

## SECTION 31 PEDESTRIAN STRUCTURES

### 31.1 GENERAL REQUIREMENTS

This section addresses design and performance requirements for typical pedestrian bridges intended to carry pedestrians, bicyclists, equestrian riders, and light maintenance vehicles.

### 31.2 CODE REQUIREMENTS

Design shall be in accordance with the AASHTO *Standard Specifications for Highway Bridges*, except as modified by the AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges* and this BDM.

### 31.3 PERFORMANCE REQUIREMENTS

#### 31.3.1 Service Life

Pedestrian bridges must be designed to achieve a minimum service life of 75 years.

#### 31.3.2 Maintenance Requirements

Pedestrian bridges should be designed to allow ease of inspection and maintenance. Periodic preventive maintenance and inspections will be performed on all pedestrian bridges to extend the service life of the structure. Preventive maintenance may include cleaning, removing debris, painting, sealing deck joints, etc.

#### 31.3.3 Aesthetic Goals

Refer to Section 2.3 of this BDM for information about aesthetic requirements.

### 31.4 GEOMETRY AND CLEARANCES

#### 31.4.1 Geometry

##### 31.4.1.1 Width

Bridge deck width should be based on the type of anticipated local usage and corresponding current ADA Standards for Accessible Design guidelines. Clear width should be measured from face to face of rail.

Wider bridges are preferred for two-directional pedestrian traffic rather than narrow decks with passing spaces due to the difficulty in design and constructability of the landings. However, when passing spaces are used, they should conform to ADA requirements and be located at reasonable intervals, not to exceed 200 ft.

Coordinate with the local agency to determine the final section on a pedestrian or bicycle bridge.

Refer to Chapter 14 of CDOT Roadway Design Guide for additional pedestrian facilities geometry requirements.

#### 31.4.1.2 Profile and Grade

Refer to current ADA Standards for Accessible Design for maximum grade allowed on pedestrian bridges.

Pedestrian bridges over waterways shall satisfy all requirements set for vehicle bridges for freeboard, scour, and overtopping.

#### 31.4.1.3 Ramps

Pedestrian overpass structures, if practical, may be provided with both ramps and stairways, but under no condition should a structure be built with stairs only.

Maximum grades on approach ramps shall conform to ADA requirements. Whenever existing structures or other local constraints prevent design of the structure that satisfies maximum grade requirement, landings shall be provided to accommodate a maximum rise of 2.5 ft. Landings shall be level, the full width of the bridge, and a minimum of 5 ft. in length. Landings shall also be provided whenever the direction of the ramp changes. However, straight grades or vertical curves are preferred instead of landings whenever possible.

The deck and ramps shall have a non-skid surface, such as a transverse fiber broom finish for concrete. Concrete bridge decks must have transverse joints to minimize map cracking. The Designer shall specify the spacing of the joints.

#### 31.4.1.4 Physical Requirements

The Structure Selection Report should evaluate all feasible structure types.

The deck of the bridge should maintain the cross-slope of the approach trail. Cover plates should be provided at all expansion joints to minimize tripping hazards. Approach slabs are not required on pedestrian bridges unless requested by the Owner.

Section 2.4 of this BDM outlines the requirements for the pedestrian and bicycle railing.

### 31.4.2 Vertical Clearances

The minimum vertical clearance from an under-passing roadway surface to a pedestrian bridge shall be 17.5 ft. as outlined in Section 2.2.2 of this BDM. The minimum vertical clearance from a pedestrian or bicycle path to an overhead obstruction shall be 8 ft.-4 in., or 10 ft. for an equestrian path, measured at 1 ft. from the face of curb, parapet, or rail.

### 31.4.3 Horizontal Clearances

Horizontal clearances shall conform to AASHTO.

**AASHTO 2.3.3**

## 31.5 LOADS AND DEFLECTIONS

### 31.5.1 Live Loads

#### 31.5.1.1 Pedestrians

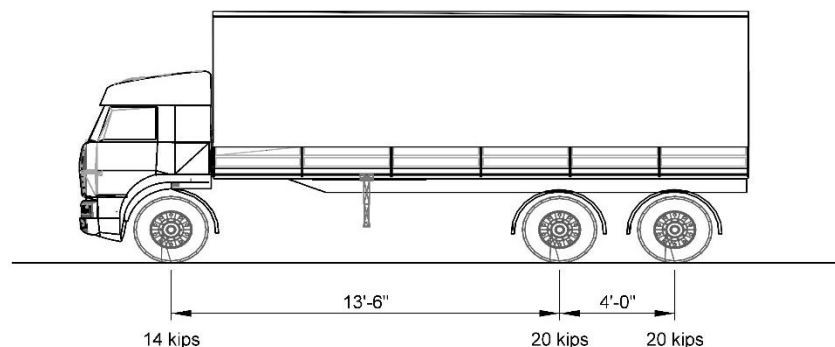
Refer to the current edition of *AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges* for the design value of the pedestrian live load.

