

## SECTION 1 INTRODUCTION

### 1.1 GENERAL REQUIREMENTS

The intent of the CDOT Bridge Design Manual (BDM) is to complement current *American Association of State Highway and Transportation Officials Load and Resistance Factor Design Bridge Design Specifications with current interim edition* (AASHTO) and to provide interpretations applicable to the design of Colorado projects. This BDM also establishes CDOT policies and describes preferred practices and procedures in the state of Colorado. Whenever conflicts between AASHTO and this BDM arise, policies established in this BDM shall govern.

### 1.2 DEFINITIONS

#### 1.2.1 Bridge Definition

A bridge is a structure that spans over a road, railway, river, or other obstacle to provide passage for pedestrians and vehicles from one side to the other.

#### 1.2.2 Culvert Definition

In general, a culvert is a structure, conduit, or drain that passes underneath a road, railroad track, or other obstruction to allow water to be directed away from travel corridors. Some large culverts can carry pedestrian and vehicle traffic inside.

#### 1.2.3 Glossary of Terms

For additional acronyms and abbreviations, refer to CDOT Standard Plans M-100-2.

AASHTO – American Association of State Highway and Transportation Officials. For the purpose of the CDOT BDM, “AASHTO” will refer specifically to *Load and Resistance Factor Design Bridge Design Specifications*.

ABC – Accelerated Bridge Construction

Abutment – A structure that supports the end of a bridge, provides lateral support for fill material on which the roadway rests immediately adjacent to the bridge, and transfers the loads from the superstructure into the ground.

Alignment – Control line used to determine the direction of travel in the roadway.

Approach Slab – A concrete slab that provides a transition between roadway pavement and the bridge and is used to alleviate problems with settlement of the bridge approaches relative to the bridge deck.

ASD – Allowable Stress Design

Batter – Inclination of a vertical surface (typically wall or pile) in relation to a horizontal plane.

BDM – CDOT Bridge Design Manual

Bent – A structure that supports the superstructure at each end of a span.

Bent Angle – Angle between the centerline of a support and a layout line (see Figure 4-1). This angle is typically used as a bridge description skew and a culvert skew.

CBT girders – Colorado Bulb Tee Girders

Clear Zone – The total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles.

Diaphragm (integral) – Concrete block encasing free ends of girders at abutments or piers. Usually provided to resist lateral forces and to ensure proper load distribution to points of support.

Diaphragm (intermediate) – A vertically oriented solid transverse member connecting adjacent longitudinal flexural components to transfer and distribute vertical and lateral loads and to provide stability to the compression flanges.

Efflorescence – White deposit on concrete caused by the crystallization of soluble salts brought to the surface by moisture in the concrete.

Embankment – A bank of earth constructed above the natural ground surface to carry a road.

End Block – An increase in web width at the girder end intended to provide adequate bearing.

ERS – Earthquake resisting system

FHWA – Federal Highway Administration

FIR – Field Inspection Review, occurs at approximately 30% project completion.

FOR – Final Office Review, occurs at approximately 90% project completion.

Freeboard – Clearance between the lowest point of the bridge superstructure and the design water surface elevation immediately upstream of the bridge.

Girder – A main horizontal structural member that supports vertical loads.

GRS – Geosynthetic Reinforced Soil

Haunch – The section of concrete between the top of girder and the underside of deck.

HCL – Horizontal Control Line

HLMR – High-Load Multi-Rotational bearings (pot, spherical, and disc bearings)

LCCA – Life Cycle Cost Analysis

LFD – Load Factor Design

Life Cycle – The period of time used for the calculation of LCCA. A bridge is expected to be in operation in excess of this period.

LRFD – Load and Resistance Factor Design

Milepost – A post placed along a roadway to mark a distance in miles.

MOT (Maintenance of Traffic) – Traffic flow alternatives used to allow construction.

MSE – Mechanically Stabilized Earth

NBIS – National Bridge Inspection Standards

OSHA – Occupational Safety and Health Administration

PDA – Pile Driving Analyzer

Pier – The part of a bridge structure that provides intermediate support to a superstructure.

PPC – Polyester Polymer Concrete

P&S Submittal – Construction plans and specifications

PTFE – Polytetrafluoroethylene (typically used for sliding bearings)

QA/QC – Quality Assurance and Quality Control

QMP – Quality Management Plan

Refined Analysis – Detailed, sophisticated structural modeling approach that typically involves computerized finite element analysis.

RFC – Release for Construction

RFI – Request for Information

Riprap – Protective covering material deposited on river stream beds or banks to prevent erosion and scour.

ROW (Right of Way) – A privately owned strip of land granted or reserved by the owner for construction of facilities, such as highways, railroads, power lines, and other infrastructure.

Sacrificial Anode – The anode in a cathodic protection system used to inhibit the object's corrosion.

SC – Site Class

SDC – Seismic Design Category

Skew Angle – Angle between the centerline of a support and a line normal to the layout line (see Figure 4-1). This angle is typically used in Structure Inspection Reports and Bridge Geometry.

Sleeper Slab – A strip of concrete that supports the free end of the approach slab.

SPT (Standard Penetration Test) – An in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil.

Staff Bridge Branch – A branch of CDOT tasked with setting overall policies and procedures for bridges and bridge-related structures, providing direction, and reviewing and approving plans for the individual projects in the state of Colorado. Review and approval shall be by CDOT Designer/Reviewer or Unit Leader.

Substructure – The part of a bridge structure supporting the superstructure that includes elements such as piers and abutments.

Superstructure – The part of a bridge structure that directly supports traffic loads and includes elements such as bridge rail, bridge deck, and girders.

WEAP – Wave Equation Analysis of Pile driving

Wingwall – A retaining wall adjacent to an abutment or a culvert that serves to retain earth in an embankment.

## 1.3 DESIGN SPECIFICATIONS

### 1.3.1 Load and Resistance Factor Design (LRFD)

Load and Resistance Factor Design (LRFD) is a current design method that shall be used for all new structure designs in the state of Colorado. It is a reliability-based design methodology in which force effects caused by factored loads are not permitted to exceed the factored resistance of the components. Load and resistance factors are used to take into account statistical probability of both the variability of loads and the uncertainty of material properties.

Load modifier  $\eta_i$  is not permitted to be less than 1.00 under any conditions for ductility, redundancy or operational importance.

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### 1.3.2 Load Factor Design (LFD)

Load Factor Design (LFD), also known as Ultimate Strength Design, is a design method that incorporates safety provisions by separately accounting for uncertainties relative to load and resistance. Unit Leader may allow the use of this design method on some rehabilitation and widening projects where the original structure was designed in LFD. The intent to use the LFD method shall be documented in the Structure Selection Report and approved by Unit Leader before beginning the design process.

### **1.3.3 Allowable Stress Design (ASD)**

Allowable Stress Design (ASD), also known as Service Load Design Method or Working Stress Design, uses uniform factors of safety to account for uncertainty in both applied loads and structure capacity. This method is allowed on rehabilitation and widening projects only where the original structure was designed in ASD to avoid conflicts between different design philosophies. The intent to use ASD method shall be documented in the Structure Selection Report and approved by Unit Leader before beginning the design process.