# I N T E R O F F I C E  M E M O

TECHNICAL SERVICES
Bridge Engineering Section
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DATE: April 7, 2014

TO: Craig Shike
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ODOT – Bridge Section

**SUBJECT: Proposed Revision to Bridge Design & Drafting Manual**

**RE: BDDM Section 1.17.2.1 & 1.17.3.1**

## *Problem Statement:*

ODOT has established the two-level performance criteria for seismically design the Oregon bridges well before AASHTO even entertained such an idea. ODOT has defined these levels as "No Collapse" and "Serviceable", whereas AASHTO specifications refer to these performance levels as "Life Safety" and "Operational". In order to maintain consistency between ODOT BDDM and AASHTO design specifications, replacing the BDDM criteria definitions of "No Collapse" and "Serviceable" with "Life Safety" and "Operational" respectively deems necessary.

## *Proposal:*

Modify/Add Section 1.17.2.1 and 1.17.3.1 as follows

### 1.17.2.1 General Considerations

ODOT requires all new bridges to be designed for a two-level performance criteria as follows:

(1) 1000-year "~~No Collapse~~Life Safety" Criteria: Design all bridges for a 1000-year return period earthquake (7% probability of exceedance in 75 years) under "~~No Collapse~~Life Safety" criteria. To satisfy the "Life Safety~~No Collapse~~" criteria, use Response Modification Factors from *Table 3.10.7.1-1* of the *AASHTO LRFD Bridge Design Specifications* using an importance category of **"other"**.

(2) 500-year "~~Serviceable~~Operational" Criteria: In addition to the 1000-year "Life Safety~~No Collapse~~" criteria, design all bridges to remain "~~Serviceable~~Operational" after a 500-year return period event (14% probability of exceedance in 75 years). To satisfy the "~~Serviceable~~Operational" criteria, use Response Modification Factors from *Table 3.10.7.1-1* of the *AASHTO LRFD Bridge Design Specifications* using an

importance category of **"essential"**. When requested in writing by a local agency, the "~~Serviceable~~Operational" criteria for local bridges may be waived.

### 1.17.3.1 General Considerations

ODOT requires all new bridges to be designed for a two-level performance criteria as follows:

(1) 1000-year "~~No Collapse~~Life Safety" Criteria: Design all bridges for a 1000-year return period earthquake (7% probability of exceedance in 75 years) under "Life Safety~~No Collapse~~" criteria. To satisfy the "Life Safety~~No Collapse~~" criteria, comply with the following requirements and guidelines:

Seismic Design Categories (SDC) A, B and C

- Meet all design requirements for SDC A, B and C according to the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*.

Seismic Design Category (SDC) D

- Meet all design requirements for SDC D according to the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, except as modified below:
    - The maximum concrete strain in confined section of the columns ($\varepsilon_{cc}$) shall not exceed 90% of the ultimate concrete strain ($\varepsilon_{cu}$), computed by Mander's model.
    - The maximum strain of reinforcing steel shall not exceed the εRsu as defined on Table 8.4.2-1 of the AASHTO Guide Spec.
    - The maximum strain of prestressing steel shall not exceed εRps,u = 0.03

The above guidelines are applicable even for the other Seismic Design Categories, if Pushover Analysis will be used instead of the implicit equation.

(2) 500-year "~~Serviceable~~Operational" Criteria: In addition to the 1000-year "Life Safety~~No Collapse~~" criteria, design all bridges to remain "~~Serviceable~~Operational" after a 500-year return period event (14% probability of exceedance in 75 years). To satisfy the "~~Serviceable~~Operational" criteria, comply with the following requirements and guidelines:

Seismic Design Categories (SDC) A, B, C and D

- Verify the "~~Serviceable~~Operational" performance for a 500-year return event when potentially liquefiable soils are present on site.

Seismic Design Categories (SDC) A and B

- No structural analysis is required for the "~~Serviceable~~Operational" criteria.

Seismic Design Category (SDC) C

- Each bridge bent shall satisfy the *equation 4.8-1* of the AASHTO Guide Spec ($\Delta^L{}_D < \Delta^L{}_C$), where $\Delta^L{}_C$ is determined from the *equation 4.8.1.1* of the AASHTO Guide Spec (displacement capacity for SDC B).

Seismic Design Category (SDC) D

- Meet all design requirements for SDC D according to the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, except as modified below:

- The maximum concrete strain in confined section of the columns shall not exceed $\varepsilon_{cc} = 0.005$
- The maximum strain of reinforcing steel shall not exceed $2*\varepsilon_{sh}$, where $\varepsilon_{sh}$ is defined on *Table 8.4.2-1* of the AASHTO Guide Spec.
- The maximum strain of prestressing steel (for 270 ksi strands) shall not exceed $\varepsilon_{ps,EE} = 0.0086$

Long Span Bridges: *Article 3.1* of the *AASHTO Guide Specifications for LRFD Seismic Bridge Design* states that the seismic provisions of this Manual are applicable for bridges with spans not exceeding 500 ft. For seismic design of bridges with spans exceeding 500 feet, consult with the Seismic Design Standards & Practice Engineer to discuss whether special analysis and design procedures are warranted.

Pedestrian Bridges: *Article 3.6* of the *AASHTO Guide Specifications for LRFD Seismic Bridge Design* states that pedestrian bridges over roads carrying vehicular traffic shall satisfy the performance criteria defined for other highway bridges. Design new pedestrian bridges over roads carrying vehicular traffic per the requirements of this section. However, pedestrian bridges that do not cross roads carrying vehicular traffic do not need be designed for the 500-year "~~Serviceable~~Operational" Criteria.

## *Analysis / Research / Other Supporting Data:*

☒ None
☐ Attached:
- [name of attachment]
- [name of attachment]

## *Bridge Engineering Section Response:*

| | | |
|---|---|---|
| ☐ Accepted for consideration as submitted<br>☐ Accepted for consideration as noted<br>☐ Proposal tabled, see Remarks<br>☐ Proposal not accepted, see Remarks | | |
| Remarks: | | |
| | | |
| [name of reviewer]<br>Bridge Design Standards Reviewer | | Date |
| | | |
| Craig Shike<br>Bridge Operations & Standards Managing Engineer | | Date |

Cc: file