



# INDOT LOCAL PUBLIC AGENCY PROGRAM

## Asset Management for Local Public Agency Bridges

APRIL 2016

Approved

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## **PURPOSE**

Maintaining bridges in good condition has proven to extend service life and to be more cost effective than allowing deterioration. Bridge deterioration results in the need for more extensive and costly rehabilitation or replacement projects. Development and implementation of a comprehensive bridge preservation plan provides a local public agency a tool which can be used to identify their needs, prioritize actions, and allocate available funds appropriately.

This *Asset Management for Local Public Agency Bridges* is intended to provide:

1. Assistance in understanding bridge management and preservation.
2. Guidance for Local Public Agency (LPA) officials and employees in the planning, developing, programming and implementing of effective and cost-efficient capital program, including maintenance actions to preserve the bridges under their jurisdiction.
3. Information to aid the LPAs
  - a. In understanding its local bridge system.
  - b. In understanding the importance of bridge preservation and implementing a strategic, long term program of identifying, programming, budgeting and completing bridge preservation projects to improve the statewide condition of these assets at the lowest possible cost to taxpayers.
  - c. In supporting the Call for Projects Application for federal funds.

## **BRIDGE ASSET MANAGEMENT**

Per Code of Federal Regulations, 23 CFR 500.107: *“An effective BMS (Bridge Management System) for bridges on and off Federal-aid highways that should be based on the “AASHTO Guidelines for Bridge Management Systems” and that supplies analyses and summaries of data, uses mathematical models to make forecasts and recommendations, and provides the means by which alternative policies and programs may be efficiently considered. An effective BMS should include, as a minimum, formal procedures for:*

- (a) Collecting, processing, and updating data;*
- (b) Predicting deterioration;*
- (c) Identifying alternative actions;*
- (d) Predicting costs;*
- (e) Determining optimal policies;*
- (f) Performing short- and long-term budget forecasting; and*
- (g) Recommending programs and schedules for implementation within policy and budget constraints.”*

The INDOT Bridge Asset Management (BAM) was initially established to comply with 1991 ISTEA legislation mandating State DOTs to devote personnel and resources for development and implementation of a process and application capable of analyzing bridge data to recommend cost-effective bridge projects for improving the bridge network. For an LPA, the process is administered through the INDOT Local Public Agency Program. The LPA must submit its BAM Plan to the INDOT Bridges Division Office of Bridge Asset Management manager to obtain approval to ensure that the plan is in compliance with federal regulations. The LPA's BAM Plan must be updated and submitted for approval every two (2) years based on the findings of Phase I and Phase II of its Countywide Bridge Inspection and Inventory Program, in accordance with National Bridge Standards.

In a BAM program which has a BAM Plan, the LPA should adopt a philosophy that supports its capital program by developing a mixture of activities which will maximum its funding sources. The LPA should determine the maintenance, repair, and rehabilitation needs for each bridge. By comparing the cost of implementing various preservation actions based on the needs of each bridge versus deferring work needed, the LPA can determine which is the most cost effective use of its funding sources, bridge preservation or replacement. Replacement of a bridge may be warranted if replacement is the most cost-effective means to satisfy the existing structural or functional needs. Alternatively, if the physical condition of the bridge has deteriorated to a point where the bridge is considered unsafe, bridge replacement may be determined to be the only feasible alternative. A sample Bridge Asset Management (BAM) Plan is included in Appendix A.

## **BRIDGE REPLACEMENT and BRIDGE PRESERVATION**

Surface transportation programs established by the Federal government allow States to use federal funds to improve the condition of highway bridges through replacement, and preservation activities using an approved systematic process. Bridge preservation includes rehabilitation and preventative maintenance.

