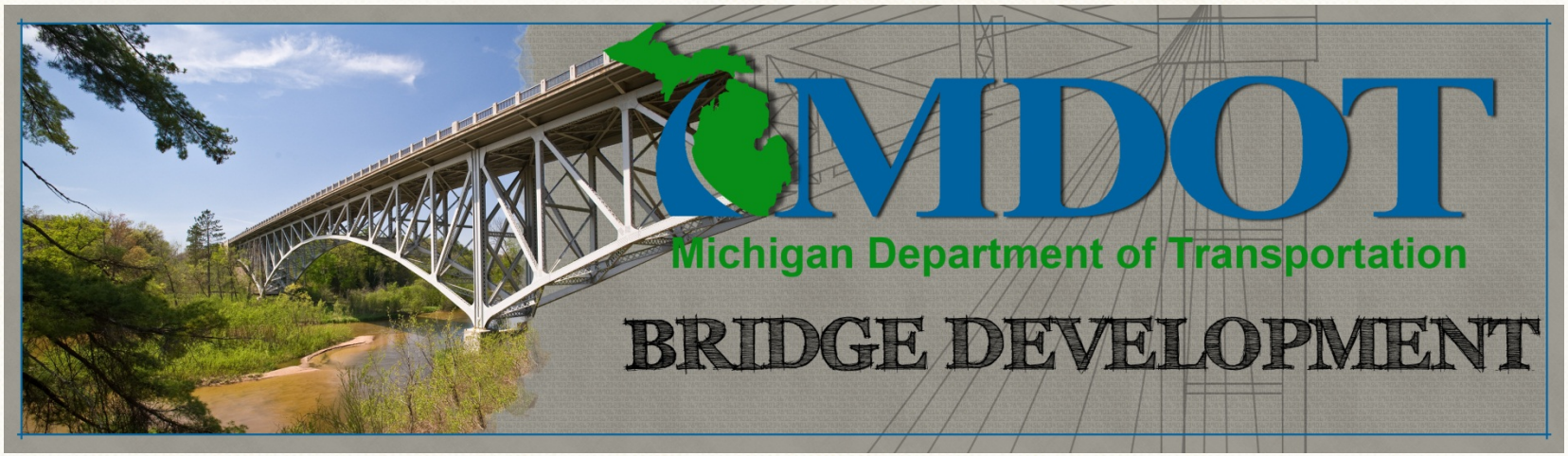



# Prioritization of Preservation Needs – Michigan DOT New Methodology

Dave Juntunen
Michigan DOT Bridge Development Engineer

October 1, 2015 Midwest Bridge Preservation Partnership

Kansas City, Missouri

# National Goals and Performance Measures

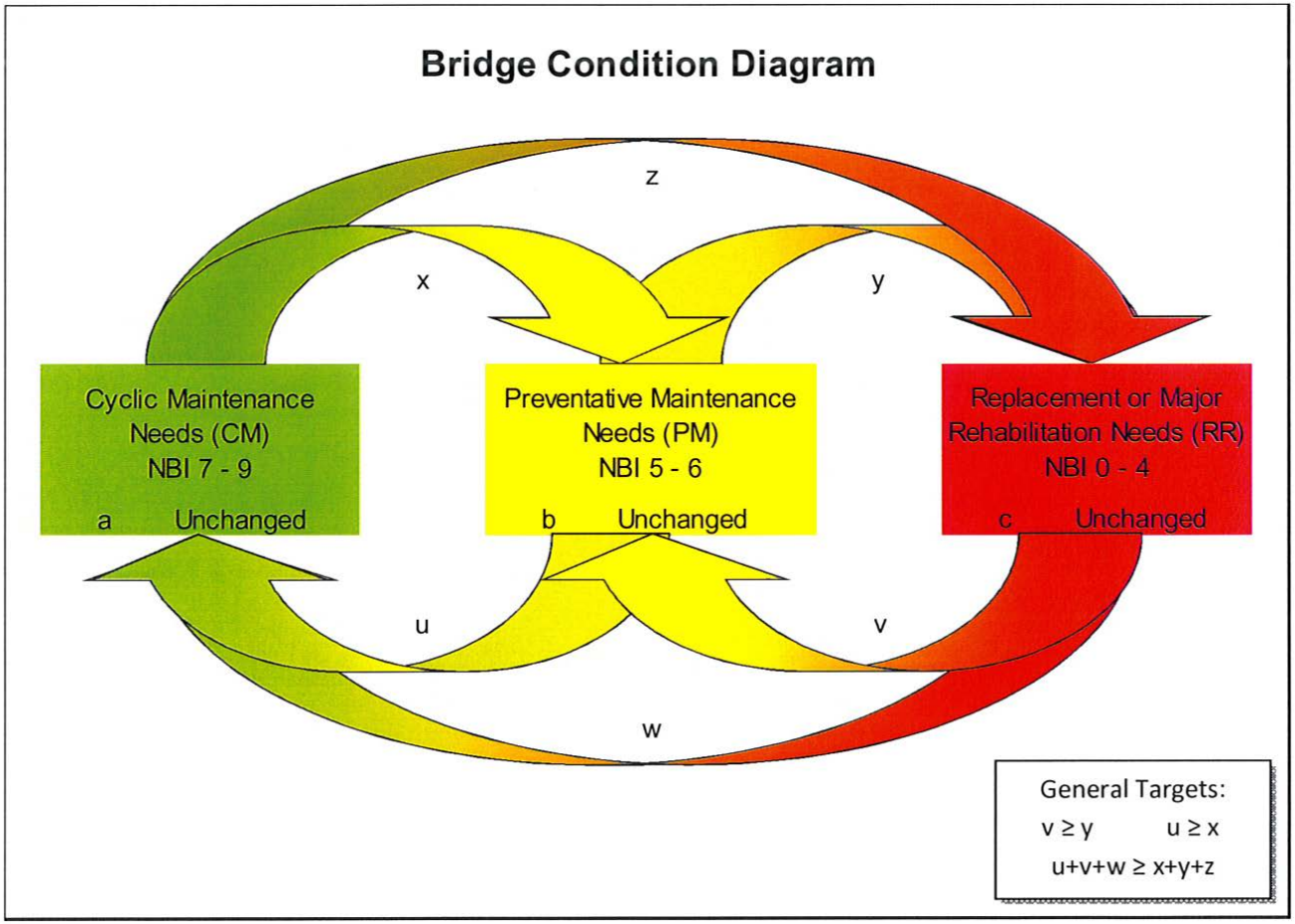
## MAP-21 (Moving Ahead for Progress in the 21st Century)

- ***No more than 10% of the total bridge deck area in a State on the National Highway System can be classified as structurally deficient for a period of 3 years without a penalty being imposed.*** **Title 23, U.S.C. §1119(f)(2)(A)**

- **A State shall develop a risk-based asset management plan for the National Highway System to improve or preserve the condition of the assets and the performance of the system.**

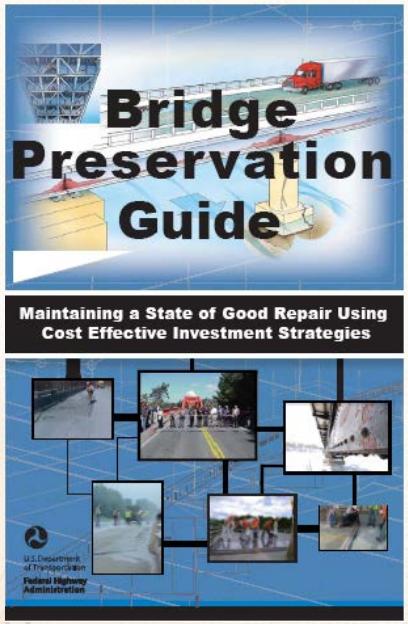
- ***States must maintain the highway infrastructure asset system in a state of good repair.*** **Title 23, U.S.C. §1119(b)(2)**

