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Cross-frames and diaphragms connecting adjacent girders are stressed when one girder deflects with respect to the adjacent girder connected by the diaphragm or cross-frame. The sense of stress is reversed when the vehicle is positioned over the adjacent girder. Since it is the total stress range that produces fatigue, the effects of trucks in different transverse positions usually creates the largest stress range in these bracing members. To cause one cycle of the stress range so computed requires two vehicles to traverse the bridge in separate transverse positions with one vehicle leading the other. For cases where the force effects in these members are available from an analysis, such as in horizontally curved or sharply skewed bridges, it may be desirable in some instances to check fatigue-sensitive details on a bracing member subjected to a net applied tensile stress determined as specified herein. In lieu of more specific owner supplied guidance, it is recommended that one cycle of stress be taken as 75 percent of the stress range in the member determined by the passage of the factored fatigue load in the two different transverse positions just described. The factor of 0.75 is distinct from the load factor specified for the applicable fatigue load combination in Table 3.4.1-1; i.e., both factors may be applied simultaneously. The reduction is intended to approximate the low probability of two vehicles being located in the critical relative positions, such as outside of a striped lane, over millions of cycles. However, in no case should the calculated range of stress be less than the stress range caused by loading of only one lane. There is no provision in this recommended procedure to account for the need for two trucks to cause a single cycle of stress. For cases where the nominal fatigue resistance is calculated based on a finite life, the Engineer may wish to consider a reduction in the number of cycles whenever two trucks are required to cause a single cycle of stress.

6.6.1.2.2—Design Criteria

For load-induced fatigue considerations, each detail shall satisfy:

$$\gamma(\Delta f) \le (\Delta F)_n \qquad (6.6.1.2.2\text{-}1)$$

where:

γ = load factor specified in Table 3.4.1-1 for the fatigue load combination

(Δf) = force effect, live load stress range due to the passage of the fatigue load as specified in Article 3.6.1.4 (ksi)

$(\Delta F)_n$ = nominal fatigue resistance as specified in Article 6.6.1.2.5 (ksi)

C6.6.1.2.2

Eq. 6.6.1.2.2-1 may be developed by rewriting Eq. 1.3.2.1-1 in terms of fatigue load and resistance parameters:

$$\eta\gamma(\Delta f) \le \phi(\Delta F)_n \qquad (C6.6.1.2.2\text{-}1)$$

but for the fatigue limit state,

$\eta = 1.0$
$\phi = 1.0$

6.6.1.2.3—Detail Categories

Components and details shall be designed to satisfy the requirements of their respective detail categories summarized in Table 6.6.1.2.3-1. Where bolt holes are depicted in Table 6.6.1.2.3-1, their fabrication shall conform to the provisions of Article 11.4.8.5 of the *AASHTO LRFD Bridge Construction Specifications.* Where permitted for use, unless specific information is available to the contrary, bolt holes in cross-frame, diaphragm, and lateral bracing members and their connection plates shall be assumed for design to be punched full size.

Except as specified herein for fracture critical members, where the projected 75-year single lane Average Daily Truck Traffic $(ADTT)_{SL}$ is less than or equal to that specified in Table 6.6.1.2.3-2 for the component or detail under consideration, that component or detail should be designed for finite life using the Fatigue II load combination specified in Table 3.4.1-1. Otherwise, the component or detail shall be designed for infinite life using the Fatigue I load combination. The single-lane Average Daily Truck Traffic $(ADTT)_{SL}$ shall be computed as specified in Article 3.6.1.4.2.

Table 6.6.1.2.3-2—75-yr $(ADTT)_{SL}$ Equivalent to Infinite Life

Detail Category	75-Year $(ADTT)_{SL}$ Equivalent to Infinite Life (trucks per day)
A	530
B	860
B′	1035
C	1290
C′	745
D	1875
E	3530
E′	6485

Components and details on fracture-critical members should be designed for infinite life using the Fatigue I load combination specified in Table 3.4.1-1.

C6.6.1.2.3

Components and details susceptible to load-induced fatigue cracking have been grouped into eight categories, called detail categories, by fatigue resistance.