Bridge replacement is defined in the Code of Federal Regulations, 23 CFR 650.405: *"Total replacement of a structurally deficient or functionally obsolete bridge with a new facility constructed in the same general traffic corridor. A nominal amount of approach work, sufficient to connect the new facility to the existing roadway or to return the gradeline to an attainable touchdown point in accordance with good design practice is also eligible. The replacement structure must meet the current geometric, construction and structural standards required for the types and volume of projected traffic on the facility over its design life."* Replacement project work must improve the condition rating of the total bridge from "poor" to "good" or higher.

Bridge preservation is defined by Federal Highway Administration (FHWA) as: *Actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good condition; and extend their useful life.* Preservation consists of activities performed on bridge elements or components that aim to prevent, delay, or mitigate deterioration. Preservation activities do not entail structural or operational improvements of an existing asset beyond its originally designed strength or capacity. *"Preservation actions include rehabilitation and preventive maintenance. Preventive maintenance is further defined as being either condition based or cyclical based."* Bridge

preventive maintenance is defined as a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without substantially increasing structural capacity).

Bridge rehabilitation is defined in 23 CFR 650.405 Code of Federal Regulations: "*The project requirements necessary to perform the major work required to restore the structural integrity of a bridge (e.g. superstructure, substructure, deck, etc.) as well as work necessary to correct major safety defects (e.g. bridge railings, scour, etc.) are eligible except as noted under ineligible work. Bridges to be rehabilitated both on or off the F-A System shall, as a minimum, conform with the provisions of 23 CFR part 625, Design Standards for Federal-aid Highways, for the class of highway on which the bridge is a part.*" Rehabilitation project work must improve the condition of the total bridge from "poor" or "fair" to "good" or higher.

A systematic plan to preserve bridges must define a specific goal for the maintenance activities and described what the systematic process is to be to achieve said goal. The FHWA defines a systemic process as "*a documented methodology regularly applied to repeatedly achieve a desired outcome or goal.*" INDOT's Preventative Maintenance (PM) Agreement and *Indiana Design Manual* (IDM) has established what the benefits, measures and candidate criteria are for determining what preventative maintenance activities are considered cost effective and may be employed based on the condition ratings of different bridge components. INDOT's PM and IDM are valuable resources which the LPA can utilize for including preventative maintenance activities in its BAM Plan.

Cyclical Preventive Maintenance is recognized as a cost effective way to maintain and/or extend the service life of bridges. Cyclical activities are those that are scheduled on a fixed cycle. Cyclical activities that have been determined to be cost-effective and the bridge component condition criteria are defined in INDOT's PM Agreement and the IDM.

Condition-Based Preventative Maintenance is recognized as a cost-effective way to maintain and/or extend the service life of bridges. Condition based activities are performed on bridge elements as needed and identified through the bridge inspection process. Condition based activities and the bridge component condition criteria are defined in INDOT's PM Agreement and the IDM.

An effective bridge preservation program:

1. Employs long term network strategies and practices that are aimed to preserve and/or increase the condition of bridges, extending their service life.
2. Has an adequate and future funding source.
3. Ensures appropriate treatments are applied and performed at the appropriate time.
4. Supports INDOT's mission statement: "INDOT will plan, build, maintain and operate a superior transportation system enhancing safety, mobility and economic growth."

5. Supports INDOT's *Open Roads* (Practical Design) Initiative by implementing low-cost project solutions that enhance the overall condition and function of bridges without diminishing safety.

## ***PLAN and DEVELOPMENT***

The LPA is highly encouraged to develop a BAM Plan which includes preservation that maximizes the service life of bridges under its jurisdiction and optimizes available funding sources. The BAM Plan should include bridge replacement and bridge preservation which will improve the overall condition of its bridges at the lowest possible cost to taxpayers.

Per National Bridge Inspection Standards (23 CFR 650C), an LPA is required to have its bridges inspected on an interval not to exceed two (2) years. INDOT requires that the inspection findings be recorded in the Bridge Inspection Application System (BIAS) database. BIAS stores both current and historical condition ratings for use by the LPA in developing its BAM Plan. Sufficiency rating and structural adequacy are some of the key measures which can be obtained from data in the BIAS.

