Manual for Bridge Element Inspection | 2



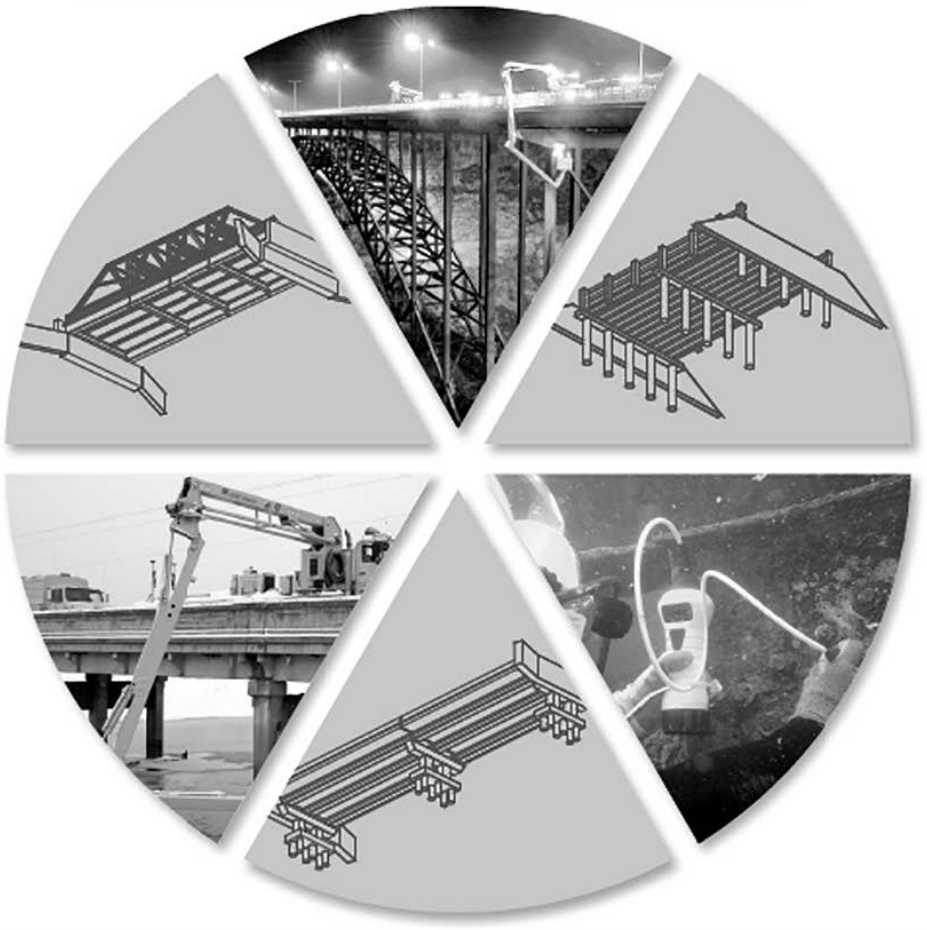
Second Edition, 2019

American Association of State Highway and Transportation Officials
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Manual for Bridge Element Inspection | 2



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PREFACE

This Manual incorporates suggested changes that were submitted by many inspecting agencies, consultant inspection firms, and training instructors that helped improve this updated version. AASHTO would like to thank member agencies for their continued dedication to improving bridge inspection in the United States.

AASHTO also would like to recognize the dedication and tireless efforts of the following technical team members who worked together to develop the First Edition of this Manual:

Name	Agency	Role
Michael B. Johnson	California Department of Transportation (Caltrans)	Team Lead
Wade Casey	Federal Highways Administration (FHWA)	Technical Team Member
Larry O'Donnell	FHWA	Technical Team Member
Derek Soden	FHWA	Technical Team Member
Paula Allec	Caltrans	Technical Support
Allen R. Marshall	Allen R. Marshall Consulting LLC	Manual Development Consultant

As a result of NCHRP 12-104, Guidelines to Improve the Quality of Element-Level Bridge Inspection, a new *Manual for Bridge Element Inspection* (MBEI), 2nd Ed. was developed. Section 3 of the MBEI was reorganized to list elements by material. Other revisions include:

- A new introduction was developed for Section 3.
- Visual guide sections were added to defect tables for Concrete, Prestressed Concrete, Steel, Joints, and Bearings.
- The "Condition State" header was removed from the tables and replaced with CS 1, CS 2, CS 3, and CS 4 nomenclature in the tables showing defects and defect descriptions.
    - The defect descriptions themselves were not changed in any way.
- Crack pattern and crack width measurement guides were added to Article 3.3.
- Spatial estimating guides were added in Article 3.12. These guides provide assistance to an Inspector for estimating areas (ft^2) and length (ft) of damage.
- Element commentary (Article 3.2) was revised as follows:
    - The element commentary was previously included with each element, resulting in repetition. For example, every concrete element included commentary regarding the width of cracks, meaning the same element commentary appeared in at least 17 places in Section 3. Element commentary has been consolidated into a single section to reduce repetition. In some cases, this required minor rewording to make the element commentary more general. For example, the "Other" elements each had a unique description that indicates the element type (e.g., "other deck" or "other column"). This was reworded to remove the specific reference such that one explanation of the "other" materials was applicable to all elements so described.
    - The concrete and prestressed concrete commentary regarding crack widths were stated in a table to improve readability.
    - Element commentary that was unique to a single element was maintained with the element in the listing of Article 3.1, and stated as a note. Typically, these notes are enhancements to the element description.
    - There were no intentional changes to the element commentary, although some rewording was done for grammatical purposes.
- A single, comprehensive listing of all elements documenting the element description, quantity calculation, unit of measure, and classification was developed and included in Article 3.1. This section was organized by material. Within each material, components and subcomponents are identified (such as deck, railing, superstructure, substructure, joints, etc.)
    - Subsections within general classes of components that did not provide different information than the subsection heading were eliminated. For example, the subsection 3.5.1 Columns/pier walls read "(1) This article covers supporting elements of the structure. (2) These items include columns and pier walls." (1) is redundant with the main heading, and (2) is a repeat of the subsection heading. In cases like these, the subsection text was omitted. This included Articles 3.5.1, 3.5.2, 3.5.3, and others.

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- Section 3 has gone from 186 pages to 76 pages. This number of pages would increase with the inclusion of additional visual guides, but still be reduced relative to the previous versions of the MBEI.

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INTRODUCTION

The proper assessment of the condition of bridge elements is the cornerstone of sound bridge management. The introduction of element inspection condition methods in the early 1990s represented a significant advancement in bridge inspection practice and has been adopted by the vast majority of the state transportation departments in the United States. Bridge Owners nationwide have recognized the benefits of detailed condition assessments through the use of the raw inspection information, expanded performance measures, and bridge management system deterioration forecasting and evaluation. As the use of element-level inspection techniques has proliferated, the need for updates and enhancements to the standard element specification has been identified. This Manual incorporates improvements to the AASHTO Commonly Recognized (CoRe) Structural Elements through changes in the measurement units of decks and slabs, the development of a wearing surface element, the standardization of the number of element states, and the development of protective coating elements for concrete and steel, as well as deck protection systems. Elements constructed of innovative materials are also identified. The goal of this Manual is to completely capture the condition of bridges in a simple, effective way that can be standardized across the nation while providing the flexibility to be adapted to both large- and small-agency settings.

This manual is not intended to supplant proper bridge and element inspection training or the exercise of engineering judgment by the Inspector or Professional Engineer.

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2022 INTERIM REVISIONS INSTRUCTIONS AND INFORMATION

General

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Affected Articles

Underlined text indicates revisions that were approved in 2021 by the AASHTO Committee on Bridges and Structures. ~~Strikethrough text~~ indicates any deletions that were likewise approved by the Committee. A list of affected articles is included below.

All interim pages are displayed on a pink background to make the changes stand out when inserted in the first edition binder. They also have a page header displaying the interim publication year. Please note that these pages may also contain nontechnical (i.e., editorial) changes made by AASHTO publications staff; any changes of this type will not be marked in any way so as not to distract the reader from the technical changes.

2022 Changed Articles

SECTION 2: ELEMENT LOCATION MATRIX
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2.1.3

SECTION 3: DETAILED ELEMENT DESCRIPTIONS
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B2.2.5
B2.2.6
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B3.2.3

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B3.2.4
B3.2.6

APPENDIX C: ELEMENT GROUPINGS
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2024 INTERIM REVISIONS INSTRUCTIONS AND INFORMATION

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Please note that where applicable, additions from the previous interim are included and are indicated by *italic text*.

Affected Articles

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All interim pages have a page header displaying the interim publication year. Please note that these pages may also contain nontechnical (i.e., editorial) changes made by AASHTO publications staff; any changes of this type will not be marked in any way so as not to distract the reader from the technical changes.