Experience indicates that in the design process the fatigue considerations for Detail Categories A through B′ rarely, if ever, govern. Nevertheless, Detail Categories A through B′ have been included in Table 6.6.1.2.3-1 for completeness. Investigation of components and details with a fatigue resistance based on Detail Categories A through B′ may be appropriate in unusual design cases.

Table 6.6.1.2.3-1 illustrates many common details found in bridge construction and identifies potential crack initiation points for each detail. In Table 6.6.1.2.3-1, "Longitudinal" signifies that the direction of applied stress is parallel to the longitudinal axis of the detail. "Transverse" signifies that the direction of applied stress is perpendicular to the longitudinal axis of the detail.

Category F for allowable shear stress range on the throat of a fillet weld has been eliminated from Table 6.6.1.2.3-1. When fillet welds are properly sized for strength considerations, Category F should not govern. Fatigue will be governed by cracking in the base metal at the weld toe and not by shear on the throat of the weld. Research on end-bolted cover plates is discussed in Wattar et al. (1985).

Where the design stress range calculated using the Fatigue I load combination is less than $(\Delta F)_{TH}$, the detail will theoretically provide infinite life. Except for Categories E and E′, for higher traffic volumes, the design will most often be governed by the infinite life check. Table 6.6.1.2.3-2 shows for each detail category the values of $(ADTT)_{SL}$ above which the infinite life check governs, assuming a 75-year design life and one stress range cycle per truck.

The values in Table 6.6.1.2.3-2 were computed using the values for A and $(\Delta F)_{TH}$ specified in Tables 6.6.1.2.5-1 and 6.6.1.2.5-3, respectively, and a number of stress range cycles per truck passage, n, equal to one. These values were rounded up to the nearest five trucks per day. The indicated values were determined by equating infinite and finite life resistances with due regard to the difference in load factors used with the Fatigue I and Fatigue II load combinations. For other values of n, the values in Table 6.6.1.2.3-2 should be modified by dividing by the appropriate value of n taken from Table 6.6.1.2.5-2.

Table 6.6.1.2.3-1—Detail Categories for Load-Induced Fatigue

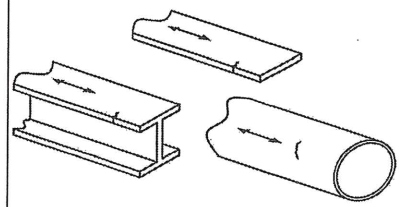
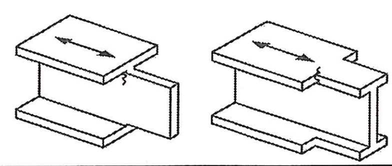
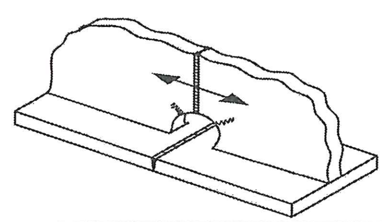
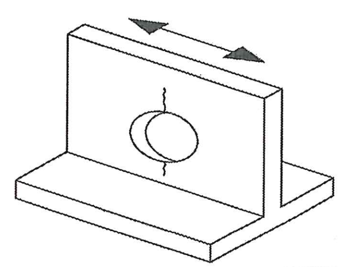
Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 1—Plain Material away from Any Welding					
1.1 Base metal, except noncoated weathering steel, with rolled or cleaned surfaces. Flame-cut edges with surface roughness value of 1,000 μ-in. or less, but without re-entrant corners.	A	250×10^8	24	Away from all welds or structural connections	
1.2 Noncoated weathering steel base metal with rolled or cleaned surfaces designed and detailed in accordance with FHWA (1989). Flame-cut edges with surface roughness value of 1,000 μ-in. or less, but without re-entrant corners.	B	120×10^8	16	Away from all welds or structural connections	
1.3 Member with re-entrant corners at copes, cuts, block-outs or other geometrical discontinuities made to the requirements of AASHTO/AWS D1.5, except weld access holes.	C	44×10^8	10	At any external edge	
1.4 Rolled cross sections with weld access holes made to the requirements of AASHTO/AWS D1.5, Article 3.2.4.	C	44×10^8	10	In the base metal at the re-entrant corner of the weld access hole	
1.5 Open holes in members (Brown et al., 2007).	D	22×10^8	7	In the net section originating at the side of the hole	

