

## 6.1 Designation of Steel Bridge Members

### 6.1.1 GENERAL

This memo provides examples for showing steel bridge member designations on the plans for *Fracture Critical Members (FCM)*, *Primary Members*, and *Secondary Members* of steel girder and truss bridges in accordance with *STP 6.1*. *STP 6.1* addresses the requirements for identifying and designating steel bridge members.

*AASHTO-CA BDS-8* (AASHTO, 2017; Caltrans, 2019b) Article 6.6.2 requires engineers to identify and designate steel bridge members as *FCM*, *Primary Member*, or *Secondary Member* on the contract documents. *AASHTO-CA BDS-8* also introduces a new term “*System Redundant Member (SRM)*”, where a member traditionally designated as an *FCM* for which redundancy is not known by engineering judgment, and a refined analysis has shown that its simulated fracture does not result in bridge collapse or a portion thereof. At the design stage, a refined analysis to identify *SRMs* is not required, and *SRMs* are not required to be designated on design plans.

### 6.1.2 STEEL GIRDER BRIDGES

In accordance with *AASHTO-CA BDS-8* Table 6.6.2.1-1, steel girders shall be identified as *Primary Members*, and lateral bracing members and cross frames shall be identified as *Secondary Members*. Figure 6.1.2.1 shows a moment diagram for a three-span continuous steel girder bridge under Strength I of the *AASHTO-CA BDS-8*. Steel member designation examples for girder bridges are based on this moment diagram.

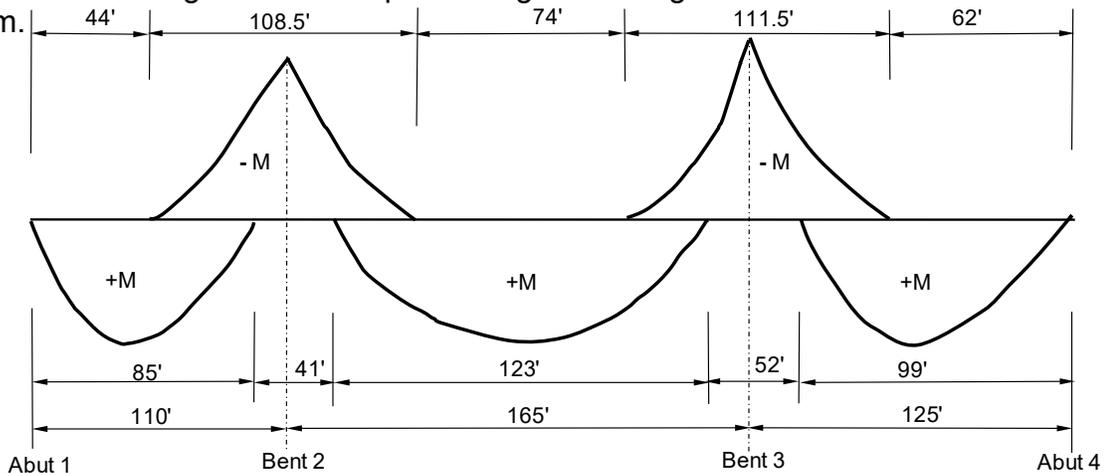
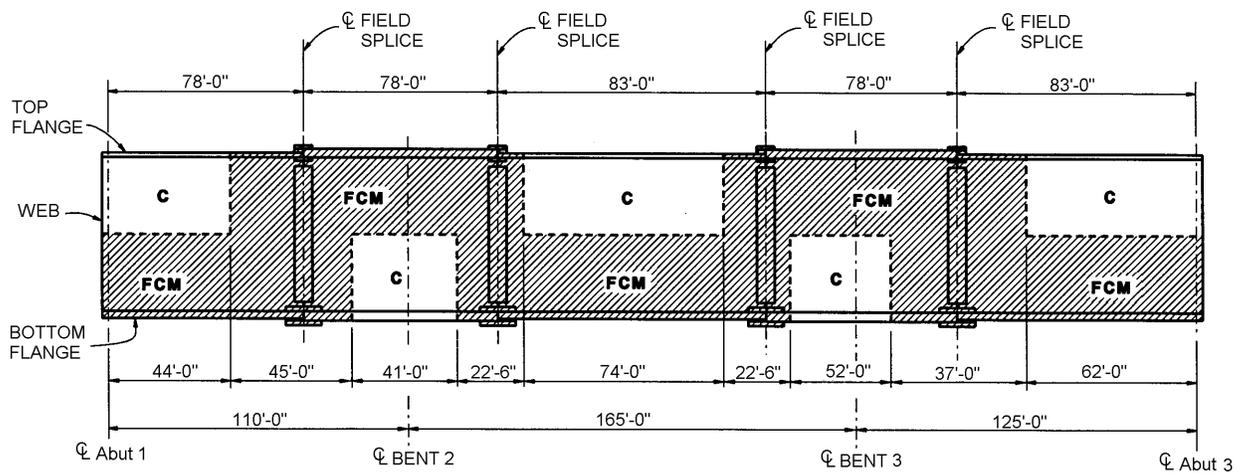


Figure 6.1.2.1 Moment Diagram of Steel Girder (Not to Scale)

For a two-girder steel bridge, tension portions of a steel girder shall be identified and designated as *FCM* as shown in Figure 6.1.2.2.