# Ultimate Goal – Maintain Bridges in a "State of Good Repair"



# AASHTO SCOBS Recommended Performance Measure Based Upon Bridge Preservation Needs


Bridge Action Categories (Courtesy; FHWA Bridge Preservation Guide - http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf)




MDOT Michigan Department of Transportation BRIDGE DEVELOPMENT

# Prioritization of Replacement Needs Risk Assessment -MDOT River Bridges

*CONTRACTOR'S FINAL REPORT*

**A Guide to Highway Vulnerability Assessment**

**for Critical Asset Identification and Protection**

Prepared for
The American Association of State Highway and Transportation Officials' Sec

As National Cooperative Highway Research Program Project 20-07/Task 151B

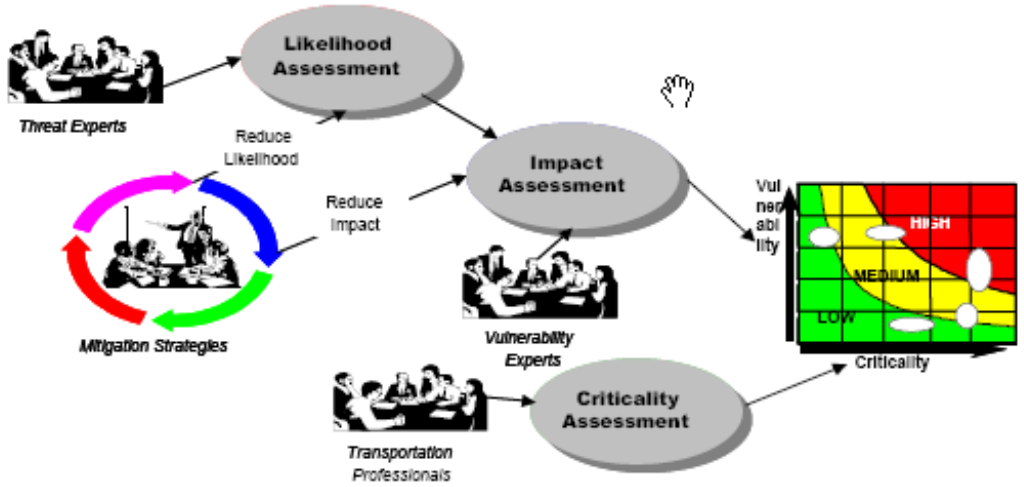
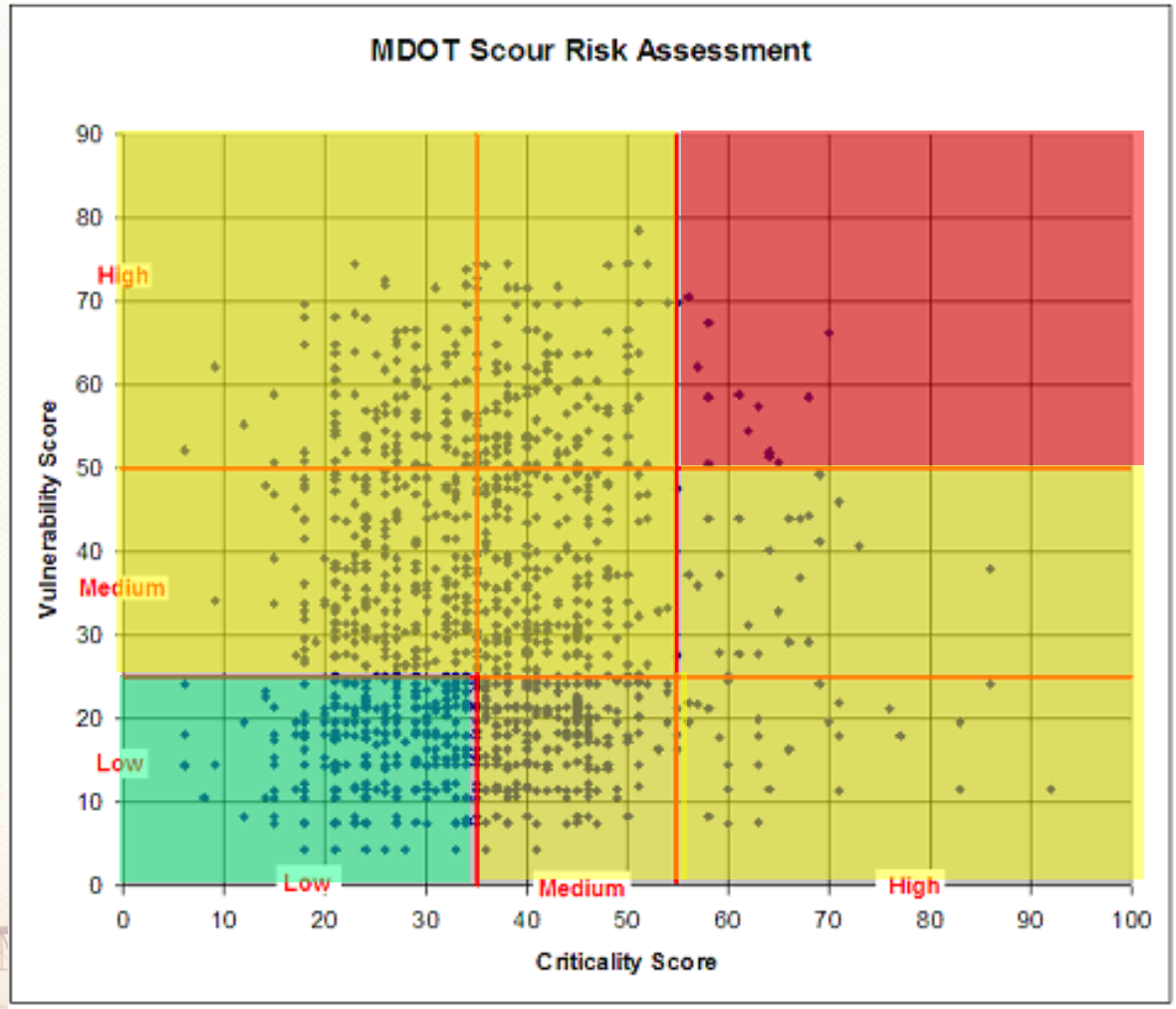