The sufficiency rating is one component being utilized by the INDOT LPA Program in determining federal funding eligibility. The sufficiency rating formula combines structural adequacy (55%), serviceability and functional obsolescence (30%), and essentiality for public use (15%) to obtain a numerical percentage between 0 and 100. The rating is indicative of the bridges sufficiency to remain in service, where a score of 100 represents a completely sufficient structure and 0 represents a completely insufficient structure. A sufficiency rating below 80 qualifies a bridge for rehabilitation funding, while a sufficiency rating below 50 qualifies a bridge for replacement funding.

Structural adequacy is another component being utilized by the INDOT LPA Program in determining federal funding eligibility. Structural adequacy, also known as bridge deficiencies, is based on condition and/or appraisal ratings. Listed below are the two terms used to summarize bridge deficiencies: structurally deficient and functionally obsolete.

A bridge is considered structurally deficient if significant load carrying elements are found to be in poor condition due to deterioration and/or damage, or the adequacy of the waterway opening by the bridge is determined to be extremely insufficient to the point of causing overtopping with intolerable traffic interruptions. A structurally deficient bridge is defined numerically as follows:

1. A bridge component (deck, superstructure, substructure or culvert) having an NBI condition rating of 4 or less (poor condition). NBI Items #58, 59; 60 or 62.
2. Structural Evaluation or Waterway Adequacy NBI appraisal rating of a 2 or less (a bridge with a very low load rating capacity, or a bridge that is subject to overtopping with significant or severe traffic delays). NBI Items # 67 or 71.

NOTE: Only one of the above must be true.

A bridge is considered functionally obsolete when the deck geometry, load carrying capacity (comparison of the original design load to the current State legal load), clearance, or approach roadway alignment no longer meets the usual criteria for the roadway system which the bridge is an integral part of. Functionally obsolete in general means that the bridge was built to standards which are no longer currently being used today. A functionally obsolete bridge is defined numerically as follows:

1. Deck geometry (width of bridge), underclearance, or approach roadway alignment NBI appraisal rating of 3 or less. NBI Items # 68, 69 or 72.
2. Structural Evaluation or Waterway Adequacy NBI appraisal rating of 3. NBI Items # 67 or 71.

NOTE: Only one of the above must be true.

Once its bridges have been inspected and the data entered into BIAS, the LPA will have the data necessary to assess the condition of bridges under its jurisdiction. The LPA then must determine what activities must be performed to best preserve bridges. A properly developed BAM Plan usually includes a combination of activities ranging from Cyclical Preventative Maintenance, Condition-Based Preventative Maintenance, Rehabilitation, and Replacement.

The developed BAM Plan should have short-term and long-term objectives. Long-term objectives address the need for sustained investment in the local bridge system using a combination of preservation and replacement activities. Short-term objectives address the bridges that are currently in "fair to good" condition using preservation activities to extend the service life of the bridge

## **LOCAL BRIDGE SYSTEM**

National Bridge Inspection Standards (23 CFR 650C) require all publicly owned highway bridges on public roadways be inspected on an interval not to exceed two (2) years. Highway bridges by definition are structures carrying public roadways with a span length greater than 20 feet, measured along the roadway centerline.

The purpose of inspections is to:

1. Ensure public safety.
2. Comply with all federal and state laws, rules and policies.
3. Provide condition and appraisal ratings which the LPA can use to determine what activities must be performed to best preserve its bridges at the lowest possible cost to taxpayers.

The FHWA *Recording and Coding Guide for Structure Inventory and Appraisal of the Nation's Bridges* provides thorough and detailed guidance in evaluating and coding specific bridge data. Condition ratings are used to describe the current existing condition of the bridge components compared to their original as-built condition. Evaluations are completed on all major components of the structure. Major components of the structure include, but are not limited to, deck (including joints), superstructure and substructure. The condition rating range with coding and description, structural adequacy and common feasible actions are shown in table below.