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

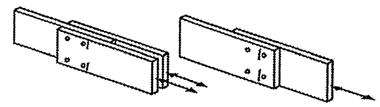
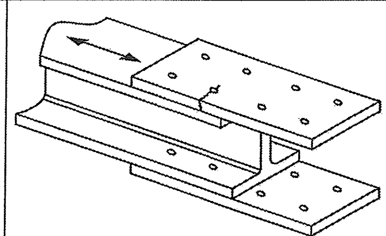
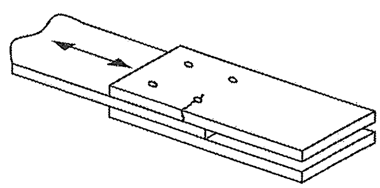
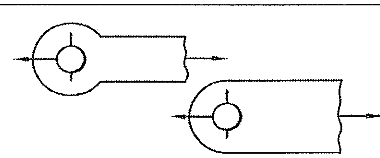
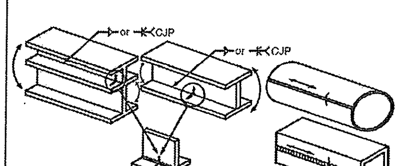
Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 2—Connected Material in Mechanically Fastened Joints					
2.1 Base metal at the gross section of high-strength bolted joints designed as slip-critical connections with pre-tensioned high-strength bolts installed in holes drilled full size or subpunched and reamed to size—e.g., bolted flange and web splices and bolted stiffeners. (Note: see Condition 2.3 for bolt holes punched full size.)	B	120×10^8	16	Through the gross section near the hole	
2.2 Base metal at the net section of high-strength bolted joints designed as bearing-type connections, but fabricated and installed to all requirements for slip-critical connections with pre-tensioned high strength bolts installed in holes drilled full size or subpunched and reamed to size. (Note: see Condition 2.3 for bolt holes punched full size.)	B	120×10^8	16	In the net section originating at the side of the hole	
2.3 Base metal at the net section of all bolted connections in hot dipped galvanized members (Huhn and Valtinat, 2004); base metal at the appropriate section defined in Condition 2.1 or 2.2, as applicable, of high-strength bolted joints with pretensioned bolts installed in holes punched full size (Brown et al., 2007), and base metal at the net section of other mechanically fastened joints, except for eyebars and pin plates; e.g., joints using ASTM A307 bolts or non pretensioned high strength bolts.	D	22×10^8	7	In the net section originating at the side of the hole or through the gross section near the hole, as applicable	
2.4 Base metal at the net section of eyebar heads or pin plates (Note: for base metal in the shank of eyebars or through the gross section of pin plates, see Condition 1.1 or 1.2, as applicable).	E	11×10^8	4.5	In the net section originating at the side of the hole	
Section 3—Welded Joints Joining Components of Built-Up Members					
3.1 Base metal and weld metal in members without attachments built-up of plates or shapes connected by continuous longitudinal complete joint penetration groove welds back-gouged and welded from the second side, or by continuous fillet welds parallel to the direction of applied stress.	B	120×10^8	16	From surface or internal discontinuities in the weld away from the end of the weld	