#### 31.5.1.2 Maintenance Vehicles

Whenever vehicle access is not prevented by permanent physical methods, pedestrian/bicycle bridges shall be designed for vehicle live load. In most cases, maintenance vehicle H5 or H10 will be used (refer to *AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges* for maintenance vehicle configurations).

However, in some locations pedestrian bridges are expected to carry emergency vehicles and construction live loads, such as firetrucks in rural areas where no other route is available. In such instances, pedestrian structures must be designed to carry CDOT Legal Load Type 3 (shown on Figure 31-1). The Designer must coordinate with Staff Bridge and the local authority to determine the type of live load required on each pedestrian bridge. The Structure Selection Report and bridge project special specification must discuss live load selection. No vehicle live load is required for bridges with clear widths equal to or less than 7 ft.

All pedestrian bridges designed to carry vehicle load must be rated, with the rating factor specified on the plans or shop drawings. Either the truss manufacturer or the Engineer of Record is expected to perform the rating. Rating requirements should be coordinated with Staff Bridge to determine the appropriate vehicles and load case assumptions.



**Figure 31-1: CDOT Legal Load Type 3**

### 31.5.2 Collision

Vehicular collision load will not be considered in the structural design of the pedestrian bridge superstructure. However, all pedestrian bridges must be provided with the means to prevent the superstructure from sliding off the supports and onto the highway in case of collision. These means can include shear keys, keeper blocks, and anchor bolts at piers and abutments.

Design of the sliding prevention mechanisms can be done based on a concentrated 54 kips collision load applied at the support. Note that this load value is taken directly from AASHTO Table A13.2-1, as transverse collision load on traffic barrier at Test Level-4. No additional research or case studies were performed prior to publication to improve the accuracy of this value. The Designer must exercise engineering judgment when using this design method.

### **31.5.3 Deflection Limits**

AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges* outlines requirements for deflection limits of pedestrian bridges.

### **31.5.4 Vibration Limits**

AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges* outlines requirements for vibration limits of pedestrian bridges. However, in rare cases that experience unusually high pedestrian traffic loads, setting lower vibration limits is advised, such as bridges next to sport stadiums. The Designer is expected to exercise engineering judgment and consult similar projects.

## **31.6 FRACTURE CRITICAL DESIGNATION**

Fracture critical members and welds shall satisfy provisions of AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges* and be clearly identified on both the structural plans and the shop drawings. The reviewing engineer is responsible for identifying missing fracture critical designations while checking vendor shop drawings.

## **31.7 RAILING AND FENCING REQUIREMENTS**

Pedestrian railings shall be designed in accordance with AASHTO *LRFD Guide Specifications for the Design of Pedestrian Bridges*. Handrails shall be provided for all stairs and ramps with grades greater than 5%. Refer to current ADA guidelines and Section 2.4 of this BDM for pedestrian and bicycle railing and fencing requirements.

## **31.8 COVERED/ENCLOSED STRUCTURES**

Staff Bridge does not regulate the use of enclosed bridge structures. Local Agencies or the Landscape Architect can decide when to use them. However, whenever covered bridges are used, the roof of the enclosure should be designed to all applicable Local Agencies' loads and load cases, including the uplift wind forces. Because this topic is not covered by AASHTO, the Designer can use other applicable codes, such as IBC and ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

## **31.9 DECK**

Any available deck types, except steel grid, are allowed on pedestrian bridge structures. The Designer should consider the use of protection systems on all pedestrian bridge decks to extend the service life of the structure. Use of innovative materials is encouraged but must be discussed with Staff Bridge. All pedestrian bridge decks shall have non-skid surfaces.

**31.10 LIGHTING**

For pedestrian bridge lighting requirements, refer to Section 2.3.2 of this BDM.

**31.11 DRAINAGE**

Curbs shall be provided on both sides of pedestrian bridges that cross roads and highways to prevent water running over the sides. Drainage systems must be installed at bridge ends in combination with the curbs. Positive deck cross-slope may be used to facilitate drainage.