Figure 2 – Staffing the Vulnerability Assessment Process



MDOT Michigan Department of Transportation BRIDGE DEVELOPMENT

# Program Level Risk Assessment
# MDOT River Bridges - Scour



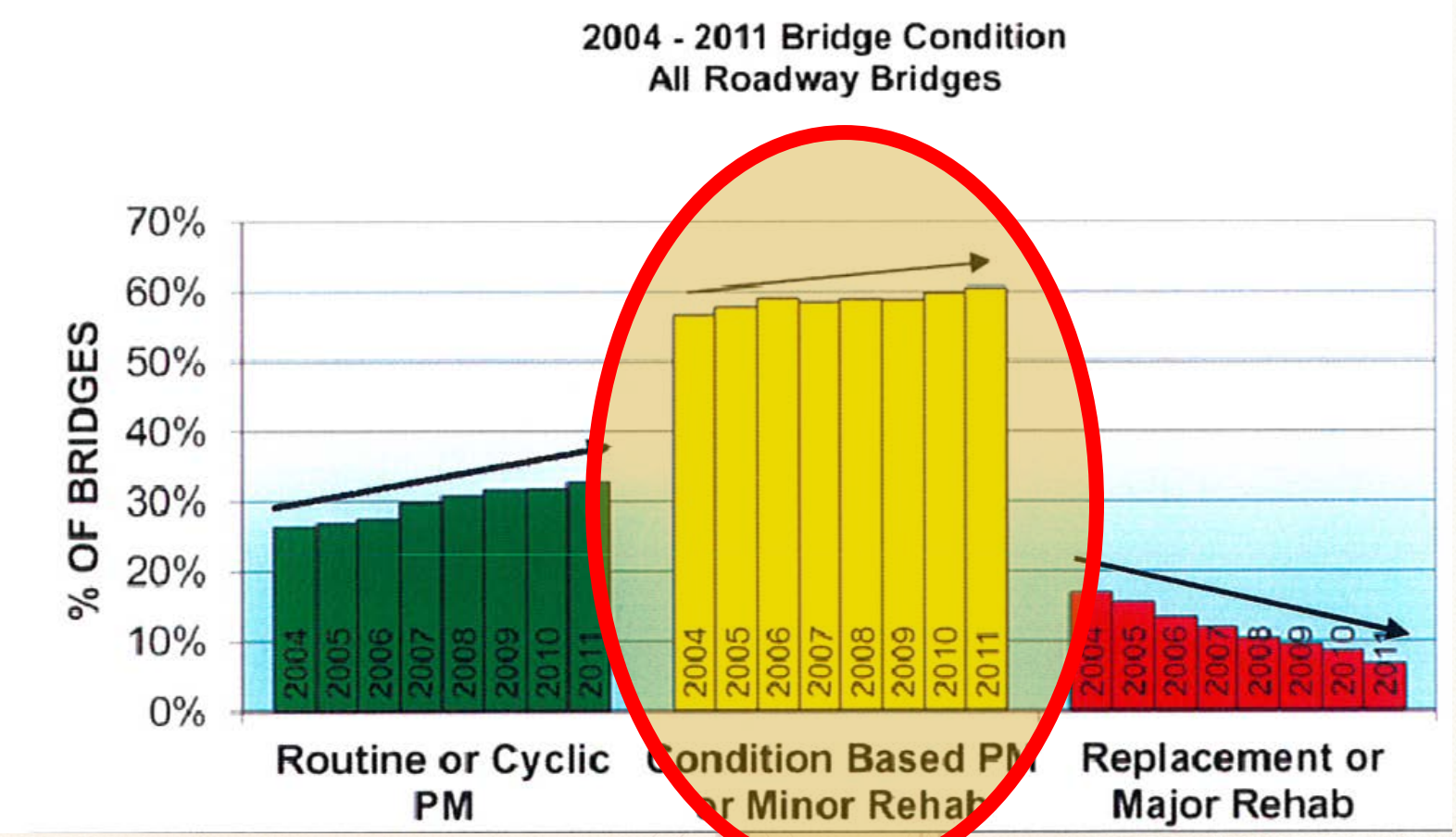

| Scour Vulnerability Factors | |
|---|---|
| Factor | Relative Weight |
| Scour (Item 113) | 8.0 |
| # of Sub Units | 3.0 |
| Footing Type | 2.5 |
| Skew Angle | 5.0 |
| Channel Protection | 5.0 |
| Soil Type | 2.5 |
| Scour Mitigation | 2.0 |
| Presence of Scour | 6.0 |
| **Total Weight** | **34.0** |

| Scour Criticality Factors | |
|---|---|
| Factor | Relative Weight |
| Highway Classification | 1.0 |
| Traffic Volume | 2.0 |
| Detour Length | 3.0 |
| Cost of Replacement | 3.0 |
| Economic Impact | 5.0 |
| **Total Weight** | **14.0** |



MDOT Michigan Department of Transportation
BRIDGE DEVELOPMENT

# How to we Prioritize Preservation? Or Preventive Maintenance?



# Markov Transition Probability

**Bridge Condition Change Matrix** 2009-2010 Number

| Went up | Sample Size | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 41 | 9 | | | | | | | | 4 | 11 | 26 |
| 2 | 224 | 8 | | | | | | | 14 | 34 | 176 | |
| 4 | 1114 | 7 | | | | 1 | 2 | 9 | 81 | 1021 | | |
| 47 | 1555 | 6 | | | | 2 | 7 | 76 | 1470 | | | |
| 56 | 904 | 5 | | | | 1 | 24 | 879 | | | | |
| 30 | 275 | 4 | | | | 7 | 268 | | | | | |
| 10 | 104 | 3 | | | | 104 | | | | | | |
| 1 | 1 | 2 | | | 1 | | | | | | | |
| | | 1 | | 0 | | | | | | | | |
| | | 0 | | | | | | | | | | |
| 150 | 4218 | | | | | | | | | | | |

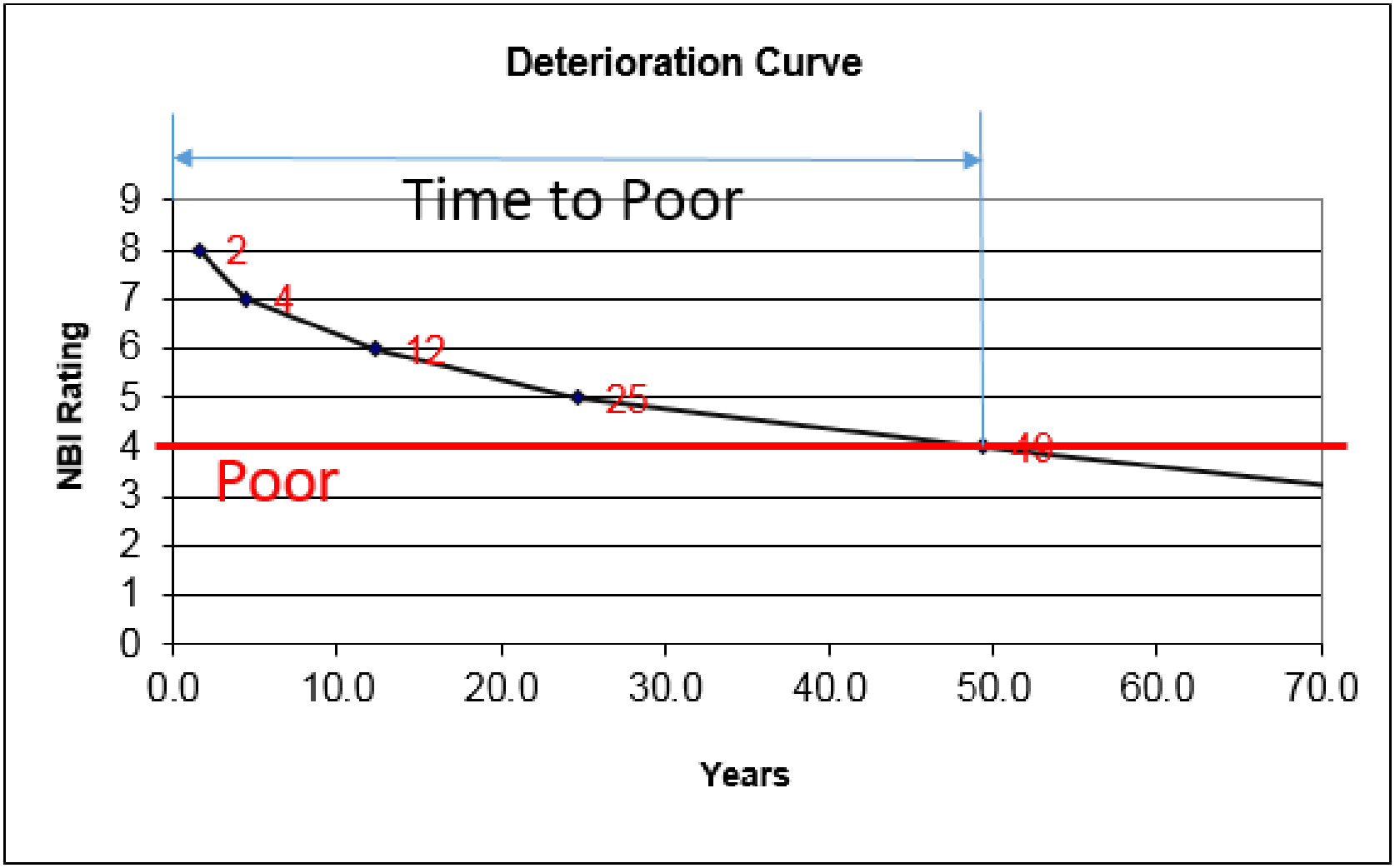
**Transition Probability Matrix** Percent

| Unrated | 62 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.76% | 26.83% | 63.41% |
| | | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 6.25% | 15.18% | 78.57% | 1.5 |
| | | 7 | 0 | 0 | 0 | 0.09% | 0.18% | 0.81% | 7.27% | 91.65% | 2.9 | |
| | | 6 | 0 | 0 | 0 | 0.13% | 0.45% | 4.89% | 94.53% | 8.0 | 4.4 | |
| | | 5 | 0 | 0 | 0 | 0.11% | 2.66% | 97.23% | 12.3 | 12.3 | | |
| | | 4 | 0 | 0 | 0 | 2.55% | 97.45% | 24.7 | 24.7 | | | |
| | | 3 | 0 | 0 | 0 | 100.00% | 26.9 | 49.4 | | | | |
| | | 2 | 0 | 0 | 100.00% | | 76.3 | | | | | |
| | | 1 | 0 | 0 | | | | | | | | |