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

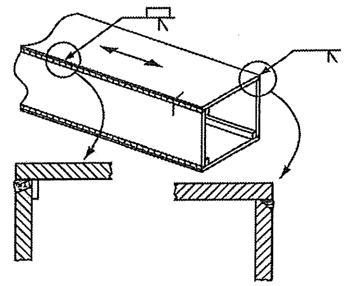
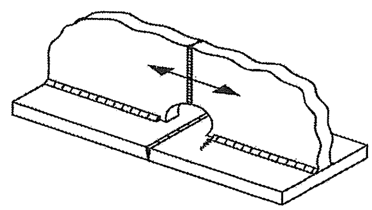
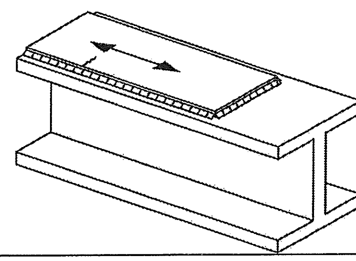
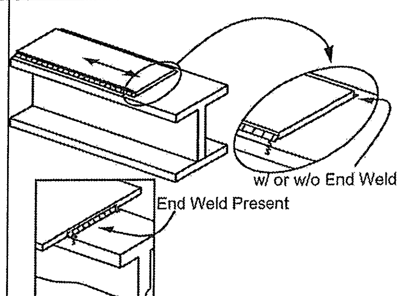
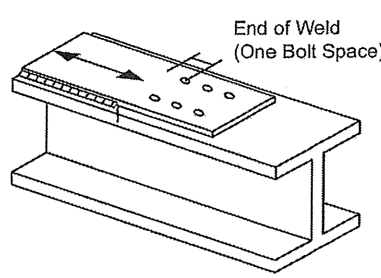
Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
3.2 Base metal and weld metal in members without attachments built-up of plates or shapes connected by continuous longitudinal complete joint penetration groove welds with backing bars not removed, or by continuous partial joint penetration groove welds parallel to the direction of applied stress.	B′	61×10^8	12	From surface or internal discontinuities in the weld, including weld attaching backing bars	
3.3 Base metal and weld metal at the termination of longitudinal welds at weld access holes made to the requirements of AASHTO/AWS D1.5, Article 3.2.4 in built-up members. (Note: does not include the flange butt splice).	D	22×10^8	7	From the weld termination into the web or flange	
3.4 Base metal and weld metal in partial length welded cover plates connected by continuous fillet welds parallel to the direction of applied stress.	B	120×10^8	16	From surface or internal discontinuities in the weld away from the end of the weld	
3.5 Base metal at the termination of partial length welded cover plates having square or tapered ends that are narrower than the flange, with or without welds across the ends, or cover plates that are wider than the flange with welds across the ends:				In the flange at the toe of the end weld or in the flange at the termination of the longitudinal weld or in the edge of the flange with wide cover plates	
Flange thickness ≤ 0.8 in.	E	11×10^8	4.5		
Flange thickness > 0.8 in.	E′	3.9×10^8	2.6		
3.6 Base metal at the termination of partial length welded cover plates with slip-critical bolted end connections satisfying the requirements of Article 6.10.12.2.3.	B	120×10^8	16	In the flange at the termination of the longitudinal weld	

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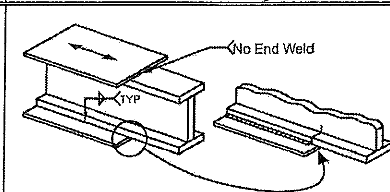
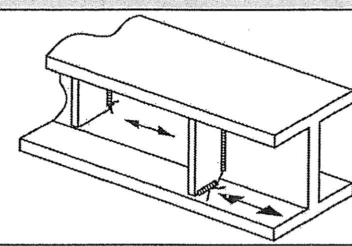
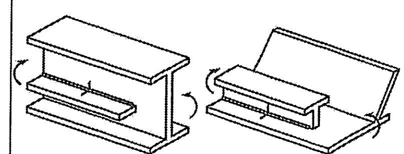
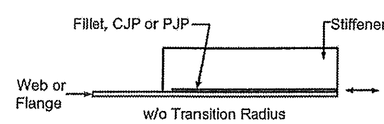
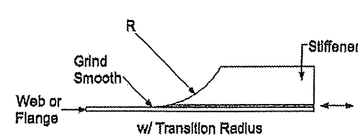
Table 6.6.1.2.3-1 (continued)—Detail Categories for Load-Induced Fatigue

Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
3.7 Base metal at the termination of partial length welded cover plates that are wider than the flange and without welds across the ends.	E′	3.9×10^8	2.6	In the edge of the flange at the end of the cover plate weld	
Section 4—Welded Stiffener Connections					
4.1 Base metal at the toe of transverse stiffener-to-flange fillet welds and transverse stiffener-to-web fillet welds. (Note: includes similar welds on bearing stiffeners and connection plates).	C′	44×10^8	12	Initiating from the geometrical discontinuity at the toe of the fillet weld extending into the base metal	
4.2 Base metal and weld metal in longitudinal web or longitudinal box-flange stiffeners connected by continuous fillet welds parallel to the direction of applied stress.	B	120×10^8	16	From the surface or internal discontinuities in the weld away from the end of the weld	
4.3 Base metal at the termination of longitudinal stiffener-to-web or longitudinal stiffener-to-box flange welds:					
With the stiffener attached by fillet welds and with no transition radius provided at the termination:				In the primary member at the end of the weld at the weld toe	
Stiffener thickness < 1.0 in.	E	11×10^8	4.5		
Stiffener thickness ≥ 1.0 in.	E′	3.9×10^8	2.6		
With the stiffener attached by welds and with a transition radius R provided at the termination with the weld termination ground smooth:					
$R \geq 24$ in.	B	120×10^8	16	In the primary member near the point of tangency of the radius	
24 in. > $R \geq 6$ in.	C	44×10^8	10		
6 in. > $R \geq 2$ in.	D	22×10^8	7		
2 in. > R	E	11×10^8	4.5		

continued on next page

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

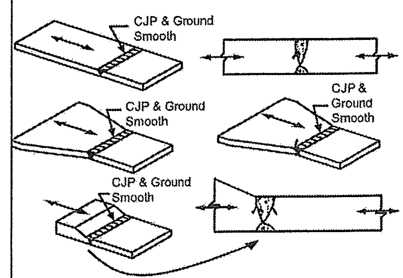
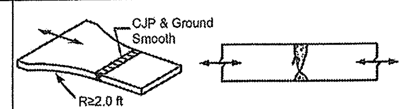
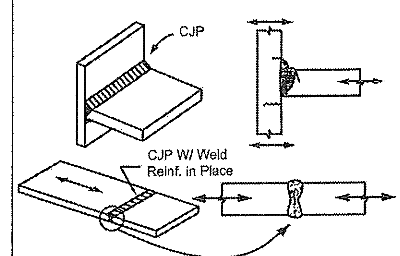
Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 5—Welded Joints Transverse to the Direction of Primary Stress					
5.1 Base metal and weld metal in or adjacent to complete joint penetration groove welded butt splices, with weld soundness established by NDT and with welds ground smooth and flush parallel to the direction of stress. Transitions in thickness or width shall be made on a slope no greater than 1:2.5 (see also Figure 6.13.6.2-1).				From internal discontinuities in the filler metal or along the fusion boundary or at the start of the transition	
$F_y < 100$ ksi	B	120×10^8	16		
$F_y \geq 100$ ksi	B′	61×10^8	12		
5.2 Base metal and weld metal in or adjacent to complete joint penetration groove welded butt splices, with weld soundness established by NDT and with welds ground parallel to the direction of stress at transitions in width made on a radius of not less than 2 ft with the point of tangency at the end of the groove weld (see also Figure 6.13.6.2-1).	B	120×10^8	16	From internal discontinuities in the filler metal or discontinuities along the fusion boundary	
5.3 Base metal and weld metal in or adjacent to the toe of complete joint penetration groove welded T or corner joints, or in complete joint penetration groove welded butt splices, with or without transitions in thickness having slopes no greater than 1:2.5 when weld reinforcement is not removed. (Note: cracking in the flange of the 'T' may occur due to out-of-plane bending stresses induced by the stem).	C	44×10^8	10	From the surface discontinuity at the toe of the weld extending into the base metal or along the fusion boundary	

