PREFACE

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. Issue public statement only in an objective and truthful manner.
5. Issue public statement only in an objective and truthful manner.
6. Act for each employer or client as faithful agents or trustees.
7. Avoid deceptive acts.
8. Conduct themselves honorably, reasonably, ethically and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

GUIDELINES FOR BRIDGE INSPECTION FREQUENCIES

Bridge Field Services, Structures Management Section

The NBIS sets the maximum frequencies for Routine, Fracture Critical, and Underwater Inspections. Typically maximum frequencies are used for bridges in fair to good condition. Evaluation of the conditions encountered during the inspection for each bridge will require engineering judgment to verify the appropriate frequency for future inspections. These guidelines are to be used as reference for bridge inspectors to maintain consistency statewide. It is recognized that the conditions encountered are unique for each bridge.

Reduced frequencies are set to verify and ensure stability of the deficient element and to make sure there are no significant changes in the primary elements between inspections.

COMPONENT OR BRIDGE TYPE		FREQUENCY [1] (Months)					COMMENTS [2][3]
		≤ 6	≤ 12	< 24	≤ 36	≤ 48	
DECK (SI&A Item 58)							
ROUTINE	Item 58 or 58B NBI rating = 4			X			Notify maintenance (MDOT Owned) or Bridge Owner (Local Agency Owned) to monitor deck soffit. Schedule an in-depth inspection.
	Item 58 or 58B NBI rating = 3		X				Schedule an in-depth inspection.
	Decks containing false decking						Review the in-depth inspection guidelines.
IN-DEPTH	Item 58 or 58B NBI rating = 6						Schedule the initial in-depth inspection within 24 months. Perform as-needed to assess condition.
	Item 58 or 58B NBI rating = 4					X	Schedule the initial in-depth inspection within 12 months.
	False decking protects < 75% of span						Perform an in-depth inspection as-needed when engineering judgment warrants.
	False decking protects ≥ 75% of span					X	Schedule the initial in-depth within 12 months. Review MiSIM Chapter 5 for removal requirements.
SUPERSTRUCTURE (SI&A Item 59)							
ROUTINE	**CONCRETE PRIMARY MEMBERS**						
	Main rebar or prestressing strands exposed with section loss			X			Complete structural analysis. Set frequency based on analysis.
	Spall on beam end with loss of bearing		X				Schedule a special inspection to monitor beam and bearing until repairs are complete.
	Longitudinal cracks in beam		X				Schedule a special inspection to monitor until analysis or repairs have been completed.
	Diagonal shear cracks in beam		X				Schedule a special inspection to monitor until analysis or repairs have been completed.
	STEEL PRIMARY MEMBERS						
	Section loss (amount unknown)						Schedule an in-depth inspection.
	Extensive loss of section		X				Schedule a special inspection to monitor until analysis or repairs have been completed. Extensive LOS on primary load carrying members includes beam ends with LOS > 25% and locations of high stress that would result in a reduced capacity with less than 25% section loss.
	Fatigue cracks in redundant primary member	X					Schedule a special inspection to monitor cracks until arrested.
	Temporary supports under beams		X				Schedule a special inspection to monitor adequacy of supports and bearing location on beam until repairs are completed.
FRACTURE CRITICAL	Extensive loss of section		X				Perform a fracture critical inspection until deterioration is mitigated. Provide detailed measurements when increased LOS is identified.
	Severe distortion of built-up members induced by pack rust		X				Perform a fracture critical inspection until deterioration is mitigated or bridge is closed.
	Fatigue cracks identified within previous 4 Years		X				Perform a fracture critical inspection until deterioration is mitigated. Continue to monitor similar fatigue sensitive details and locations where cracks have been arrested to detect further propagation.
	Gusset plates exhibiting out-of-plane distortion	X					Record detailed measurements and continue increased frequency until structural analysis is complete. Set frequency based on analysis.
	Elements rated in poor condition	X					Perform a fracture critical inspection until deterioration is mitigated or bridge is closed.