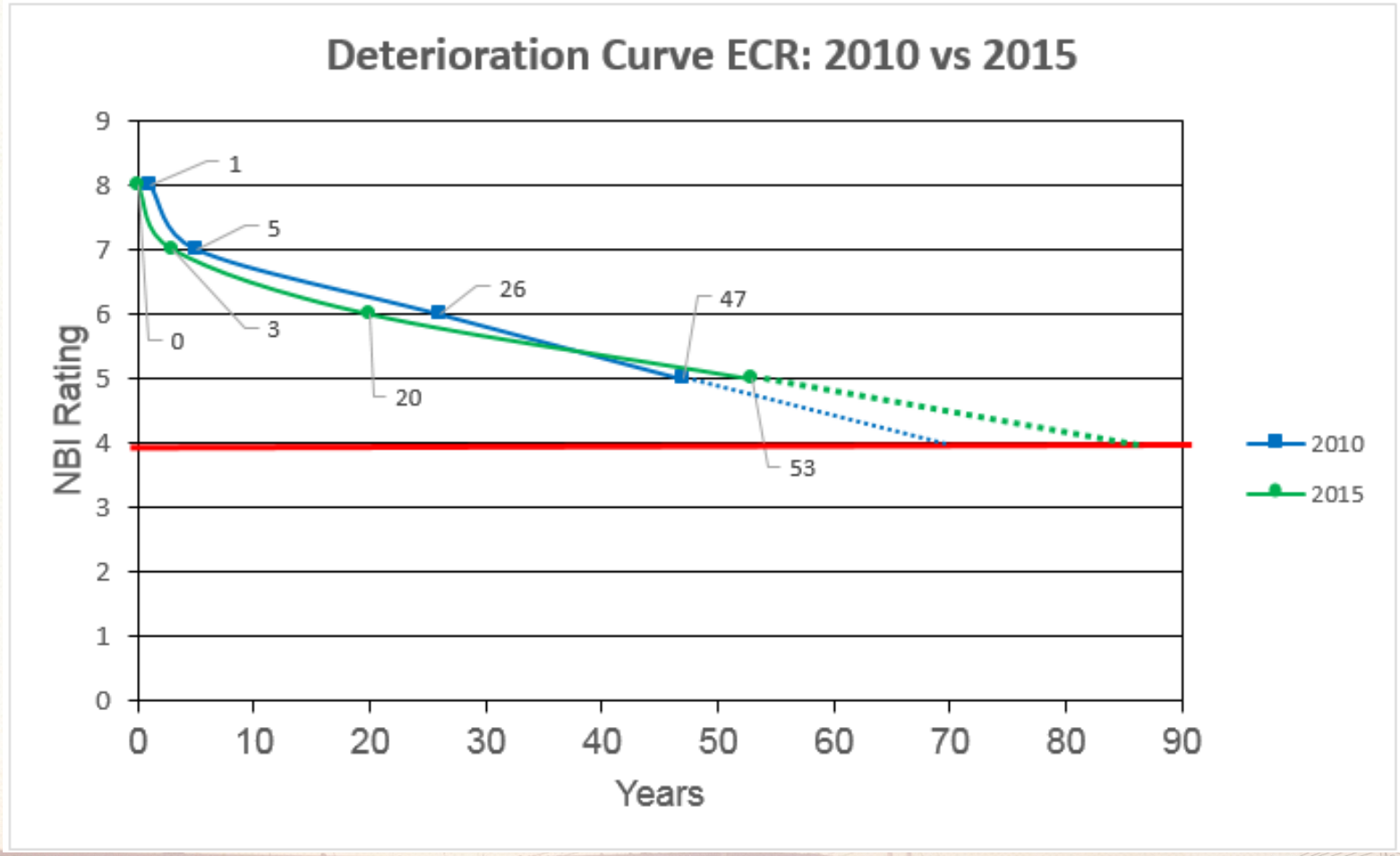
$$n = \frac{\log(0.5)}{\log(T)}$$

where; T = Transition Probability
n = average # of years to reach next condition state.

