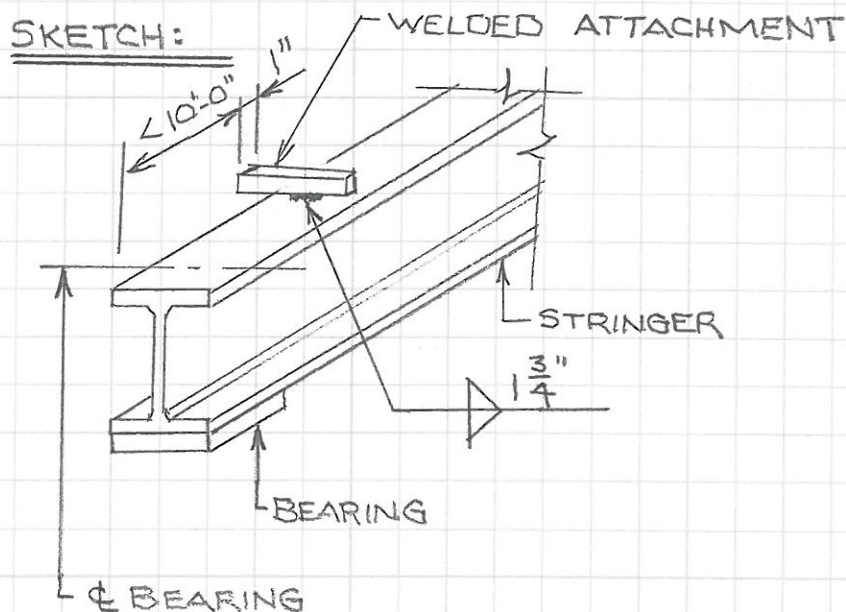


OBJECTIVE: SCOTT FEBUS (WALSH) STATED THAT DECK FORM HANGERS WERE WELDED TO THE TOP FLANGE OF THE STRINGERS NEAR THE EXPANSION JTS. HE ASKED IF IT WAS ACCEPTABLE TO LEAVE THE WELDED ATTACHMENTS PERMANENTLY. EVALUATE REQUEST



CALCULATIONS:

PER ODOT BDM 302.4.1.2, WELDING OF ATTACHMENTS IN TENSION AREAS IS NOT ACCEPTABLE.

DESIGN CALCULATIONS ASSUMED A KNIFE EDGE SUPPORT @ ¢ BEARING. GIVEN THIS ASSUMPTION TENSION DOES EXIST DUE TO FATIGUE LOADING. IN REALITY THIS DOES NOT EXIST.

MAXIMUM FATIGUE STRESS RANGE = 0.97 ksi

FATIGUE CATEGORY = C  $\Rightarrow \Delta F_{TH} = 10 \text{ ksi} > 0.97 \text{ ksi}$  OK







Table 6.6.1.2.3-1 (continued)—Detail Categories for Load-Induced Fatigue

| Description   | Category          | Constant $A$ (ksi <sup>3</sup> ) | Threshold $(\Delta_f)_{TH}$ ksi | Potential Crack Initiation Point                             | Illustrative Examples |
|---|-------------------|----------------------------------|---------------------------------|--|-----------------------|
| Section 6—Transversely Loaded Welded Attachments (continued)  |                   |                                  |                                 |  |                       |
| 6.4 Base metal in a transversely loaded detail (e.g. a lateral connection plate) attached to a longitudinally loaded component by a fillet weld or a partial joint penetration groove weld, with the weld parallel to the direction of primary stress (Note: Condition 6.1 shall also be checked.)  | See Condition 5.4 |                                  |                                 |  |                       |
| Section 7—Longitudinally Loaded Welded Attachments  |                   |                                  |                                 |  |                       |
| 7.1 Base metal in a longitudinally loaded component at a detail with a length $L$ in the direction of the primary stress and a thickness $t$ attached by groove or fillet welds parallel or transverse to the direction of primary stress where the detail incorporates no transition radius:   |                   |                                  |                                 | In the primary member at the end of the weld at the weld toe |                       |
| $L < 2$ in.   | C                 | $44 \times 10^8$                 | 10                              |  |                       |
| $2$ in. $\leq L \leq 12t$ or 4 in.  | D                 | $22 \times 10^8$                 | 7                               |  |                       |
| $L > 12t$ or 4 in.  |                   |                                  |                                 |  |                       |
| $t < 1.0$ in.   | E                 | $11 \times 10^8$                 | 4.5                             |  |                       |
| $t \geq 1.0$ in.  | E'                | $3.9 \times 10^8$                | 2.6                             |  |                       |
| (Note: see Condition 7.2 for welded angle or tee section member connections to gusset or connection plates.)  |                   |                                  |                                 |  |                       |
| 7.2 Base metal in angle or tee section members connected to a gusset or connection plate by longitudinal fillet welds along both sides of the connected element of the member cross-section. The fatigue stress range shall be calculated on the effective net area of the member, $A_e = UA_g$ , in which $U = (1 - \bar{x}/L)$ and where $A_g$ is the gross area of the member. $\bar{x}$ is the distance from the centroid of the member to the surface of the gusset or connection plate and $L$ is the maximum length of the longitudinal welds. The effect of the moment due to the eccentricities in the connection shall be ignored in computing the stress range (McDonald and Frank, 2009). | E                 | $11 \times 10^8$                 | 4.5                             | Toe of fillet welds in connected element                     |                       |

continued on next page

There are several systems available for coating steel bridges. These coatings are specified in CMS 514 or by the plan notes provided in the appendix. See Section 302.4.1.5 for guidelines on selecting a coating system.

