TRANSPORTATION PERFORMANCE MANAGEMENT

BRIDGE PERFORMANCE MANAGEMENT

BRIDGE CONDITION

Federal law, outlined in the National Bridge Inspection Standards (NBIS), defines a bridge as a structure carrying traffic with a span greater than 20 feet and requires that all bridges be inspected every two years to monitor and report condition ratings. The FHWA requires that for each applicable bridge, the performance measures for determining condition be based on the minimum values for substructure, superstructure, deck, and culverts. The FHWA further requires counting this condition by the respective deck area of each bridge and express condition totals as a percentage of the total deck area of bridges in a state.

Condition ratings are based on a 0-9 scale and assigned for each culvert, or the deck, superstructure and substructure of each bridge. These ratings are recorded in the National Bridge Inventory (NBI) database. Condition ratings are an important tool for transportation asset management, as they are used to identify preventative maintenance needs, and to determine rehabilitation and replacement projects that require funding.

REPORTING ON BRIDGE CONDITION

The Transportation Performance Management (TPM) Bridge Condition Rule designates recurring four-year performance periods for which MDOT is required to two-year (midpoint) and four-year (full performance) targets for bridge condition on the National Highway System (NHS). MDOT is required to submit three performance reports to FHWA within the 4-year performance period.

- Baseline Performance Report
  -October 1st, 2018
- Mid-Performance Period Progress Report
  -October 1st, 2020
- Full Performance Period Progress Report
  -October 1st, 2022

The two performance measures for assessing bridge condition are:

- **% of NHS bridges in Good Condition; and**
- **% of NHS bridges in Poor Condition.**

MDOT established bridge targets on May 20, 2018.
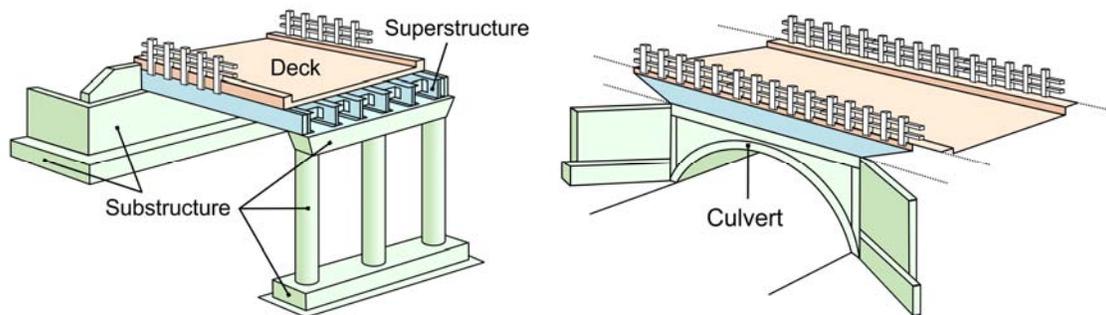
ANATOMY OF A BRIDGE OR CULVERT

| NBI Condition Ratings			
7-9	Good Condition		Routine maintenance candidate.
5-6	Fair Condition		Preventative maintenance and minor rehabilitation candidate.
4	Poor Condition	Poor	Major rehabilitation or replacement candidate.
2-3		Serious or Critical	Emergency repair or high priority major rehabilitation or replacement candidate. Unless closely monitored it may be necessary to close until corrective action can be taken.
0-1		Imminent Failure or Failed	Major rehabilitation or replacement candidate. **Bridge is closed to traffic.**

REPORTING ON BRIDGE CONDITION, CONTINUED

• **MPO Targets**: MPOs are required to establish four-year targets for these measures and have two options for target selection: agree to plan and program projects that support MDOT targets or commit to their own targets for their Metropolitan Planning Area (MPA).

• **MPO Targets Due:** MPO targets are due on November 16, 2018, 180 days after MDOT's targets. These targets are not reported to FHWA but must be reported to MDOT in a manner both parties agree to. MPOs will include targets in their TIPs and LRPs and explain how their projects and programs support either MDOT's or the MPO's targets.

• **Significant Progress:** FHWA will determine significant progress on the Mid- and Full Performance Period Progress Reports. Significant progress is defined as achieving a condition that is equal to or better than the target, or better than the baseline condition. If significant progress is not achieved, MDOT must document how it plans to achieve it for the next report.