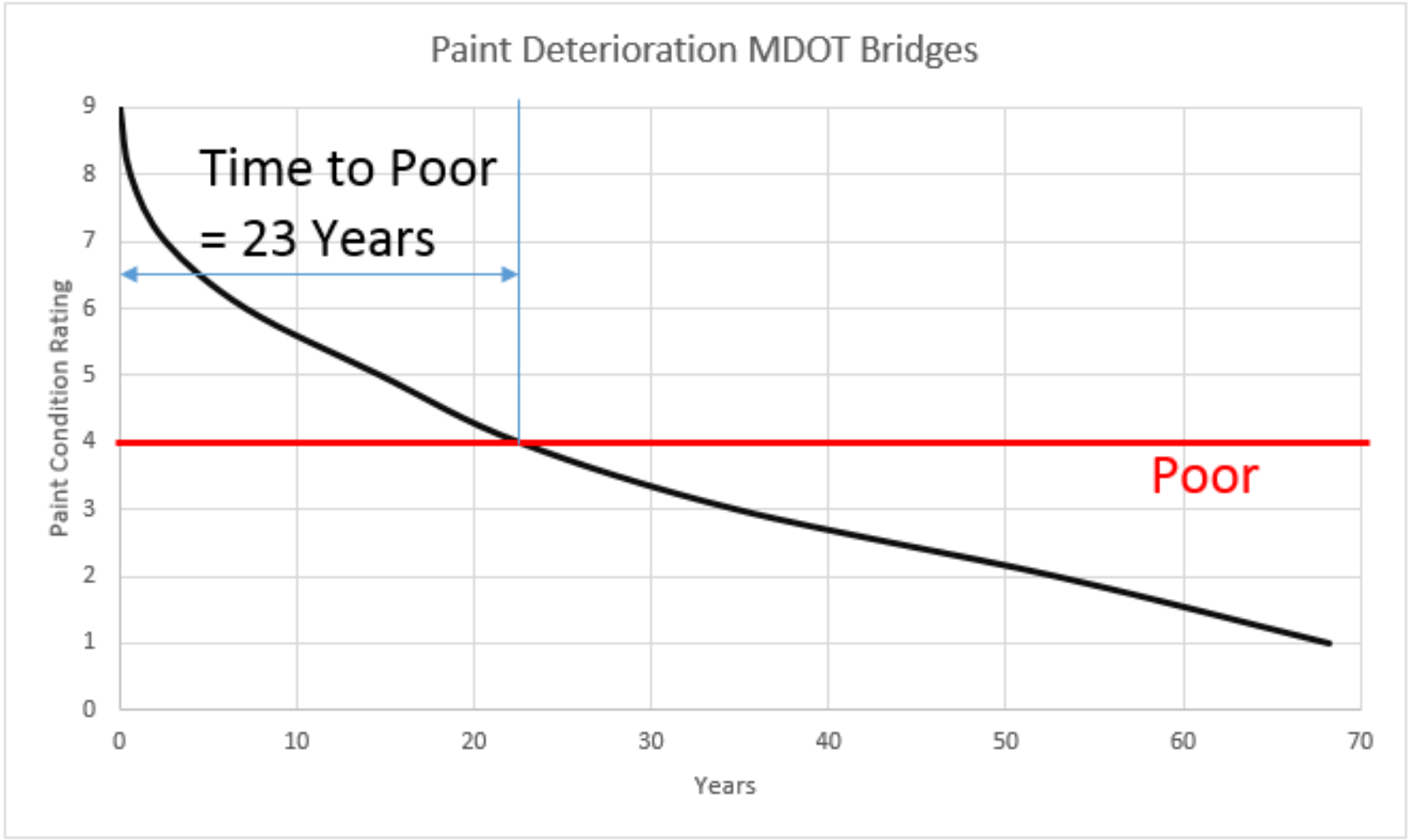
# Deterioration Curves



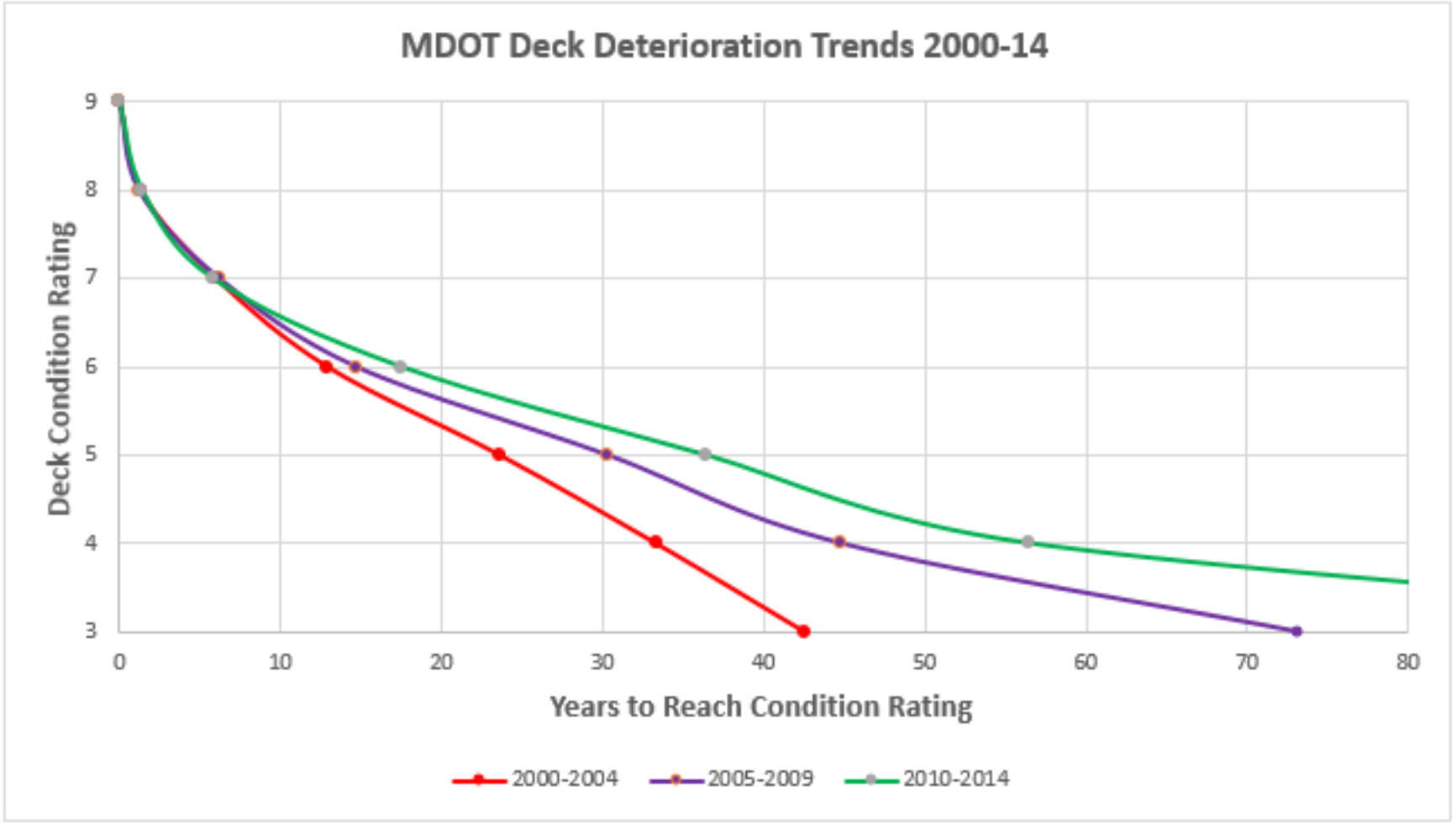
# Decks with Epoxy Coated Rebar Deterioration Curve



# Painted Steel Beams



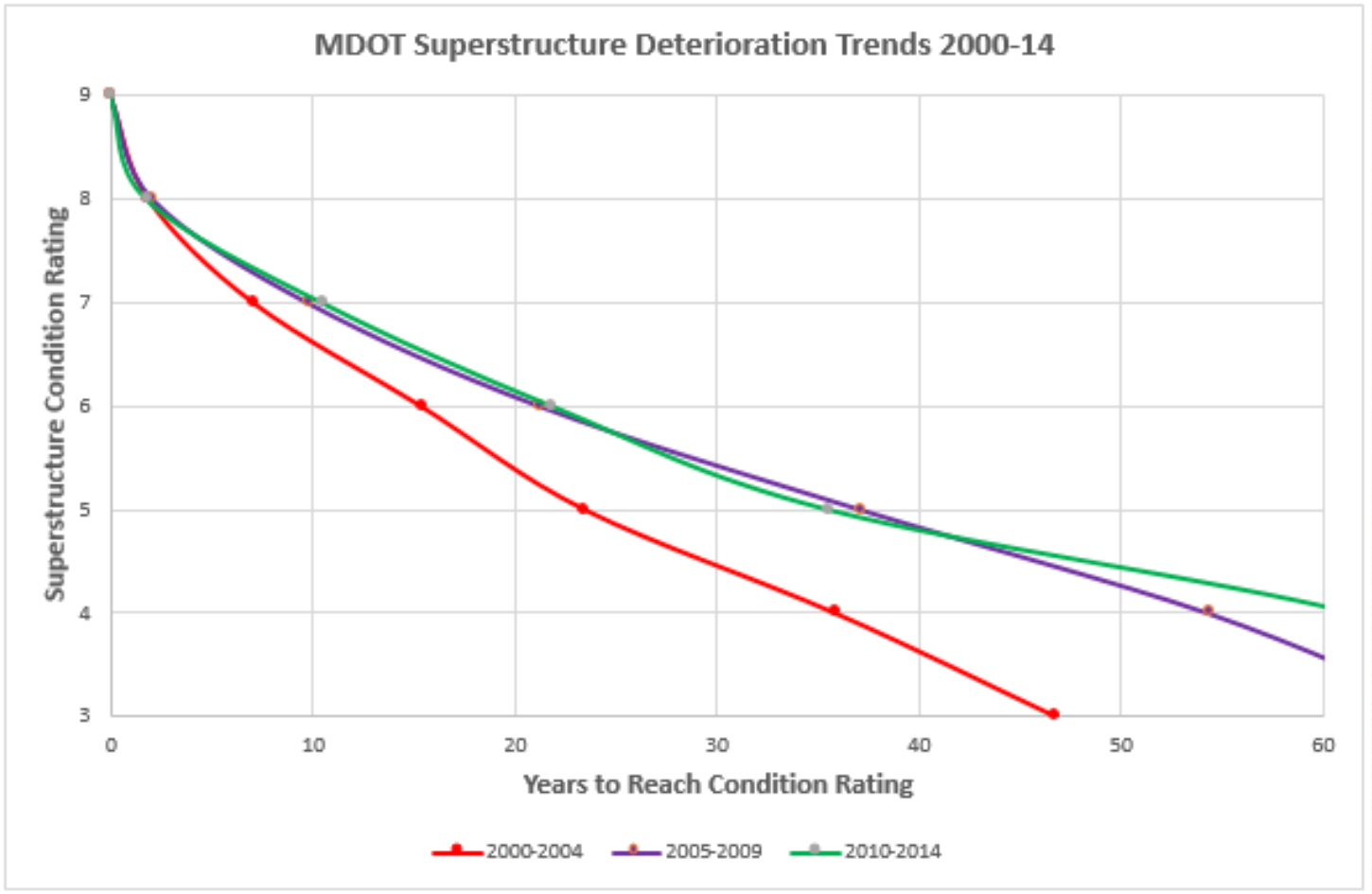
# Deck Trends




Bridge Preservation Works!