GUIDELINES FOR BRIDGE INSPECTION FREQUENCIES

Bridge Field Services, Structures Management Section

COMPONENT OR BRIDGE TYPE		FREQUENCY [1] (Months)					COMMENTS [2][3]
		≤ 6	≤ 12	< 24	≤ 36	≤ 48	
SUPERSTRUCTURE (SI&A Item 59)							
IN-DEPTH	Item 59 NBI rating = 6					X	Schedule an initial in-depth inspection within 24 months.
	Item 59 NBI rating = ≤ 4					X	Schedule an initial in-depth inspection within 12 months.
	BSIR Item 11 (Section Loss) = 2					X	Schedule an initial in-depth inspection within 12 months.
	BSIR Item 11 (Section Loss) ≤ 1			X			Schedule an initial in-depth within 6 months.
DAMAGE	Minor unreported damage with < 2" of primary member distortion, no bending near secondary members, or spalling < 6" in diameter (Type 1)						Document observations on the BSIR. Perform a Type II damage inspection when additional defects are suspected or concern exists.
	Damage reported by law enforcement, exceeds Type 1 limits, or fire damage (Type 2)						Document observations and measurements on the damage inspection report form. When additional actions must be taken submit a Request for Action to the bridge owner.
	Critical damage resulting in instability, loss of structural capacity, or fire damage (Type 3)						Document observations and measurements on the damage inspection report form and submit a Request for Action that identifies the immediate action taken and intermediate actions pursued.
SUBSTRUCTURE (SI&A Item 60)							
ROUTINE	Scour countermeasure damage or displacement			X			Consult a hydraulics engineer for recommendations to improve effectiveness.
	Item 60 NBI rating = 4			X			Schedule an in-depth inspection.
	Item 60 NBI rating = 3		X				Schedule an in-depth inspection.
UNDERWATER DIVING	Item 60 NBI rating = 5 and deterioration causing reduced rating is located on submerged surfaces					X	Ensure Level II inspection intensity is performed on at least 10% of the submerged surface area.
	Item 60 NBI rating = 4 and deterioration causing reduced rating is located on submerged surfaces				X		Consider increasing Level II inspection intensity to greater than 10% of the submerged surface area. Perform Level III inspection intensity when necessary.
	Item 60 NBI rating = 3 and deterioration causing reduced rating is located on submerged surfaces			X			Consider increasing Level II inspection intensity to greater than 10% of submerged surface area. Perform Level III inspection intensity when necessary.
IN-DEPTH	Item 60 NBI rating = 5					X	Applies to wade and probe or boat and probe methods only. Schedule the initial in-depth inspection within 24 months.
	Item 60 NBI rating ≤ 4				X		Applies to wade and probe or boat and probe methods only. Schedule the initial in-depth inspection within 12 months.
DAMAGE	Damage caused by vehicular or vessel impact to abutments, piers, bents, or protection systems						May require underwater diving inspection to detect deficiencies on submerged surfaces.
ROUTINE / DIVING	**STREAM BED CROSS-SECTIONS**						
	Scour critical bridges with active erosion or observed scour			X			Minimum every two years or after flood event where the scour POA was reviewed and monitoring occurred (Item 113 = U, 0-3).
	Scour critical bridges with no active erosion or observed scour					X	Minimum every four years or after flood event where the scour POA was reviewed and monitoring occurred (Item 113 = U, 0-3).
	Structures with minor observed scour or erosion						Minimum of one cross section must be in the bridge file. Record additional cross-sections as changes in the channel are observed and every 60 months for locations requiring underwater diving.
	Structures over water with no substructures in the water and no channel erosion						Minimum of one cross section must be in the bridge file for each structure over water. Record additional cross-sections as changes in the channel are observed.

GUIDELINES FOR BRIDGE INSPECTION FREQUENCIES

Bridge Field Services, Structures Management Section

COMPONENT OR BRIDGE TYPE		FREQUENCY [1] (Months)					COMMENTS [2][3]
		≤ 6	≤ 12	< 24	≤ 36	≤ 48	
WADE / BOAT / DIVING	**SCOUR CRITICAL STRUCTURES [4]**						
	Structure with minor to no observed scour						Monitor according to the scour POA. Document high flow events and subsequent activities on the scour inspection report.
	Observed scour noted with exposed footing		X				Schedule special inspection to monitor substructure until repairs are completed. Document high flow events and subsequent activities on the scour inspection report.
	Observed scour within or below the limits of the footing	X					Schedule special inspection to monitor substructure until repairs are completed. Document high flow events and subsequent activities on the scour inspection report. When immediate action is required notify the MDOT Bridge Inspection Program Manager to report the Critical Finding.
CHANNEL (SI&A Item 61)							
ROUTINE	Item 61 NBI rating = 5 and Item 113 = U, 0-3			X			Remove debris that restricts the channel or consult a hydraulics engineer for recommendations to improve scour countermeasures.
	Item 60 NBI rating = 4			X			Remove debris that restricts the channel or consult a hydraulics engineer for recommendations to improve scour countermeasures.
	Item 60 NBI rating = 3		X				Remove debris that restricts the channel or consult a hydraulics engineer for recommendations to improve scour countermeasures.
IN-DEPTH	Item 61 NBI rating = 5 and Item 113 = U, 0-3					X	Schedule an initial in-depth inspection within 12 months to document damage to river control devices and establish a baseline for the deteriorated conditions.
	Item 60 NBI rating = 4 and Item 113 =U, or 0-3					X	Schedule an initial in-depth inspection within 6 months to document damage to river control devices and establish baseline for deteriorated conditions.
	Item 60 NBI rating = 3				X		Schedule an initial in-depth inspection within 3 months to document damage to river control devices and establish baseline for deteriorated conditions.
CULVERT (SI&A Item 62)							
ROUTINE	Moderate loss of fill or joint alignment			X			Schedule a special inspection to monitor substructure until repairs are completed.
	Item 62 NBI rating = 4			X			Schedule an in-depth inspection.
	Item 62 NBI rating = 3		X				Schedule an in-depth inspection.
IN-DEPTH	Item 62 NBI rating = 5						Schedule an initial in-depth inspection within 24 months. Perform as-needed to assess condition.
	Item 62 NBI rating = 4					X	Schedule an initial in-depth inspection within 12 months.
	Item 62 NBI rating = 3				X		Schedule an initial in-depth within 6 months.
POSTED BRIDGES							
ROUTINE	Design deficient			X			Evaluate the design capacity and fatigue connections to set frequency.
	Structural deterioration		X				A change in the condition may warrant re-analysis. Load analysis should be completed when there is significant deterioration to a primary load carrying member.

NOTES:

(1) Load rating calculations should be reviewed and reflect the current conditions of the structure. Most of the conditions listed in this frequency guideline warrant a review of the load rating calculations.

(2) Requests for load analysis and immediate repairs shall be made with the Request for Action and submitted using MiB^{RIDG}E.

(3) Whenever a structural analysis is indicated, an "Other, Special Inspection" may be used at the suggested frequency pending the result of the load analysis.

(4) For MDOT owned structures with undermining contact the MDOT Hydraulics Engineer to complete an emergency countermeasure design.