End of 2017 NHS Bridge Condition by Count – Statewide (for reference only)								
Owner	Good		Fair		Poor		Total	
Trunkline	823	30%	1768	65%	138	5%	2729	92%
Bridge Authority	3	38%	5	62%	0	0%	8	<1%
Local	92	41%	94	42%	39	17%	225	8%
Total	918	31%	1867	63%	177	6%	2962	

End of 2017 NHS Bridge Condition by Deck Area - Statewide								
Owner	Good		Fair		Poor		Total (sft)	
Trunkline	11,145,968	34%	18,568,765	56%	3,221,383	10%	32,936,116	88%
Bridge Authority	291,482	15%	1,707,000	85%	-	0%	1,998,482	5%
Local	782,324	32%	1,197,624	49%	446,003	18%	2,425,951	6%
Total	12,219,774	33%	21,473,389	57%	3,667,386	10%	37,360,549	

NATIONAL HIGHWAY SYSTEM
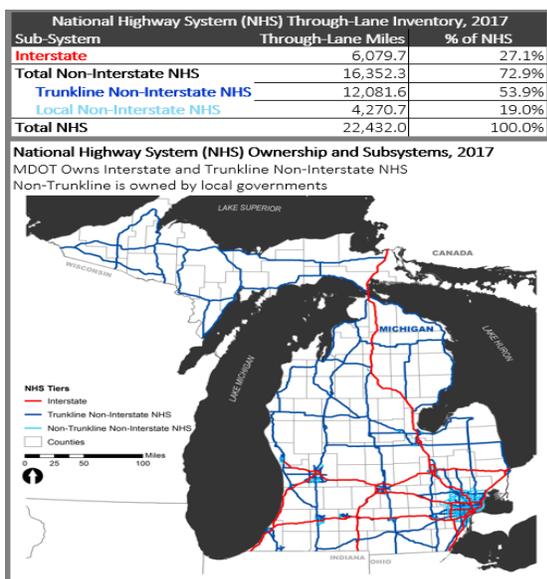
While the National Bridge Inspection Standards applies to all publicly owned highway bridges, the TPM Targets are only applied to those bridges carrying routes on the NHS including bridge on- and off-ramps connected to the NHS. The NHS consists of roadways important to the nation's economy, defense, and mobility. The NHS includes the following subsystems of roadways: interstate, other principal arterials, strategic highway network, major strategic highway network connectors, and intermodal connectors. condition totals as a percentage of the total deck area of bridges in a state.

Local agencies own 6 percent of the NHS bridge deck area in Michigan, while MDOT and the Bridge Authorities maintain ownership of approximately 94 percent of bridge deck area (see table above). MDOT and MPO targets must cover the entire NHS, regardless of ownership. To account for this, the rule requires MDOT and MPOs to coordinate target setting, planning, and programming, ensuring targets are feasible, and projects are geared toward achieving them.

BRIDGE DETERIORATION MODELS

As a bridge ages, its condition declines and an increasing amount of work is required to restore condition or extend the usable life of the bridge. By tracking the rate at which bridges have declined in the past, MDOT is able to predict the rate at which a bridge will decline in the future. MDOT has an established process through which trends in bridge deterioration rates can be evaluated at regular intervals. These periodic reviews will show whether preventive maintenance and other small actions taken on bridges are effective over time. This process is documented in the report "A Process for Systematic Review of Bridge Deterioration Rates" which is available on the MDOT website at: http://www.michigan.gov/documents/mdot/A_Process_for_Systematic_Review_of_Bridge_Deterioration_Rates_522422_7.pdf.

As shown in the image above, the minimum NBI condition rating is the y axis, and the number of years in each condition state is the x axis. As the Target setting periods are two and four years, the key transition times for this analysis are the Transition from Good to Fair (the time it takes to drop from 7 to 6) and the Transition from Fair to Poor (the time it takes to drop from 5 to 4). Outside of the initial drop for 9 (Excellent) to 8 (Very Good), a bridge would not be *predicted* to fall multiple condition ratings over a span of four years as it is based on statewide averages. This can sometimes occur in practice and is part of the error involved in predictions.

PROJECT IMPACTS

MDOT PROJECT SELECTION - As the product of ongoing asset management by MDOT and our local agencies, projects are programmed each year to extend life or improve condition throughout the bridge network. MDOT analyzes the candidates for each of the major work types – preventive maintenance, rehabilitation and replacement – and identifies a strategy that is the most cost-effective means to achieve

and sustain a state of good repair within financial constraints. Starting from this initial strategy, the regions then perform more detailed analysis and scopes, coordinating with other programs such as road, and selecting projects through the annual Call for Projects process.