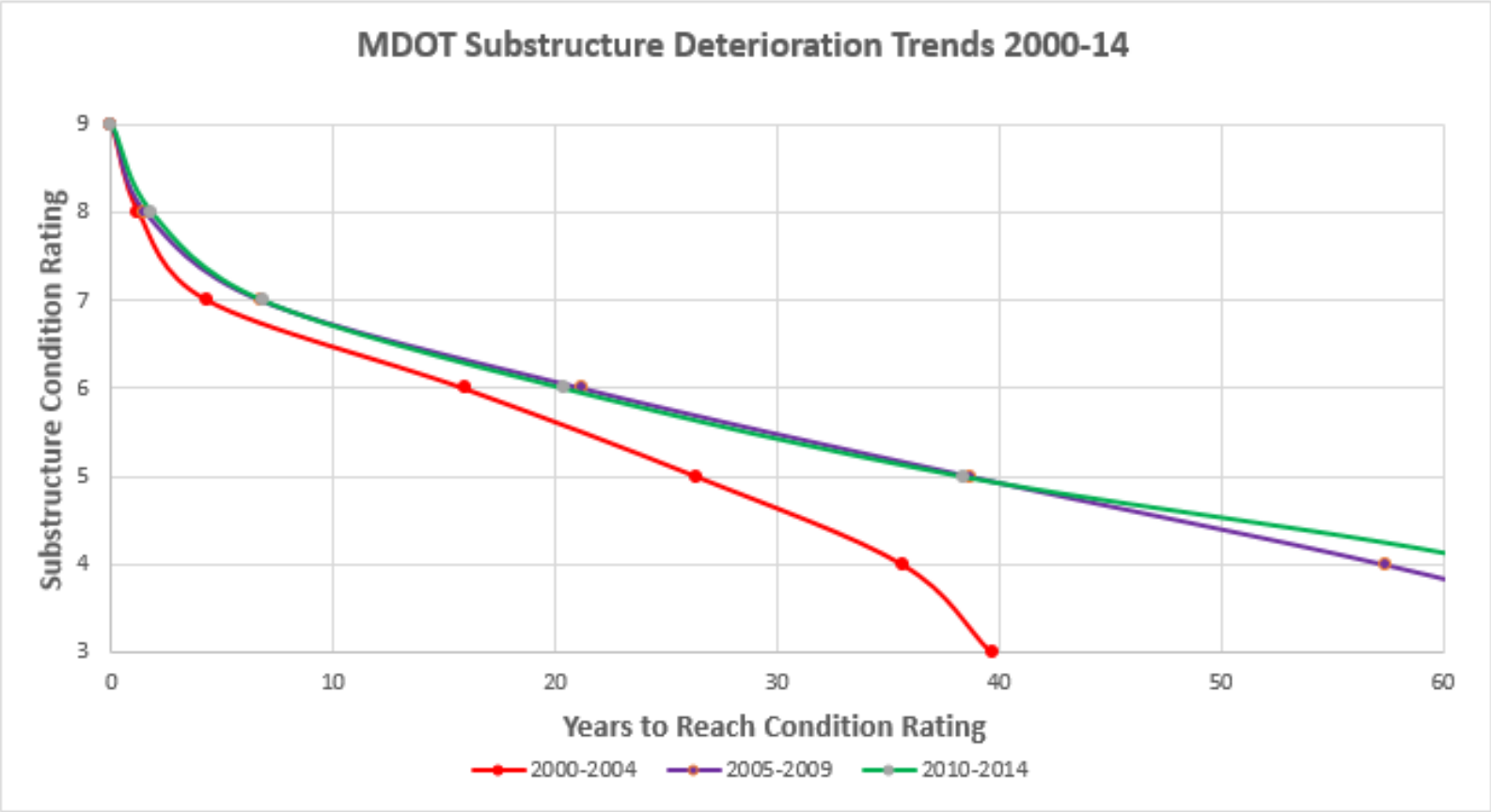
MDOT
Michigan Department of Transportation
BRIDGE DEVELOPMENT

# Superstructure Trends



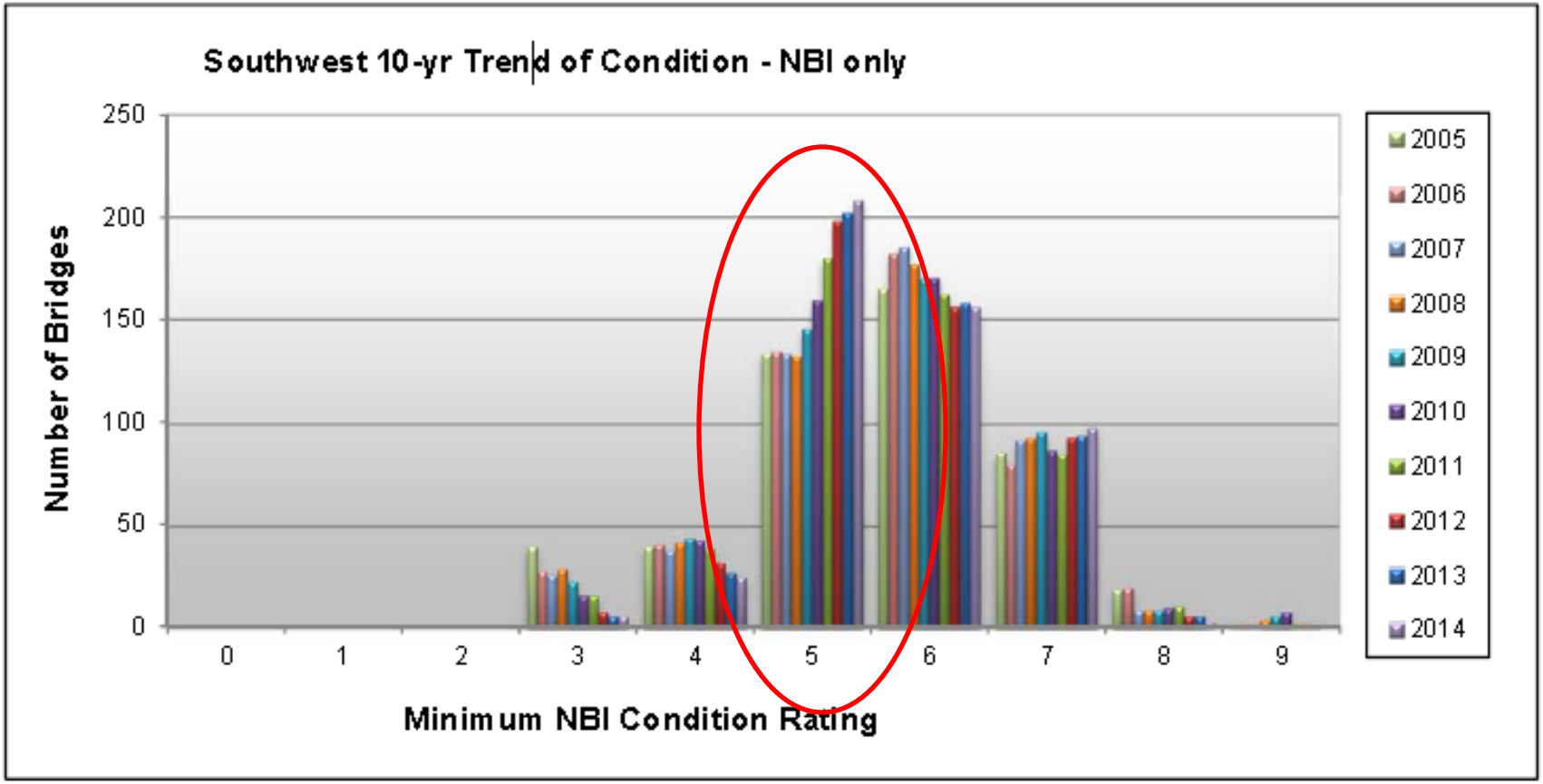

Bridge Preservation Works!