Coding Guide		Structural Adequacy	Common Feasible Actions
Code	Description		
N	NOT APPLICABLE		
9	EXCELLENT CONDITION		
8	VERY GOOD CONDITION – No problems noted.		Preventative Maintenance
7	GOOD CONDITION – Some minor problems.		
6	SATISFACTORY CONDITION – Structural elements show some minor deterioration.		Preventative Maintenance and/or Repair
5	FAIR CONDITION – All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.		
4	POOR CONDITION – Advanced section loss, deterioration, spalling or scour.	Structurally Deficient	Rehabilitation or Replacement
3	SERIOUS CONDITION – Loss of section, deterioration, spalling or scour have seriously affect primary structure components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.		
2	CRITICAL CONDITION – Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, closing the bridge may be necessary until corrective action is taken.		
1	“IMMINENT” FAILURE CONDITION – Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective section may put back in light service.		
0	FAILED CONDITION – Out of Service – Beyond correction action.		

Structurally Adequacy is based on NBI Items #58, 59, 60 and 62.

FHWA *Recording and Coding Guide for Structure Inventory and Appraisal of the Nation's Bridges* established appraisal ratings comparing currently in place items versus current design standards. These ratings are used to evaluate the bridge compared to the level of service which it provides in relationship to functional classification of the roadway which it is part of. The standard appraisal rating range with coding and description and structural adequacy are shown in table below.

Coding Guide		Structural Adequacy	
Code	Description		
N	Not Applicable		
9	Superior to present desirable criteria		
8	Equal to present desirable criteria		
7	Better than present minimum criteria		
6	Equal to present minimum criteria		
5	Somewhat better than minimum adequacy to tolerate being left in place as is		
4	Meets minimum tolerable limits to be left in place as is		
3	Basically intolerable requiring high priority of corrective action	Functionally Obsolete (NBI 67 or 71)	
2	Basically intolerable requiring high priority of replacement	Structurally Deficient	Functionally Obsolete (NBI 68, 69 or 71)
1	Rating Code not used		
0	Bridge Closed		

Structural Adequacy is based on NBI Items #67, 68, 69, 71 and 72

The INDOT *Bridge Inspection Manual* provides guidance in recording the findings of each LPA bridge inspection. The findings of each inspection must be recorded in the BIAS.

## **PROJECTS and FUNDING**

The LPA Bridge Program will consist of three types of projects: Replacement, Rehabilitation and Preventative Maintenance. To be eligible, the bridge must be in the NBI database. Specific eligibility criteria by project type are detailed in Appendix B. New bridges and culverts are not eligible.

Surface transportation programs established by the Federal government allow States to use federal funds to improve the condition of highway bridges through replacement, rehabilitation and preventative maintenance. With this being stated, the LPA Bridge Program is open to all LPAs, however the funding mechanism is different. Bridges located outside the urbanized areas of the MPO will be eligible to receive funding from the STP-Rural allocation. Bridges located inside the urbanized areas of the MPO will be eligible to receive funding typically from the STP-Urban allocation.

An LPA is allowed to apply for funding for Preventative Maintenance projects as long as the LPA has an INDOT-approved BAM Plan. The BAM Plan must at least meet the conditions outlined above in this policy. The INDOT Bridges Division Office of Bridge Asset Management will review the LPA BAM Plan and issue a letter of acceptance. If an LPA does not have an INDOT-approved BAM Plan in place, they will not be able to apply for or receive Preventative Maintenance funds during the Call for Projects. For Rehabilitation and Replacement projects, an LPA may apply for funding during the Call for Projects as long as it is in compliance with all federal and state rules and regulations and its bridge meets the eligibility criteria for Rehabilitation or Replacement projects.