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

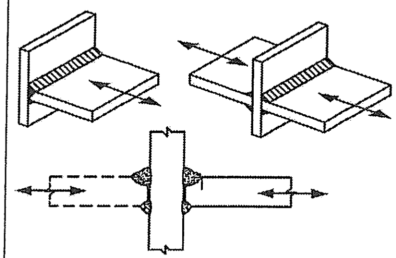
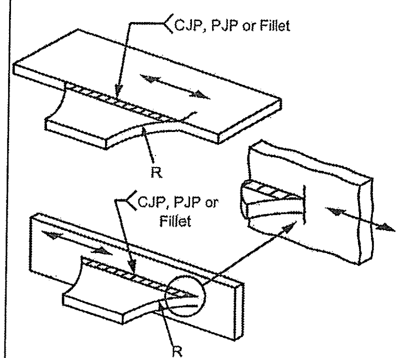
Description	Category	Constant A (ksi³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
5.4 Base metal and weld metal at details where loaded discontinuous plate elements are connected with a pair of fillet welds or partial joint penetration groove welds on opposite sides of the plate normal to the direction of primary stress.	C as adjusted in Eq. 6.6.1.2.5-4	44×10^8	10	Initiating from the geometrical discontinuity at the toe of the weld extending into the base metal or, initiating at the weld root subject to tension extending up and then out through the weld	
Section 6—Transversely Loaded Welded Attachments					
6.1 Base metal in a longitudinally loaded component at a transversely loaded detail (e.g. a lateral connection plate) attached by a weld parallel to the direction of primary stress and incorporating a transition radius R with the weld termination ground smooth.				Near point of tangency of the radius at the edge of the longitudinally loaded component	
R ≥ 24 in.	B	120×10^8	16		
24 in. > R ≥ 6 in.	C	44×10^8	10		
6 in. > R ≥ 2 in.	D	22×10^8	7		
2 in. > R	E	11×10^8	4.5		
(Note: Condition 6.2, 6.3 or 6.4, as applicable, shall also be checked.)					

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

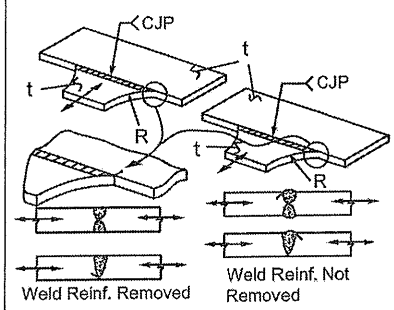
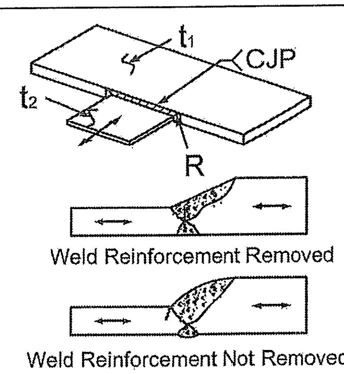
Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
6.2 Base metal in a transversely loaded detail (e.g. a lateral connection plate) attached to a longitudinally loaded component of equal thickness by a complete joint penetration groove weld parallel to the direction of primary stress and incorporating a transition radius R, with weld soundness established by NDT and with the weld termination ground smooth:					
With the weld reinforcement removed:					
$R \geq 24$ in.	B	120×10^8	16	Near points of tangency of the radius or in the weld or at the fusion boundary of the longitudinally loaded component or the transversely loaded attachment	
24 in. $> R \geq 6$ in.	C	44×10^8	10		
6 in. $> R \geq 2$ in.	D	22×10^8	7		
2 in. $> R$	E	11×10^8	4.5		
With the weld reinforcement not removed:				At the toe of the weld either along the edge of the longitudinally loaded component or the transversely loaded attachment	
$R \geq 24$ in.	C	44×10^8	10		
24 in. $> R \geq 6$ in.	C	44×10^8	10		
6 in. $> R \geq 2$ in.	D	22×10^8	7		
2 in. $> R$	E	11×10^8	4.5		
(Note: Condition 6.1 shall also be checked.)					
6.3 Base metal in a transversely loaded detail (e.g. a lateral connection plate) attached to a longitudinally loaded component of unequal thickness by a complete joint penetration groove weld parallel to the direction of primary stress and incorporating a weld transition radius R, with weld soundness established by NDT and with the weld termination ground smooth:				At the toe of the weld along the edge of the thinner plate In the weld termination of small radius weld transitions At the toe of the weld along the edge of the thinner plate	
With the weld reinforcement removed:					
R ≥ 2 in.	D	22×10^8	7		
$R < 2$ in.	E	11×10^8	4.5		
For any weld transition radius with the weld reinforcement not removed:	E	11×10^8	4.5		
(Note: Condition 6.1 shall also be checked.)					