# Substructure Trends

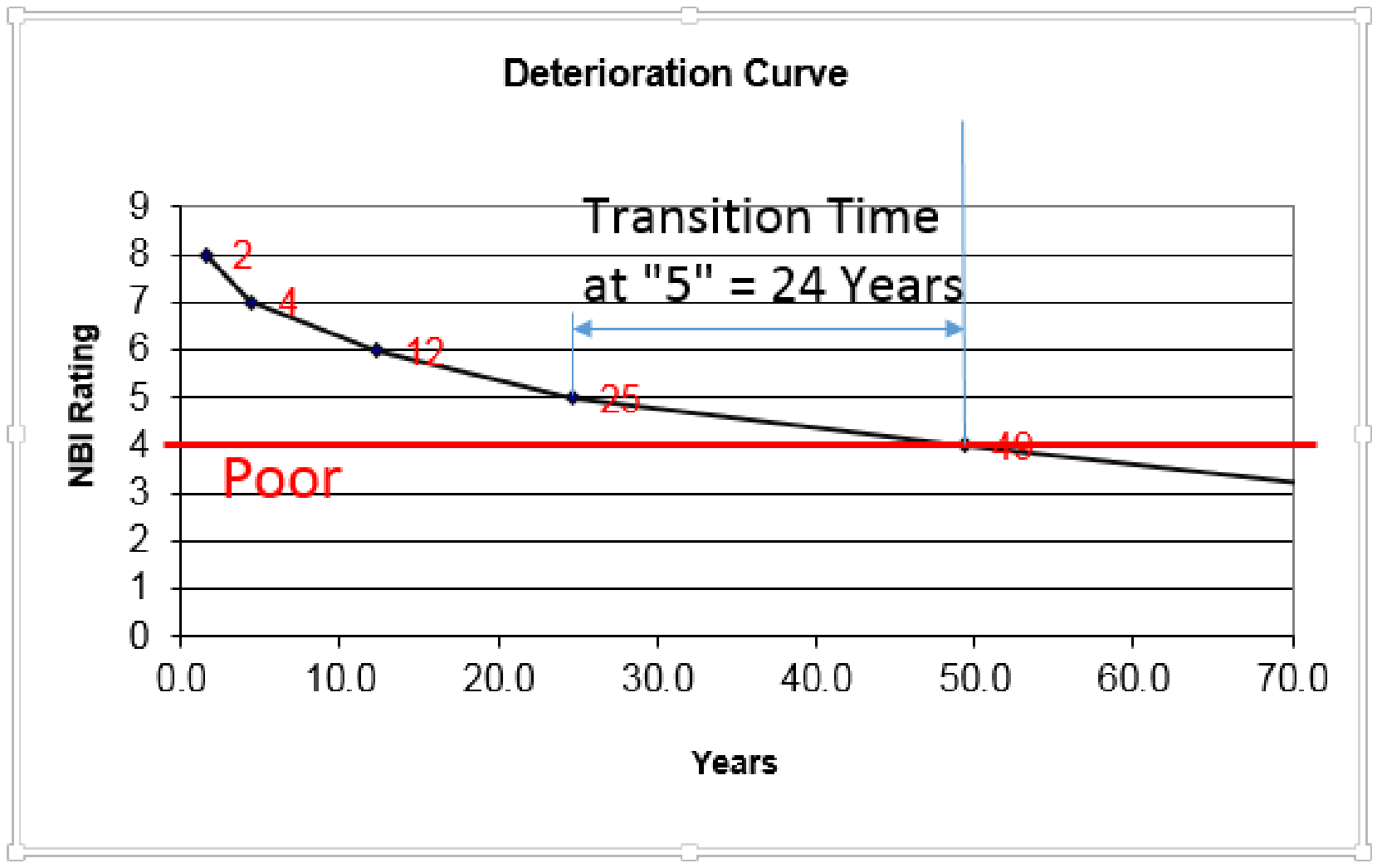



Bridge Preservation Works!