**SAMPLE BRIDGE ASSET MANAGEMENT PLAN**

(8L) Bridge Number	(8) NB Number	(6) Feature Intersected	(7) Facility Carried	(43A) Structure Type	(52) Deck Structure Width	(49) Structure Length	(58) Deck Rating	(59) Superstructure Rating	(60) Substructure Rating	(61) Channel Rating	(113A) Scour Criticality	(62) Culvert Rating	(66B) Rating	(29A) ADT-Year Built	(106A) Reconstructed	(106B) Repaired	Sufficiency Rating	Structurally Deficient/Functionally Obsolete	Work Type	Estimated Construction Cost	Additional Incidental Costs (PE, R/W, Construction Insp, etc)	Funding (Local/Federal Aid)	Planned Repair Year	Priority (H,M,L)	Note
BR 1	140						7	7	8	7		N					90.2		Preventive Maintenance	\$20,000	\$3,000		2017		
BR 2	26005						6	6	6	6		N					90.1		Bridge Deck Overlay	\$150,000	\$22,500		2020		
BR 3	24260						4	6	6	7		N					83.2		Bridge Deck Replacement	\$300,000	\$45,000		2018		
BR 4	7798						N	N	N	N		N					96.7		Superstructure Replacement	\$0	\$0				
BR 5	11120						4	4	6	5		N					65.1		Replacement	\$500,000	\$75,000		2024		
BR 6	7780						4	4	6	4		3					83.1			\$0	\$0				
BR 7	980						6	6	6	6		3					99.3			\$0	\$0				
BR 8	990						5	5	4	7		3					35.1		Bridge Replacement	\$1,000,000	\$150,000		2022		
BR 9	1070						6	6	5	6		3					80.9			\$0	\$0				
BR 10	1080						6	6	5	6		3					78.9			\$0	\$0				
BR 11	1110						7	7	8	7		N					90.2		Preventive Maintenance	\$20,000	\$3,000		2019		
BR 12	1120						6	6	6	6		N					90.3		Bridge Deck Overlay	\$150,000	\$22,500		2016		
BR 13	1170						4	6	6	7		N					83.2		Bridge Deck Replacement	\$300,000	\$45,000		2020		
BR 14	1180						7	7	6	7		6					96.3			\$0	\$0				
BR 15	1000						7	7	5	7		5					67.5			\$0	\$0				
BR 16	1010						7	7	8	7		6					99.3			\$0	\$0				
BR 17	1020						4	4	6	5		N					65.1		Superstructure Replacement	\$500,000	\$75,000		2017		
BR 18	1030						7	7	6	7		4					98.1			\$0	\$0				
BR 19	1040						7	7	6	7		4					98.1			\$0	\$0				
BR 20	1090						5	4	5	7		4					22.1		Bridge Replacement	\$1,000,000	\$150,000		2018		
BR 21	1100						6	6	5	6		4					96.0			\$0	\$0				
BR 22	1130						7	7	8	7		N					90.2		Preventive Maintenance	\$20,000	\$3,000		2020		
BR 23	1140						6	6	6	6		N					90.2		Bridge Deck Overlay	\$150,000	\$22,500		2023		
BR 24	1150						4	6	6	7		N					83.2		Bridge Deck Replacement	\$300,000	\$45,000		2024		

