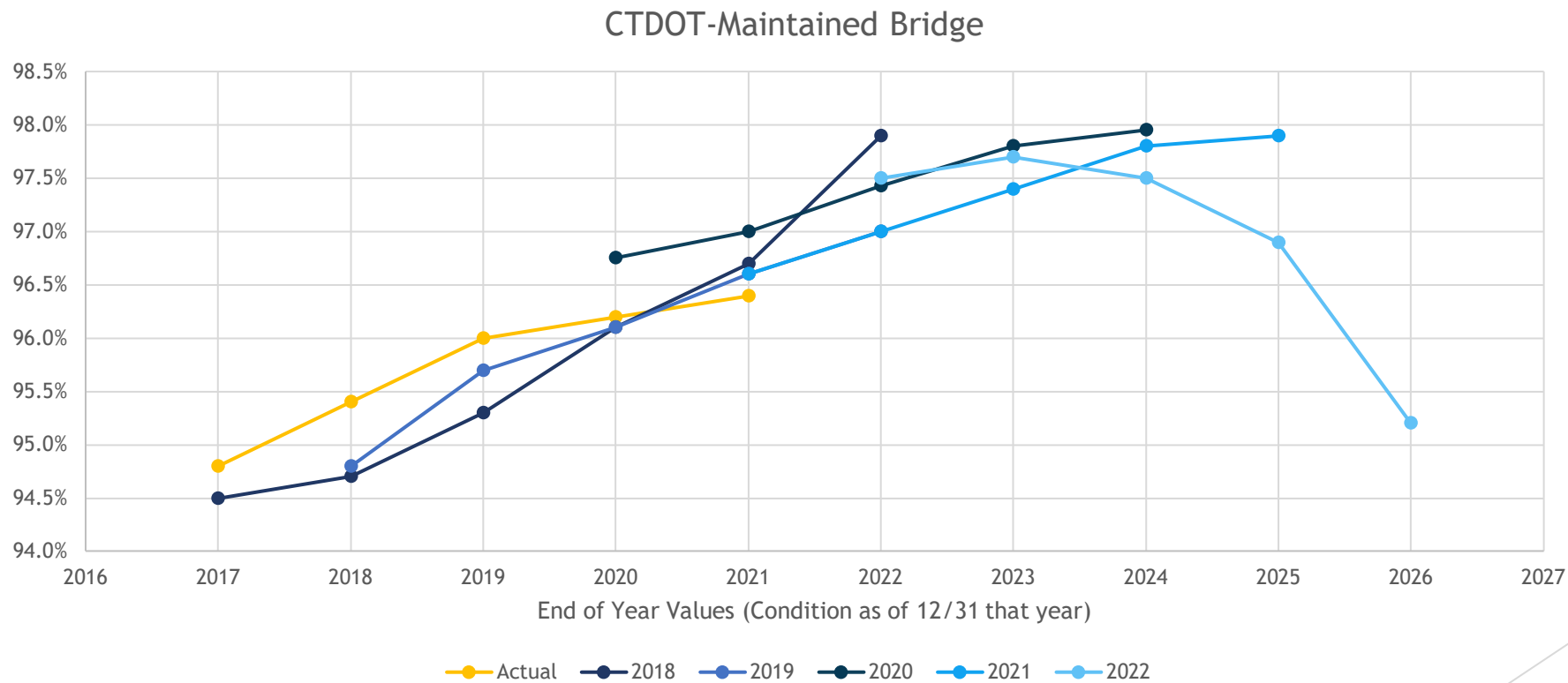- 95% or more of State-Maintained bridges in a SOGR (State target)

