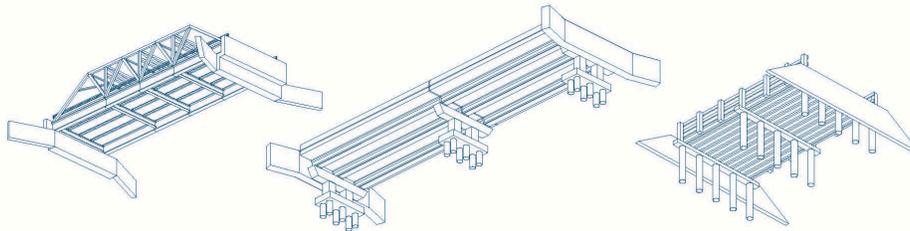


2015 Interim

Manual for Bridge Element Inspection

First Edition, 2013



AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
TRANSPORTATION OFFICIALS
AASHTO
THE VOICE OF TRANSPORTATION

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**2015
Revision**



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ISBN: 978-1-56051-622-4

Pub Code: MBEI-1-I1

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Cover photos courtesy of the following Departments of Transportation: Washington State (1), California (2–3), Idaho (4–5), and Nevada (6). Cover figures courtesy of the Montana Department of Transportation.

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ISBN: 978-1-56051-591-3

PUB CODE: MBEI-1

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**2013
Edition**

PREFACE

This manual is intended as a resource for agencies performing element-level bridge inspections. It replaces the *AASHTO Guide to Commonly Recognized Structural Elements* (1994) and the *AASHTO Guide Manual for Bridge Element Inspection* (2011) as a reference for standardized element definitions, element quantity calculations, condition state definitions, element feasible actions, and inspection conventions.

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 this manual:

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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. Standard number of condition states is four.
2. The standard condition states are good, fair, poor, and severe general descriptions.
3. Units of measure are length in feet, area in square feet, and each for enumerated elements.

1.2—NATIONAL BRIDGE ELEMENTS (NBEs)

The National Bridge Elements 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 section 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 (BMEs)

Bridge Management Elements 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. 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 within 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 (ADEs)

The elements presented within 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 agency-defined elements without ties to the 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.

1.5—HOW TO USE THIS MANUAL 2015 Revision

Bridge inspection based on this manual consists of defining the elements (pieces of the bridge) and total quantities that exist at each bridge. The condition of each element is determined by performing a field inspection and recording quantities of the element that have identified defects that correlate to the severity of the defects defined in the particular condition state definition of this manual. The condition assessment is complete when the appropriate portion of the total quantity is stratified over the defined condition states. For agencies utilizing bridge management systems (BMSs), the appropriate element defects and environment shall be recorded for use in deterioration modeling.

In this manual, the element represents the aggregate condition of the defined element inclusive of all defects. The specific listing of all defects is optional; however, the element condition must be inclusive of all defined defects. Element defects are typically to be used when the element reaches Condition State 2 or lower and they essentially act to break down the overall element condition into one or more specific observed problems. The defects defined within this manual shall always assume the units of the element with which they are associated. For example, the scour defect may be applied to a column or a pier wall. The defect language is the same for both elements; however, the units for the column defect would be each and the units for the pier wall would be linear feet. In some cases, multiple defects may operate in the same defined space. In this case, the inspector shall report the defect in the most severe condition state. If two defects in the same condition state operate in the same defined space, the inspector shall determine the predominant defect for reporting. For example, if a reinforced concrete bridge deck is cracked throughout and also has a spall in a portion of the deck, the spalling would likely be determined to be the predominant defect.

This manual attempts to cover the vast majority of all bridge elements found on highway bridges in the United States. During the course of an inspection, the inspector may find materials or elements that are not defined. In these cases, the inspector should use judgment to select the closest element match or use the “other” element type. In a similar vein, there may be cases when the specific condition observed in the field is not defined in this manual. In these cases, the inspector should use the general description of the condition states to determine the appropriate condition.

The granularity of the defect details is typically not specified with defect descriptive language for Condition State 4, as this state is reserved for severe conditions that are beyond the specific defects defined for Condition States 1 through 3. Elements with a portion or all of the quantity in Condition State 4 may often have load capacity implications warranting a structural review. Within this manual, the term “structural review” is defined as a review by a person qualified to evaluate the field observed conditions and make a determination of the impacts of the conditions on the performance of the element. Structural reviews may include a review of the field inspection notes and photographs, review of as-built plans, or analysis as deemed appropriate to evaluate the performance of the element. Agencies may establish additional guidance to aid the inspector in determining the field circumstances where structural review is warranted, taking into consideration the education, training, and experience of their inspection staff.

1.6—ORGANIZATION

Section 2 of the manual presents a master location matrix of all the elements and identification numbers for quick reference. Each element is displayed within the NBE or BME category, then by major bridge assembly, element type, and material.

Section 3 presents a detailed definition of each element with its applicable defects. Guidelines for measurement and condition assessment are included where appropriate.

The appendices provide additional guidance and background on the use of this manual. There are five appendices to aid an agency in the development of their data collection process.

These appendices are:

- A—Agency-Defined Elements (ADEs)
- B—Inspection Examples
- C—Element Groupings
- D—List of Element Defects by Material Type
- E—List of Feasible Actions by Material Type