#### **302.4.1.2 ATTACHMENTS**

Detail plans of steel beam and girder bridges shall show where welded attachments are allowed for construction purposes.

Welding of attachments, either permanent or temporary, is not acceptable in tension areas. Welding is allowed in compression areas. Detail plans shall show the extent of compression and tension areas.

Welding of scuppers, down spouts or drainage supports should not be allowed in tension areas of main members.

#### **302.4.1.3 STEEL FABRICATION QUALIFICATION**

The Department's requirements for steel fabricators are defined in CMS 513 and Supplement 1078. Steel fabricators are classified according to their capabilities into eight levels (1 thru 6, SF & UF). Levels 1 thru 6 require certification according to the American Institute of Steel Construction (AISC). No AISC certification is required for Levels SF and UF.

The AISC categories of certification are listed here for information:

- A. AISC Category Sbr - Fabricators qualified for single span rolled beam bridges
- B. AISC Category Mbr - Fabricators qualified for all other bridge structures
- C. AISC has also established a P and F endorsement for fabricators:
  - 1. P - Painting of steel structures endorsement
  - 2. F - Fracture Critical endorsement

#### **302.4.1.4 MAXIMUM AVAILABLE LENGTH OF STEEL MEMBER**

Mills can supply lengths up to maximum shipping limits, but extra charges may be added for lengths over 80'-0" [24 meters]. The designer should consider cost by providing for field splices and allowing for optional field splices. The National Steel Bridge Alliance (NSBA) and the American Iron and Steel Institute (AISI) are available to provide assistance with material sizes.

Length of a girder is generally limited by the ability to transport the member from the fabricator's shop to the job site. A length of 120'-0" [36 meters] is generally the maximum trucking length between splices, but girder lengths of 160'-0" [49 meters] and greater have been transported to project sites.







| SPAN,LOC | DEAD LOAD    |              | MAX FATIGUE I |           | MIN FATIGUE I |           | TOP FLANGE |           | BOTTOM FLANGE |           |
|----------|--------------|--------------|---------------|-----------|---------------|-----------|------------|-----------|---------------|-----------|
|          | TOP FL (ksi) | BOT FL (ksi) | MAX (ksi)     | MIN (ksi) | MAX (ksi)     | MIN (ksi) | MAX (ksi)  | MIN (ksi) | MAX (ksi)     | MIN (ksi) |
| 1.000    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.013    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.027    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.040    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.054    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.067    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.081    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.094    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.108    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.121    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.135    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.148    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.162    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.175    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.189    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.202    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.216    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.229    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.243    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.256    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.270    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.283    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.297    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.310    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.324    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.337    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.351    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.364    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.378    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.391    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.405    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.418    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.432    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.445    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.459    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.472    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.486    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.499    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.513    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.526    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.540    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.553    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.567    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.580    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.594    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.607    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.621    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.634    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.648    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.661    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.675    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.688    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.702    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.715    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.729    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.742    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.756    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.769    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.783    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.796    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.810    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.823    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.837    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.850    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.864    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.877    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.891    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.904    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.918    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.931    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.945    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.958    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.972    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.985    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |
| 1.999    | 0.00         | 0.00         | 0.00          | 0.00      | 0.00          | 0.00      | 0.00       | 0.00      | 0.00          | 0.00      |

NOTE: BRIDGE DESIGN PROGRAM BIDS VERSION 2.9.1.0 OUTPUT  
 FILENAME: C:\DOCUME~1\user\My Documents\LOCALS~1\Temp\SteelData\_wforms\StrIngr A.OUT

----- GIRDER 2 FLEXURAL FATIGUE STRESS SUMMARY -----

NOTES:  
 - MOMENTS AND STRESSES ARE FACTORED  
 - DEAD LOAD STRESSES INCLUDE LATERAL FLANGE BENDING (IF APPLICABLE)  
 - STRESSES ARE BASED ON INPUT PLATE SIZES  
 - TENSION IS POSITIVE

NOTE: BRIDGE DESIGN PROGRAM BIDS VERSION 2.9.1.0 OUTPUT  
 FILENAME: C:\DOCUME~1\user\My Documents\LOCALS~1\Temp\SteelData\_wforms\StrIngr A.OUT

----- GIRDER 2 FLEXURAL FATIGUE STRESS SUMMARY -----

NOTES:  
 - MOMENTS AND STRESSES ARE FACTORED  
 - DEAD LOAD STRESSES INCLUDE LATERAL FLANGE BENDING (IF APPLICABLE)  
 - STRESSES ARE BASED ON INPUT PLATE SIZES  
 - TENSION IS POSITIVE