For a steel girder bridge with 3 or more girders, tension portions of a steel girder are usually identified and designated as *Primary Tension Members (Non-Fracture Critical)* as shown in Figure 6.1.2.3.

For all steel girders, compression portions shall be identified and designated as *Primary Compression Members* as shown in Figures 6.1.2.2 and 6.1.2.3.



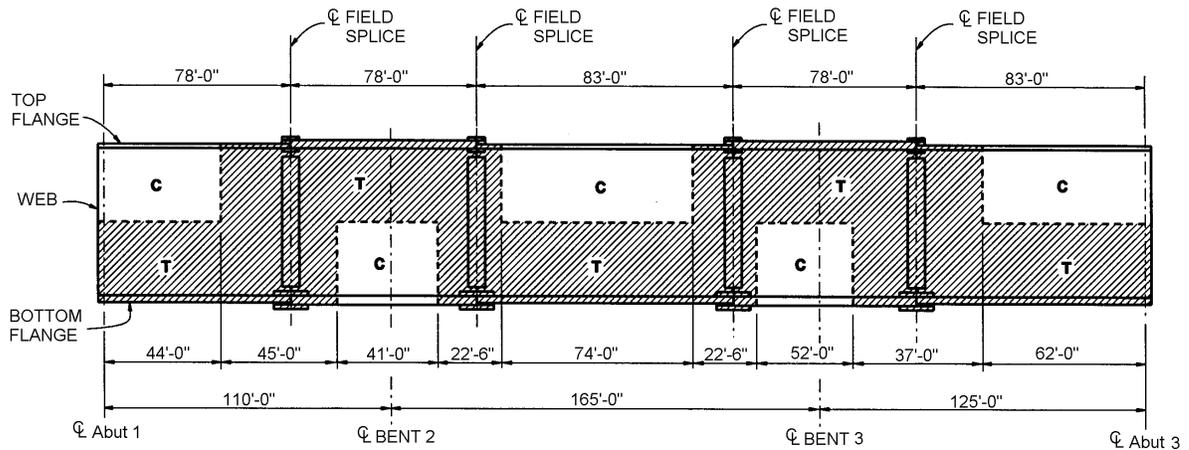
NOTES:

FCM – Fracture Critical Member

C – Primary Compression Member

FCM and C zones shown extend to the middle depth of the web

Figure 6.1.2.2 FCM and Primary Compression Member Designations



NOTES:

T – Primary Tension Member (Non-Fracture Critical)

C – Primary Compression Member

T and C zones shown extend to the middle depth of the web

Figure 6.1.2.3 Steel Girder Primary Member Designations

### 6.1.3 TRUSS BRIDGES

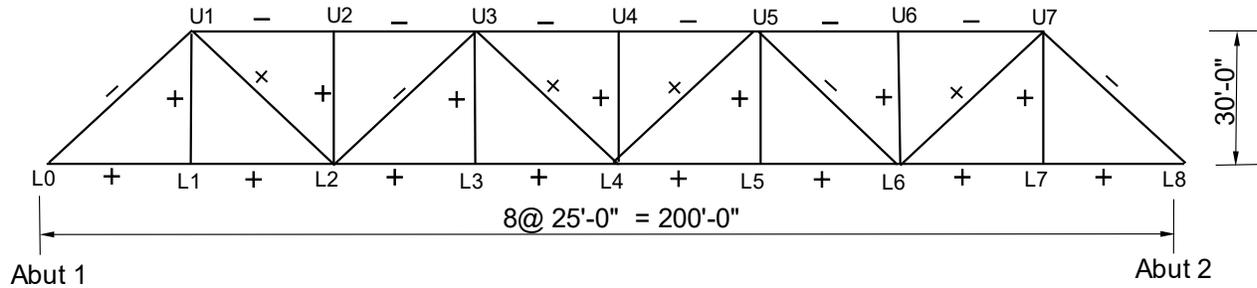
In accordance with *AASHTO-CA BDS-8* Table 6.6.2.1-1, truss chords, diagonals, verticals, portal and sway bracing members, and gusset plates are *Primary Members*. Figure 6.1.3.1 shows an axial force sign diagram for a simple-span steel through truss bridge where “+” indicates a member in tension and “-” indicates a member in compression under Strength I of the *AASHTO-CA BDS-8*. Steel member designation examples for truss bridges are based on this axial force sign diagram.