2024 Changed Articles

SECTION 2: ELEMENT LOCATION MATRIX
2.2.1

SECTION 3: DETAILED ELEMENT DESCRIPTIONS
3.1.8
3.2.8
3.10

APPENDIX C: ELEMENT GROUPINGS
FIGURE C-2

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2025 INTERIM REVISIONS INSTRUCTIONS AND INFORMATION

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Affected Articles

Underlined text indicates revisions that were approved in 2024 by the AASHTO Committee on Bridges and Structures. ~~Strikethrough text~~ indicates any deletions that were likewise approved by the Committee. A list of affected articles is included below. *Italicized text* indicates text that was changed in the previous interim.

All interim pages have a page header displaying the interim publication year. Please note that these pages may also contain nontechnical (that is, editorial) changes made by AASHTO publications staff; any changes of this type will not be marked in any way so as not to distract the reader from the technical changes.

2025 Changed Articles

SECTION 2: ELEMENT LOCATION MATRIX

2.1.3

2.1.5

2.2.3

2.2.4

SECTION 3: DETAILED ELEMENT DESCRIPTIONS

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APPENDIX C: ELEMENT GROUPINGS

Figure C-1

Figure C-2

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SECTION 1: BACKGROUND

1.1—CONDITION ASSESSMENT PHILOSOPHY: MULTIPATH AND DEFECT CONCEPTS

The *Manual for Bridge Element Inspection* (this Manual) builds on the element-level condition assessment methods developed in the *AASHTO Guide for Commonly Recognized Structural Elements*. Improvements have been made to fully capture the condition of the elements by reconfiguring the element language to utilize multiple distress paths within the defined condition states. The multipath distress language provides the means to fully incorporate all possible defects within the overall condition assessment of the element. The overall condition of an element can be utilized in this aggregate form, or broken down into specific defects present as desired by the agency for Bridge Management System (BMS) use.

This manual provides a comprehensive set of bridge elements that is designed to be flexible in nature to satisfy the needs of all agencies. The complete set of elements captures the components necessary for an agency to manage all aspects of the bridge inventory utilizing the full capability of a BMS.

The element set presented within includes two element types identified as National Bridge Elements (NBEs) or Bridge Management Elements (BMEs). The combination of these two element types comprise the full AASHTO element set. All of the elements, whether they are NBEs or BMEs, have the same general condition assessment characteristics:

1. The standard number of condition states (CS) is four.
2. The standard condition states are Good (Condition State 1), Fair (Condition State 2), Poor (Condition State 3), and Severe (Condition State 4) general descriptions.
3. Units of measure are length in feet, area in square feet, and each for enumerated elements.

1.2—NATIONAL BRIDGE ELEMENTS

The National Bridge Elements (NBEs) represent the primary structural components of bridges necessary to determine the overall condition and safety of the primary load carrying members. The NBEs are a refinement of the deck, superstructure, substructure, and culvert condition ratings defined in the Federal Highway Administration's *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*. Additional elements included in this category are bridge rail and bearings. The NBEs are designed to remain consistent from agency to agency across the country in order to facilitate and standardize the capture of bridge element conditions at the national level. In order to capture the diversity of new element design types and materials, many elements in this category have an "other" element type defined.

1.3—BRIDGE MANAGEMENT ELEMENTS

Bridge Management Elements (BMEs) include components of bridges such as joints, wearing surfaces, and protective coating systems and deck/slab protection systems that are typically managed by agencies utilizing Bridge Management Systems (BMSs). The BMEs are defined with a recommended set of condition assessment language that can be modified to suit the agencies' needs as these elements are not intended to be utilized for the purposes of national policy-making. The BMEs defined in this Manual were purposefully left fairly general in nature to provide the flexibility to develop agency-specific elements that best suit the local bridge management practices. Agencies may choose to develop additional BMEs as necessary following the agency-developed element conventions discussed in Appendix A. When considering additional elements, the agency should consider such factors as element performance, deterioration rates, feasible actions, and preservation costs, as well as the practical considerations of training and inspection costs.

1.4—AGENCY-DEVELOPED ELEMENTS

The Agency-Developed Elements (ADEs) presented in this Manual provide the flexibility for an agency to define custom elements in accordance with the defined element framework that may be sub-elements of NBEs or BMEs, or may be ADEs without ties to the other elements defined in this Manual.

By defining a comprehensive set of bridge elements necessary for robust bridge management and the minimum set of elements necessary to assess the condition of primary components of bridges, this Manual provides a flexible element set that can be tailored to the needs of all agencies. The identification numbers 800 and above are not used in this Manual for any elements and are reserved for Agency purposes.

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