A small number of MDOT bridges are managed centrally within the Big Bridge Program. The Big Bridge Population is a unique subset of MDOT's trunkline bridge population that includes twenty-three large deck bridges (deck area in excess of 100,000 sq ft), thirteen complex bridges, and twelve moveable bridges. These forty-eight bridges are unique not only from an engineering standpoint, but they also represent large capital investments in terms of their initial construction costs and in terms of their long-term preservation and rehabilitation costs. Because of the significant investment these bridges represent, MDOT's goal is to preserve and maintain the Big Bridge inventory in a continuously good or fair condition state. This population is also of unique importance to the Performance Management Target Settings as the 37 structures that carry NHS comprise 14% of the trunkline NHS deck area.

LOCAL AGENCY PROJECT SELECTION - As the product of ongoing asset management by MDOT and our local agencies, projects are programmed local agency bridge projects included in this analysis are those that have been selected through the local bridge program. Legislation enacted October 1, 2004 created a local bridge fund, a local bridge advisory board (LBAB) and seven regional bridge councils (RBC). The legislation places control of the funding allocations of the local bridge fund in the hands of the local agencies of Michigan through the LBAB and RBCs. A call for applications is sent to all local agencies on an annual basis. The submitted applications are reviewed by the staff of MDOT local agency program's bridge unit for completeness and funding eligibility. Formula rating points are computed and each region's applications are submitted to their respective RBC for addition of discretionary points. A 3-year bridge program is maintained by each RBC.
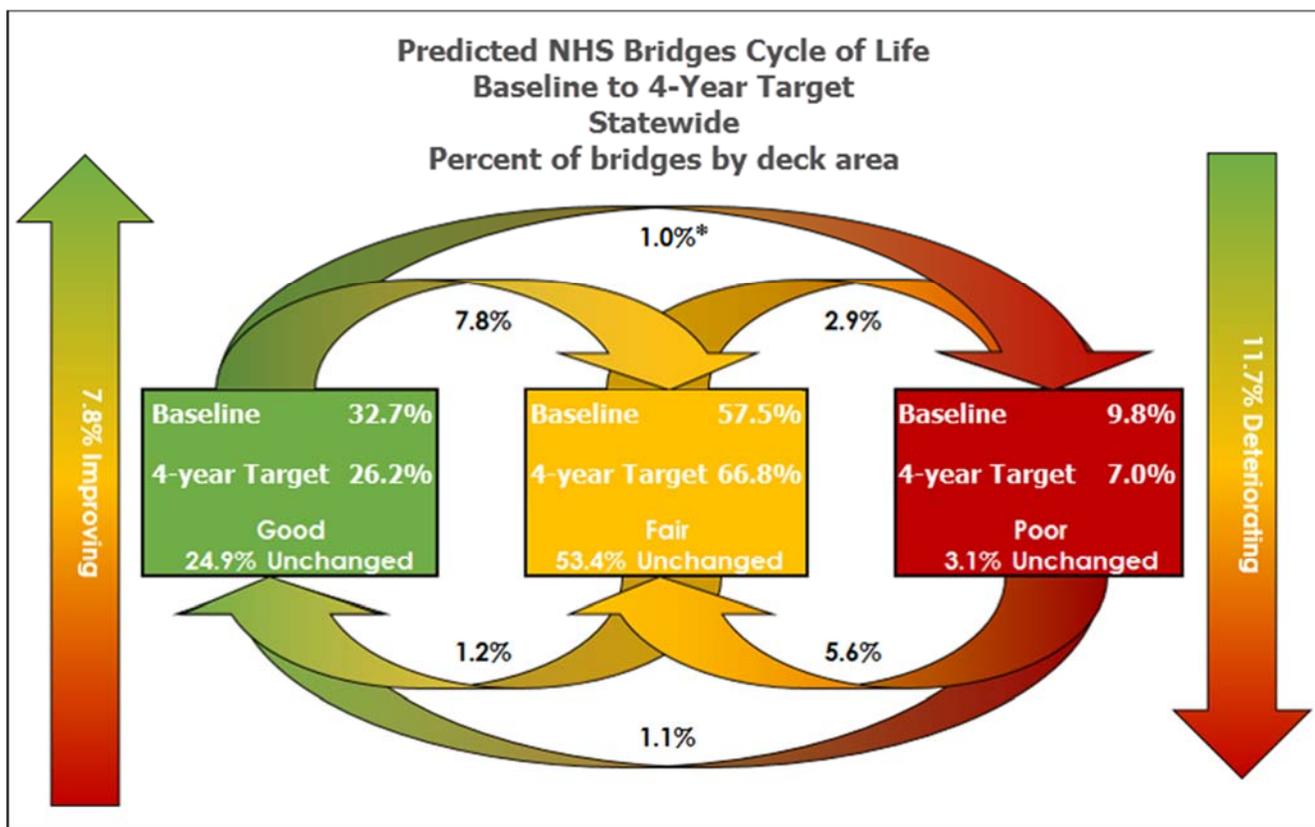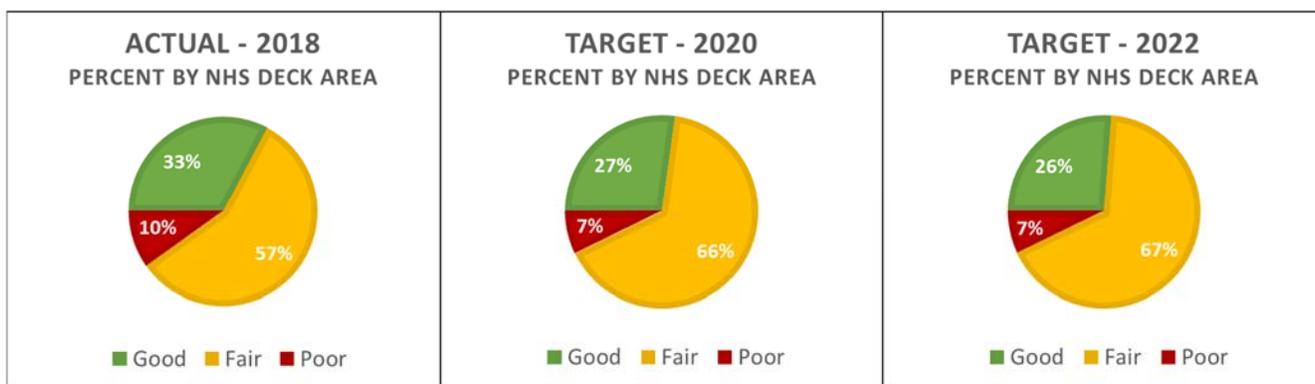
Local Agencies may also identify bridge projects through their Metropolitan Planning Organization or Rural Task Force, although because of the dollar amounts available these projects are rare. Many local agencies do projects on their bridges with their Act 51 fund distributions. These projects, however, do not have to be entered as a programmed project within the Planning Schema and would not be reflected in the results. Due to the relatively small amount of local agency deck area, this is considered an acceptable omission at this time, but is an area identified for future improvement.

