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# 5 Bridge Superstructure Design

## 5.1 General

The series of articles under Section 5, Bridge Superstructure Design, is intended to fit together as a unit. As much as possible, cross references are used to avoid duplication.

### 5.1.1 Policy overview

In the Office of Bridges and Structures, the design of typical highway bridges proceeds from preliminary to final design sections. The preliminary design section selects the superstructure type based on bridge site information, available locations for substructure components, spans between substructure components, and criteria stated in *Bridge Design Manual* Section 3, Preliminary Design. In some cases the preliminary design section also considers aesthetic criteria in Section 4, Aesthetic Design (in process). A final design section then completes the structural design and detailing following the policies in Section 5, Bridge Superstructure Design, and Section 6, Bridge Substructure Design.

In the past the office followed AASHTO Standard Specifications but now has transitioned to AASHTO LRFD Specifications for superstructure design. With the transition the superstructure sections of the manual based on the AASHTO Standard Specifications have been withdrawn and archived.

The office interprets the basic AASHTO LRFD Specifications when designing superstructures, bearings, and additional components and specifies rules for detailing these components. This series of articles on superstructure components covers most typical designs but does not cover special bridge designs for signature bridges and long-span bridges.

In all cases, superstructure components need to be designed for vertical and lateral loads, strength, serviceability, and economy considering the entire bridge structure.

For typical highway bridge superstructures, the office generally selects among four types: continuous concrete slab (CCS), pretensioned prestressed concrete beam (PPCB), continuous welded plate girder (CWPG), and rolled steel beam (RSB). In general CCS bridges are used for short spans up to 59 feet (17.983 m) and lengths to 150 feet (45.720 m) or where minimum superstructure depth is required over short spans. PPCB bridges are used for longer spans to 155 feet (47.244 m). CWPG bridges are used for spans longer than 155 feet (47.244 m), where minimum superstructure depth is required, or where the horizontal alignment is sharply curved. Standard three-span RSB bridges have center spans to 136 feet (41.450 m) and have been redesigned to the AASHTO LRFD Specifications. Except for unusual conditions the office limits bridge skew to 45 degrees.

Standard sheets and details and signed standard bridge plans that follow current policies are available for efficient design of the typical superstructures. In all cases, however, the standard sheets and standard bridge plans need to be supplemented with additional sheets to produce a complete plan set for a bridge project.

The office has signed standard plans for a series of three-span CCS bridges, single span PPCB bridges, a series of three-span PPCB bridges, and a series of three-span RSB bridges that may be used for relatively simple alignments and site conditions. The standard CCS bridges, which are intended for stream and small valley crossings, have four roadway widths from 24 to 44 feet (7.315 to 13.411 m), lengths varying from 70 to 150 feet (21.336 to 45.720 m), and skews from 0 to 45 degrees. The standard single-span PPCB bridges have lengths varying from 46.33 to 110 feet (14.121 to 33.528 m) and skews from 0 to 30 degrees. The standard three-span PPCB bridges have lengths varying from 126.33 to 243 feet (38.505 to 74.066 m) and skews from 0 to 45 degrees. The standard rolled steel beam bridges, which are intended for stream crossings and county road overpasses, have lengths varying from 160 to 340 feet (48.770 to 103.630 m), span ratios of 0.75-1.00-0.75, and skews from 0 to 45 degrees. Plans including standard rolled steel beam bridges having flange widths greater than 12 inches (300 mm) as designated in BDM 3.2.6.1.5 shall include alternate PPCB layouts and designs due to the potentially higher costs associated with the designated rolled steel beams.

The general availability of standard sheets and standard bridge plans for primary highway system projects is summarized in Table 5.1.1. All items listed in the table have roadway widths of at least 30 feet (9.144 m).

**Table 5.1.1. Summary of standard sheets and signed standard bridge plan availability**

| Superstructure type | Number of spans | AASHTO live load and specification | |
|---|---|---|---|
| | | Standard sheets | Signed standard plan sets |
| CCS, J30, J40, and J44 series (1) | 3 | --- (2) | HL-93 LRFD |
| PPCB | --- | HL-93 LRFD | --- |
| PPCB, H30SI single span series | 1 | --- | HL-93 LRFD |
| PPCB, H30, H40, and H44 series (1) | 3 | --- | HL-93 LRFD |
| CWPG | --- | HL-93 LRFD | --- |
| RSB, RS40 series | 3 | --- | HL-93 LRFD |

Table notes:

(1) The 24-foot (7.315-m) wide bridges (not shown in the table) are intended only for county and city use.

(2) The standard sheets available for three-span CCS structures designed under the AASHTO Standard Specifications have been voided.

The office prefers jointless bridges and therefore, wherever practical, selects integral abutments and continuous construction at piers. In cases where expansion joints are necessary due to bridge length, the expansion joints are to be designed according to the guidelines in a subsequent article [BDM 5.8.3].

## 5.1.2 Design information

Reserved

## 5.1.3 Definitions

Reserved

## 5.1.4 Abbreviations and notation

**CCS**, continuous concrete slab
**CWPG**, continuous welded plate girder

**PPCB**, pretensioned prestressed concrete beam
**RSB,** rolled steel beam

## 5.1.5 References

Reserved