Projected Performance vs Actual Performance

Bridge NHS Good
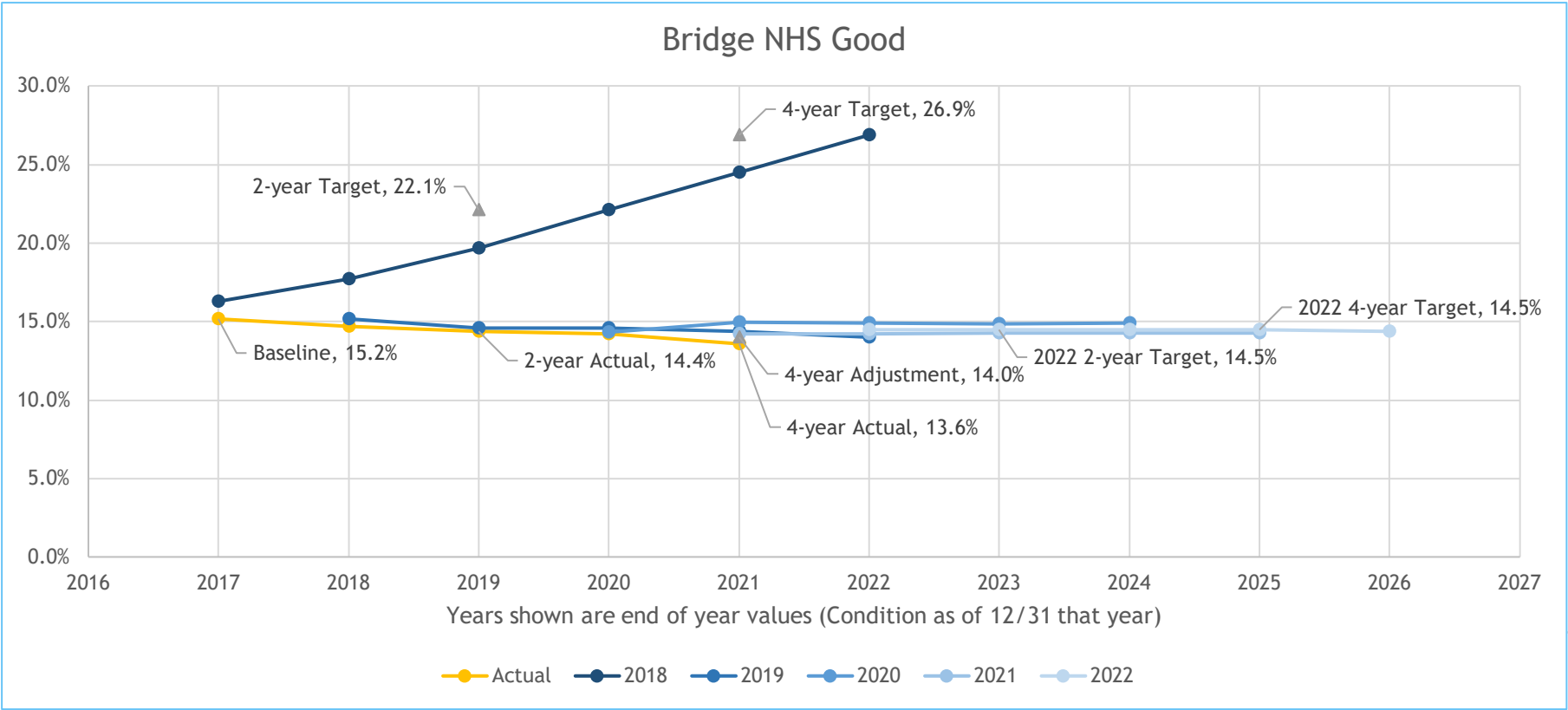
Projected Performance vs Actual Performance

Projected Performance vs Actual Performance

CTDOT-Maintained Bridge

Target Finalization
Engineering Judgement & Past Target Results

⬇

Present Targets to MPOs
Present at timely CTDOT Monthly Meeting

⬇

Publish Targets in CTDOT TAMP
Targets to be submitted are included in TAMP

Thank You

- Questions?

Discussion

- What challenges or benefits have you found with your method of target setting?

- Do you or your agency wish to use a different method but face a barrier?

- Have you been able to leverage the target setting or performance review process to bring about new actions to address performance?

- What elements have made the process more effective/ meaningful?

- Have agencies set increasing (worsening) targets and still missed them?

- How have you successfully communicated your targets to your MPOs? Leadership? The public?

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