DEVELOPING TARGETS

Starting from the condition reported with the NBI submittal on March 14th of 2018, the expected improved condition from projects and reduced condition from deterioration was summarized into expected condition in 2020 and in 2022. The deck areas in good, fair and poor conditions at each year was summarized. To account for uncertainty, the amount of deck area in good condition was conservatively reduced by 1%, and the amount of deck area in poor condition was increased by 1%. A 1% reduction for uncertainties reflects about 30 average size structures that either deteriorated faster than predicted or that did not see as much of an improvement as predicted.

ANALYZING TARGETS

Overall, the number of good bridges is expected to decline significantly as preservation efforts tend to extend life in fair condition. While the amount of bridges in good condition is predicted to decrease, the amount of deck area in poor condition is also predicted to decrease. While the decrease in poor deck area is important towards achieving and then maintaining a state of good repair, the amount of fair deck area will require a sustained commitment to preservation in order to prevent an unsustainable amount of fair bridges from falling into poor condition.

ACTUAL - 2018
PERCENT BY NHS DECK AREA

33%
10%
57%

■ Good ■ Fair ■ Poor

TARGET - 2020
PERCENT BY NHS DECK AREA

27%
7%
66%

■ Good ■ Fair ■ Poor

TARGET - 2022
PERCENT BY NHS DECK AREA

26%
7%
67%

■ Good ■ Fair ■ Poor

Predicted NHS Bridges Cycle of Life
Baseline to 4-Year Target
Statewide
Percent of bridges by deck area

7.8% Improving

11.7% Deteriorating

1.0%*

7.8%

2.9%

Baseline	32.7%
4-year Target	26.2%
Good	
24.9% Unchanged	

Baseline	57.5%
4-year Target	66.8%
Fair	
53.4% Unchanged	

Baseline	9.8%
4-year Target	7.0%
Poor	
3.1% Unchanged	

1.2%

5.6%

1.1%

PENALTY

MDOT will be penalized if it does not meet the NHS bridge condition requirement. If FHWA determines that a State DOT's Interstate pavement condition is below the minimum condition level for 3 consecutive years, then that State DOT would be subject to the penalty under the rule. The FHWA will notify MDOT annually of its compliance status regarding the minimum condition requirement prior to October 1 of the year in which the determination is made. The minimum NHS bridge condition level is that no more than 10 percent of total deck area of NHS bridges can be classified in poor condition. If the minimum condition level is not met for 3 consecutive years, the State must set aside NHPP funds for eligible bridge projects on the NHS.

For More Information

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