## **APPENDIX B CRITERIA FOR ELIGIBILITY**

### **REPLACEMENT**

1. Bridge must be on the NBI database. To be on the NBI Database, a bridge must meet the following criteria:
  - a. Have an opening measured along the center of the roadway of more than twenty (20) feet (NBI Item 49) AND
  - b. Highway bridge that carries a public roadway
2. A sufficiency rating below 50
3. Bridge must be “structurally deficient” or “functionally obsolete”
  - a. Structurally Deficient
    - Conditional rating of 4 or less for
      - NBI Item #58 (deck) OR, NBI Item #59 (superstructure) OR NBI Item #60 (substructure) OR NBI Item # 62 (culvert) OR
    - Appraisal Rating of 2 or less for
      - NBI Item #67 (structural) OR, NBI Item #71 (waterway adequacy)
  - b. Functionally Obsolete
    - Appraisal Rating of 3 or less for
      - NBI Item #68 (deck geometry) OR NBI Item #69 (underclearance) OR NBI Item #72 (approach roadway) OR
    - Appraisal Rating of 3 for
      - NBI Item #67 (structural evaluation) OR NBI Item #71 (waterway adequacy)
4. Bridge CANNOT have been rehabilitated or reconstructed (NBI Item 106) within the past ten (10) years regardless of funding source (i.e. local funds or federal funds)
5. Bridge CANNOT have been new or replaced (NBI Item 27) within the past ten (10) years regardless of funding source (i.e. local funds or federal funds)

## **BRIDGE PRESERVATION**

### **REHABILITATION**

1. Bridge must be on the NBI database. To be on the NBI Database, a bridge must meet the following criteria:
  - a. Have an opening measured along the center of the roadway of more than twenty (20) feet (NBI Item 49) AND
  - b. Highway bridge that carries a public roadway
2. A sufficiency rating below 80 qualifies
3. Bridge must be “structurally deficient” or “functionally obsolete”
  - a. Structurally Deficient
    - Conditional rating of 4 or less for
      - NBI Item #58 (deck) OR NBI Item #59 (superstructure) OR NBI Item #60 (substructure) OR NBI Item #62 (culvert) OR
    - Appraisal Rating of 2 or less for
      - NBI Item #67 (structural evaluation) OR NBI Item #71 (waterway adequacy)
  - b. Functionally Obsolete
    - Appraisal Rating of 3 or less for
      - NBI Item #68 (deck geometry) OR NBI Item #69 (underclearance) OR NBI Item #72 (approach roadway) OR
    - Appraisal Rating of 3 for
      - NBI Item #67 (structural evaluation) OR NBI Item #71 (waterway adequacy)
4. Bridge CANNOT have been rehabilitated or reconstructed (NBI Item 106) within the past ten (10) years regardless of funding source (i.e. local funds or federal funds)
5. Bridge CANNOT have been new or replaced (NBI Item 27) within the past ten (10) years regardless of funding source (i.e. local funds or federal funds)

## **PREVENTATIVE MAINTENANCE**

1. Bridge must be on the NBI database. To be on the NBI Database, a bridge must meet the following criteria:
  - a. Have an opening measured along the center of the roadway of more than twenty (20) feet (NBI Item 49) AND
  - b. Highway bridge that carries a public roadway
2. A sufficiency rating above 50
3. Bridge CANNOT have been rehabilitated or reconstructed (NBI Item 106) within the past five (5) years regardless of funding source (i.e. local funds or federal funds)
4. Bridge CANNOT have been new or replaced (NBI Item 27) within the past five (5) years regardless of funding source (i.e. local funds or federal funds)
5. Preventative Maintenance Activities must be in compliance with the IDM and INDOT/FHWA PM Agreement

## **SOURCES AND REFERENCES**

The following sources and references were used in creating this document:

1. INDOT *Local Public Agency Project Development Process Guidance Document for Local Federal-Aid Projects*
2. INDOT/FHWA Preventative Maintenance Agreement
3. INDOT *Bridge Inspection Manual*
4. *Indiana Design Manual*
5. AASHTO *Guidelines for Bridge Management Systems*, 1992
6. FHWA Preventative Maintenance Eligibility memo (October 2004)
7. FHWA *Bridge Preservation Guide*
8. FHWA Bridge Asset Management
9. FHWA *Guidance for Approval of Bridge Maintenance System and/or Systematic Process*
10. FHWA *Recording and Code Guide for Structure Inventory and Appraisal of the Nation's Bridges*
11. Code of Federal Regulations, 23 CFR 500, 23 CFR 625, 23 CFR 650
12. *Asset Management Guide for Local Agency Bridges in Michigan*