

## Engineering Manual Preamble

This manual provides guidance to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. It is expected when making significant or impactful deviations from the technical information from these guidance materials, that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the timeframes allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. MDOT Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform Services only in areas of their competence.
3. Issue public statement only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

## BRIDGE DECK PRESERVATION MATRIX – DECKS WITH EPOXY COATED REBAR (ECR)

DECK CONDITION STATE				REPAIR OPTIONS	POTENTIAL RESULT TO DECK BSIR		ANTICIPATED FIX LIFE
Top Surface		Bottom Surface			Top Surface BSIR #58a	Bottom Surface BSIR #58b	
BSIR #58a	Deficiencies % (a)	BSIR #58b	Deficiencies % (b)				
≥ 5	N/A	N/A	N/A	Hold (c) / Seal Cracks	No Change	No Change	N/A
				Silane			5 years
				Healer Sealer (d)			8 to 10 years
	≤ 10%	≥ 6	≤ 2%	Epoxy Overlay (f)	8, 9	No Change	15 to 20 years
	≤ 10%	≥ 4(k)	≤ 25%(k)	Deck Patch (e, j)	6, 7, 8	No Change	5 to 10 years
4(k) or 5	10% to 25%(k)	4(k)	10% to 25%(k)	Shallow Concrete Overlay (h, i, j)	8, 9	No Change	20 to 25 years
				HMA Overlay with waterproofing membrane (f, i)	8, 9	No Change	8 to 10 years
		2 or 3(k)	> 25%(k)	HMA Cap (g, i)	8, 9	No Change	2 to 4 years
≤ 3(k)	>25%(k)	4(k) or 5	2% to 25%(k)	Shallow Concrete Overlay (h, i, j)	8, 9	No Change	10 years
				HMA Overlay with waterproofing membrane (f, i)	8, 9	No Change	5 to 7 years
		2 or 3(k)	>25%(k)	HMA Cap (g, i)	8, 9	No Change	1 to 3 years
				Replacement with Epoxy Coated or Stainless Rebar Deck	9	9	60+ years

- (a) Percent of deck surface area that is spalled, delaminated, or patched with temporary patch material. Top surface decision making based on concrete surface, not the condition of thin epoxy overlays or other wearing surfaces.
- (b) Percent of deck underside area that is spalled, delaminated or map cracked.
- (c) The "Hold" option implies that there is on-going maintenance to sustain current ratings.
- (d) Seal cracks when cracks are easily visible and minimal map cracking. Apply healer sealer when crack density is too great to seal individually by hand. Sustains the current condition longer.
- (e) Crack sealing must also be used to seal the perimeter of deck patches and joint replacements.
- (f) Deck patching required prior to placement of epoxy overlay or waterproofing membrane.
- (g) Hot Mix Asphalt cap without waterproofing membrane for ride quality improvement. Deck should be scheduled for replacement in the 5 year plan.
- (h) If bridge crosses over traveled lanes and the deck contains slag aggregate, do deck replacement.

- (i) When deck bottom surface is rated poor (or worse) and may have loose or delaminated concrete over traveled lanes, sidewalks or non-motorized paths, an in-depth inspection should be scheduled. Any loose or delaminated concrete should be scaled off and false decking should be placed over traveled lanes where there is potential for additional concrete to become loose.
- (j) Some full depth repairs should be expected where top surface deficiencies align with bottom surface deficiencies.
- (k) Contact the Bridge Management section if a deck with epoxy coated rebar in poor condition is identified.
- (l) Proposed deck work must follow the Bridge Deck Preservation Matrix and be consistent with current ratings for Bridge Safety Inspection Report (BSIT) 58a and 58b. If the proposed work does not meet the criteria, a work justification request must be submitted for recommendation by the Bridge Subcommittee, and the CFP Approval Committee will approve or reject the project.
- (m) Deck, superstructure or substructure, must be rated four or less in order to replace that specific element. If the proposed work does not meet these criteria, a work justification request must be submitted for approval by the Bridge Subcommittee
- (n) Complete bridge replacements require submittal of a work justification form for approval.**

**Bridge Deck Preservation Matrix**

**January 2021 Rev.**

## **BRIDGE DECK PRESERVATION MATRIX DECKS WITH EPOXY COATED REBAR (ECR) USER GUIDELINES**

This matrix is a tool for Bridge Engineers to use in the selection of deck repair options when the concrete bridge deck has epoxy coated rebar (ECR). Decks built since approximately 1980 have epoxy coated steel reinforcement (rebar) placed in the top and bottom mats. As of the date of release of this preservation matrix, there have been few, if any, bridges decks that have reached a poor condition state. If during a bridge inspection or detailed scope, a bridge deck with epoxy coated rebar is identified as having a deck surface or bottom surface in poor condition, please contact MDOT's Bridge Management Section at [MDOT-Bridge\\_Management@michigan.gov](mailto:MDOT-Bridge_Management@michigan.gov).

Deep concrete overlays have been removed from the matrix because the hydro-demolition will destroy the rebar's epoxy coating.

The condition of the deck is usually the driving force, or the key indicator, leading to a structure being considered for preventive maintenance, rehabilitation, or replacement. However, there are times when other issues affecting the bridge may elicit the need for a rehabilitation project and this matrix does not address those situations. Some of these situations are super-structure deterioration, sub-structure deterioration, and functional issues such as under-clearance and/or bridge width. Sometimes it is desirable for an entire corridor to be brought up to a specific condition level as part of an overall strategy. So the user is cautioned to interpret the information from the matrix in the context of each specific case and use engineering judgment.

The matrix can be used from left to right or from right to left. If you have scoping inspection data with a deck delamination survey, select the row in the left column that matches the percent of surface defects. Then select the row in the second column that matches the percent of underside defects. To the right of this you will find a repair option and the associated changes to the NBI and the expected service life of that repair, or "fix life."

If you are looking for a fix that will last for a given period of time, select a row from the right column that matches the length of service desired and scan to the left to find the repair option. Be advised that the condition of the bridge at the time of the rehabilitation affects the expected service life of the selected repair option. So if the structure is in worse condition than shown on the left side of the matrix, the repair will not last as long. Conversely, if the deck is in better condition than shown on the left, a longer service life could be expected.

This matrix has been constructed based on element deterioration data and the best knowledge of individuals from Construction & Technology, Maintenance, and Design Support Areas, and FHWA with many years of experience working with bridges. When used in conjunction with the Bridge Safety Inspection Report (BSIR), Michigan Element Data, and Detailed Bridge Project Scoping Report, the matrix can be an accurate guide in the majority of situations and will lead to a repair option that is economical and consistent with the Departments goals.