Tension chords, diagonals, verticals, and their gusset plates for a truss bridge shall be identified and designated as *FCM* as shown in Figures 6.1.3.2 and 6.1.3.3.

All compression chords, diagonals, verticals and their gusset plates for a truss bridge shall be identified and designated as *Primary Compression Member* as shown in Figures 6.1.3.2 and 6.1.3.3.

Sway frame members and their gusset plates for a truss bridge shall be identified and designated as a *Primary Tension Member*.

Figure 6.1.3.2 shows member designations directly labeled on the plans and Figure 6.1.3.3 shows member designations tabulated on the plans.

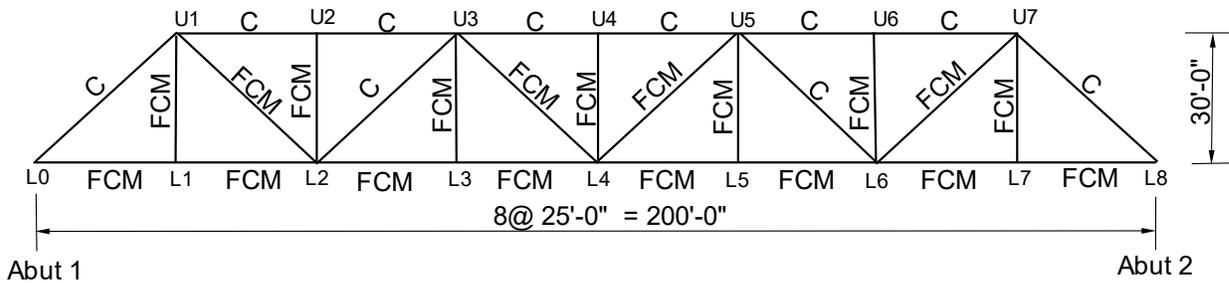


NOTES:

"+" – Member in tension

"-" – Member in compression

**Figure 6.1.3.1 Axial Force Sign Diagram for Steel Through Truss Bridge**

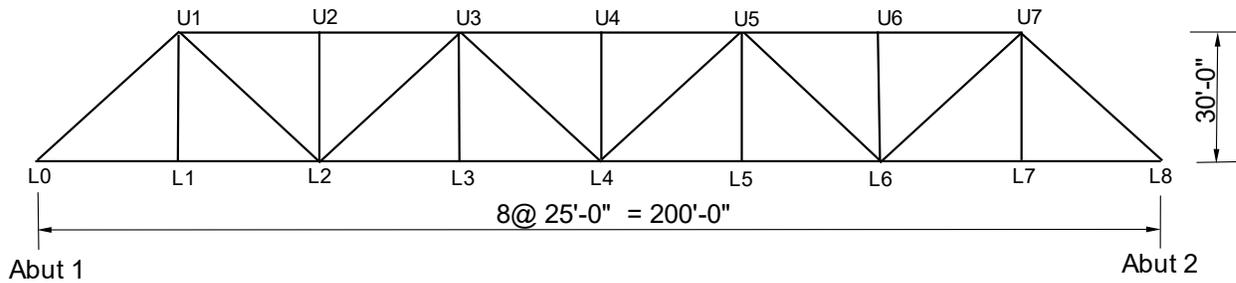


NOTES:

FCM – Fracture Critical Member including Gusset Plates

C – Primary Compression Member including Gusset Plates

**Figure 6.1.3.2 FCM and Primary Compression Member Designations (Directly Labeled)**



Member		Designations
Chord	L0L1, L1L2, L2L3, L3L4, L4L5, L5L6, L6L7, L7L8 and their gusset plates	Fracture Critical Member
	U1U2, U2U3, U3U4, U4U5, U5U6, U6U7 and their gusset plates	Primary Compression Member
Diagonal	L0U1, L2U3, U5L6, U7L8 and their gusset plates	Primary Compression Member
	U1L2, U3L4, L4U5, L6U7 and their gusset plates	Fracture Critical Member
Vertical	U1L1, U2L2, U3L3, U4L4, U5L5, U6L6, U7L7 and their gusset plates	Fracture Critical Member

Figure 6.1.3.3 FCM and Primary Compression Member Designations (Tabulated)

## 6.1.4 REFERENCES

1. AASHTO. (2017). AASHTO LRFD Bridge Design Specifications, 8th Edition, American Association of State Highway and Transportation Officials, Washington, DC.
2. Caltrans. (2019). *Structure Technical Policy 6.1, Identification of Steel Bridge Members*, California Department of Transportation, Sacramento, CA.
3. Caltrans. (2019b). California Amendments to AASHTO LRFD Bridge Design Specifications – Eighth Edition, California Department of Transportation, Sacramento, CA.