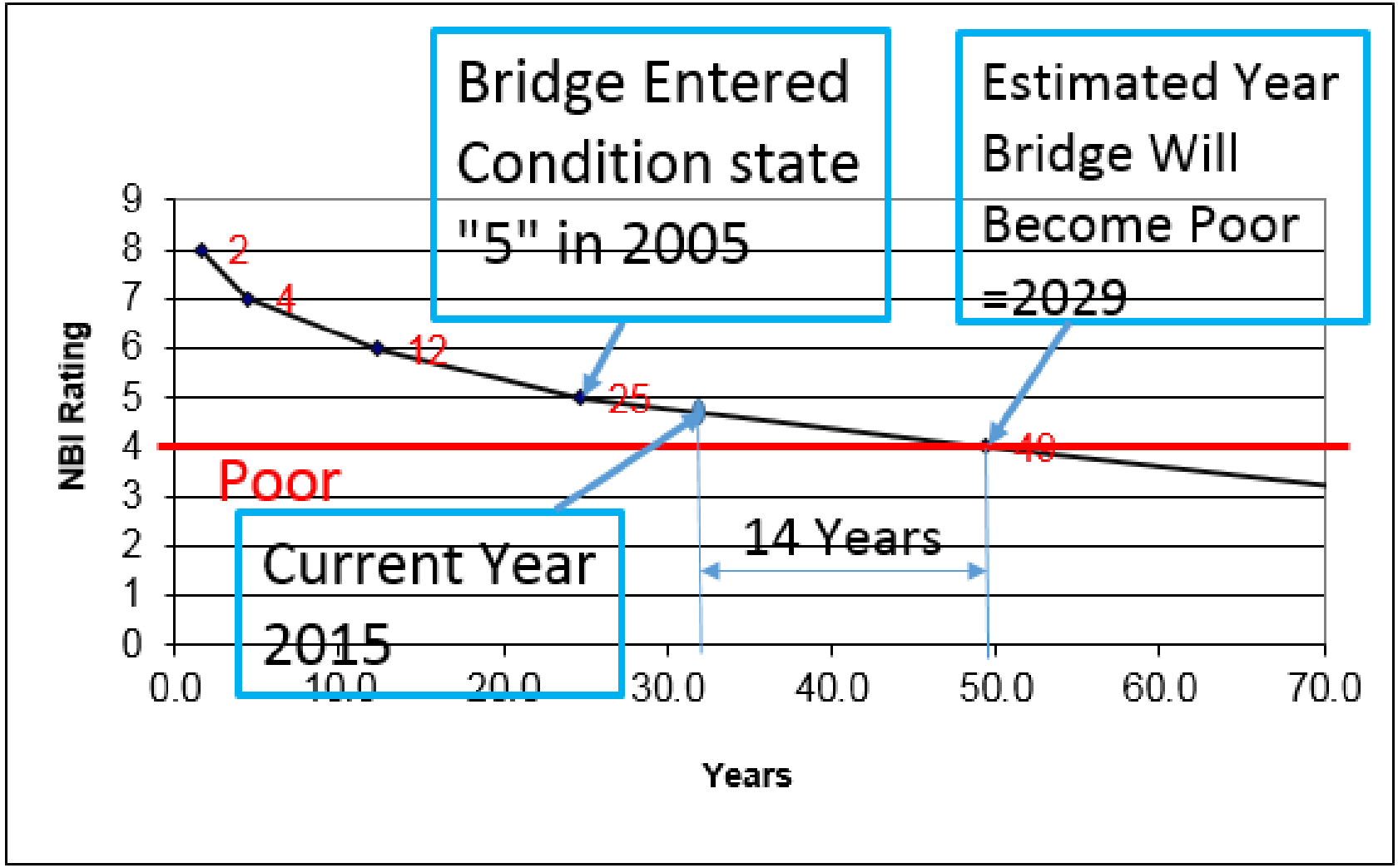
# Prioritizing our “5” Rated Bridges



# Transition Time at “5”



# For all "5" Rated Bridges Estimate Year the Bridge Will Become Poor



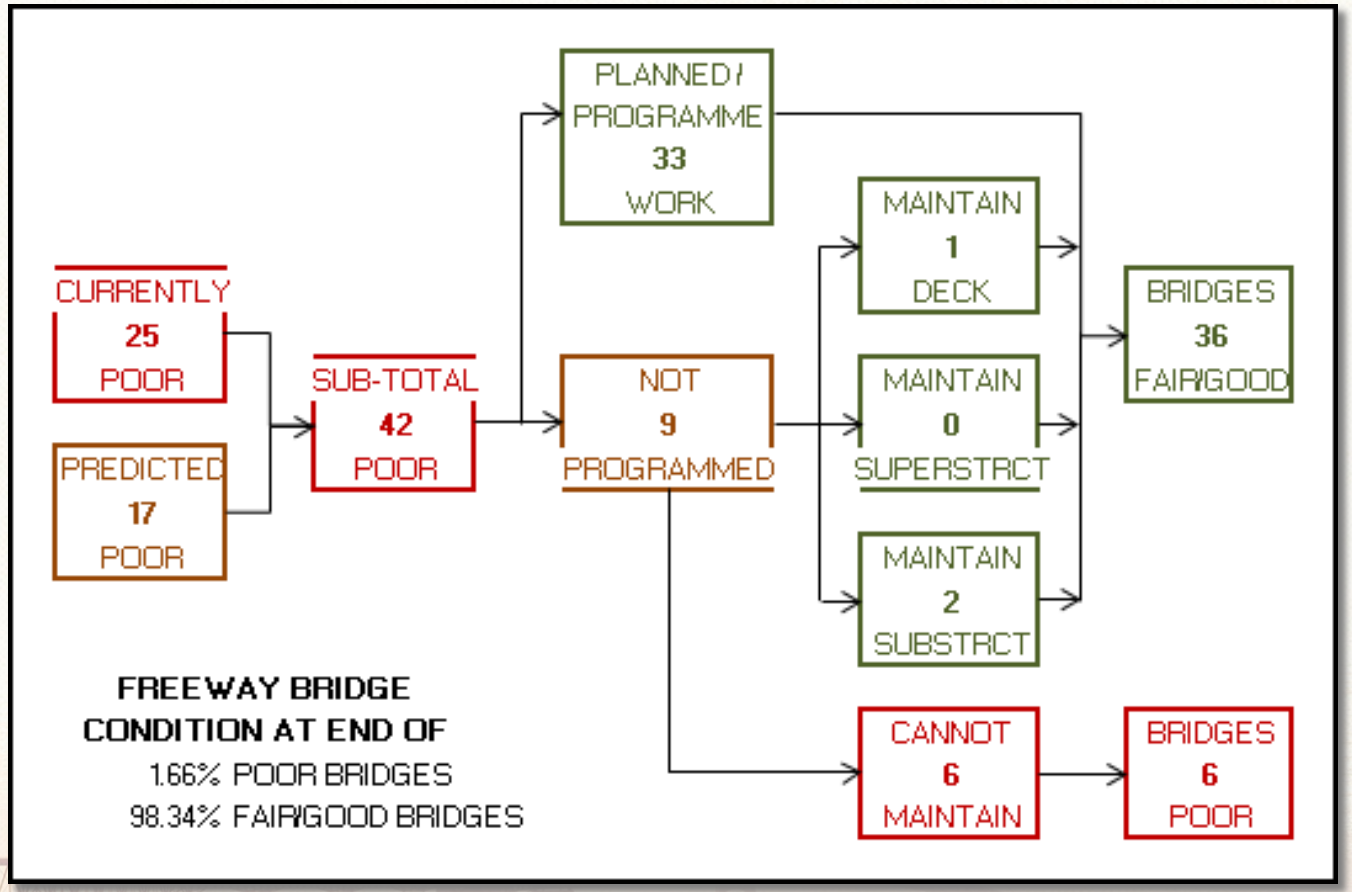
# For All 5 Rated Bridges Predict Year the Bridge Will Become Poor

| region | brkey | facility | featint | Predict Deck Poor | Predict Supr Poor | Predict Subst Poor | Predicted Poor Year |
|---|---|---|---|---|---|---|---|
| Bay | 06106021000B010 | M-61 | M BR PINE RIVER | | 2026 | | 2026 |
| Bay | 06106021000B020 | M-61 | M BR PINE RIVER | | 2024 | | 2024 |
| Bay | 06106073000B010 | US-23 | BIG CREEK | 2018 | | | 2018 |
| Bay | 06106073000B020 | US-23 | AU GRES RIVER | 2019 | 2015 | | 2015 |
| Bay | 06106091000B010 | M-65 | BIG CREEK | | | 2020 | 2020 |
| Bay | 06106111000C080 | I-75 SB | N BRANCH PINE RIVER | | | | |
| Bay | 06106111000C090 | I-75 NB | N BRANCH PINE RIVER | | | | |
| Bay | 06106111000S050 | LINCOLN ROAD | I-75 SB | | 2037 | | 2037 |
| Bay | 06106111000S060 | LINCOLN ROAD | I-75 NB | | 2037 | | 2037 |
| Bay | 09109021000B010 | M-138 | QUANICASSEE RIVER | 2030 | | | 2030 |
| Bay | 09109021000B020 | M-138 | CONSTANT DURUSSELL DRAIN | | 2024 | | 2024 |
| Bay | 09109032000B020 | M-13 & M-84 | W CHANNEL SAGINAW RIVER | | 2030 | | 2030 |
| Bay | 09109033000B010 | M-13 | KAWKAWLIN RIVER | 2032 | | | 2032 |
| Bay | 09109033000B020 | M-13 | RYAN DRAIN | | | | |
| Bay | 09109033000B030 | M-13 | TEBO DRAIN | | | 2033 | 2033 |
| Bay | 09109033000B060 | M-13 | WHITE FEATHER CREEK | | 2027 | | 2027 |
| Bay | 09109035000B010 | I-75 SB | KAWKAWLIN RIVER | | 2042 | | 2042 |
| Bay | 09109035000B020 | I-75 SB | N BR KAWKAWLIN RIVER | | | 2026 | 2026 |
| Bay | 09109035000B060 | I-75 NB | KAWKAWLIN RIVER | | 2042 | 2028 | 2028 |
| Bay | 09109035000B070 | I-75 NB | N BR KAWKAWLIN RIVER | 2016 | | | 2016 |
| Bay | 09109091000S020 | SALZBURG RD | M-47 | 2018 | 2034 | | 2018 |
| Bay | 09109101000R010 | US-10 EB | GTW RR | | 2018 | 2026 | 2018 |
| Bay | 09109101000R020 | US-10 WB | GTW RR | 2029 | | | 2029 |
| Bay | 09109101000S010 | US-10 WB | E PATRICK RD(UNION RD) | 2026 | | 2021 | 2021 |

# Region Bridge Engineer Decision Considerations

- Follow the MDOT Call For Projects Instructions
- Management Tools
  - Estimated Year Becoming Poor
- Personal Knowledge of Their Bridges
  - Inspector Recommendations
- PM Corridor Projects
- Coordination with the Road Program
  - Combining Projects for Cost Efficiency

# Bridge Engineer Shows Results of their Five Year Program




MDOT
Michigan Department of Transportation
BRIDGE DEVELOPMENT

# Thank You!

Special Thanks to
Bob Kelley
MDOT – Bridge Systems Management Engineer

Fort Street Bascule Bridge: Largest Single Span Overhead Counter Weight Bridge in US. Currently Being Built in Detroit

MDOT
Michigan Department of Transportation
BRIDGE DEVELOPMENT