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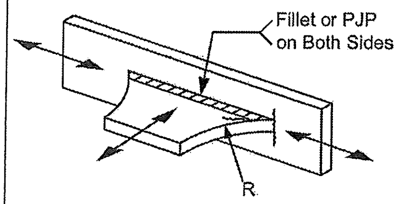
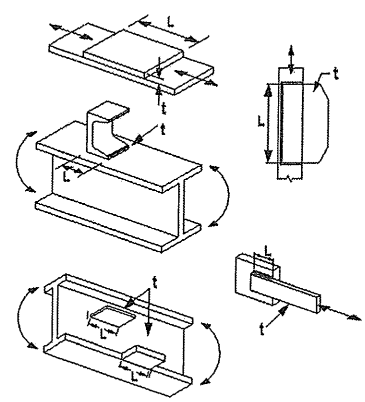
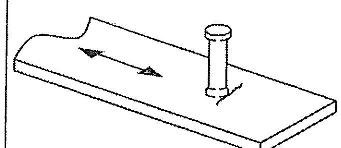
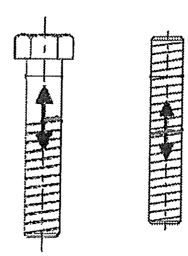
Table 6.6.1.2.3-1 (continued)—Detail Categories for Load-Induced Fatigue

Description	Category	Constant A (ksi^3)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
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	44×10^8	10		
2 in. $\leq L \leq 12t$ or 4 in	D	22×10^8	7		
$L > 12t$ or 4 in.					
$t < 1.0$ in.	E	11×10^8	4.5		
$t \geq 1.0$ in.	E′	3.9×10^8	2.6		
Section 8—Miscellaneous					
8.1 Base metal at stud-type shear connectors attached by fillet or automatic stud welding	C	44×10^8	10	At the toe of the weld in the base metal	
8.2 Nonpretensioned high-strength bolts, common bolts, threaded anchor rods and hanger rods with cut, ground or rolled threads. Use the stress range acting on the tensile stress area due to live load plus prying action when applicable.				At the root of the threads extending into the tensile stress area	
(Fatigue II) Finite Life	E′	3.9×10^8	N/A		
(Fatigue I) Infinite Life	D	N/A	7		

6.6.1.2.4—Detailing to Reduce Constraint

To the extent practical, welded structures shall be detailed to avoid conditions that create highly constrained joints and crack-like geometric discontinuities that are susceptible to constraint-induced fracture. Welds that are parallel to the primary stress but interrupted by intersecting members shall be detailed to allow a minimum gap of 1 in. between weld toes.

C6.6.1.2.4

The objective of this Article is to provide recommended detailing guidelines for common joints to avoid details susceptible to brittle fracture.

The form of brittle fracture being addressed has been termed "constraint-induced fracture" and can occur without any perceptible fatigue crack growth and, more importantly, without any warning. This type of failure was documented during the Hoan Bridge failure investigation by Wright, Kaufmann, and Fisher (2003) and Kaufmann, Connor, and Fisher (2004). Criteria have been developed to identify bridges and details susceptible to this failure mode as discussed in Mahmoud, Connor and Fisher (2005).

Intersecting welds should be avoided.

Attached elements parallel to the primary stress are sometimes interrupted when intersecting a full-depth transverse member. These elements are less susceptible to fracture and fatigue if the attachment parallel to the primary stress is continuous and the transverse attachment is discontinuous as shown in Figure C6.6.1.2.4-1. Also shown is the space between the weld of the transverse stiffener to the web and the weld of the longitudinal stiffener to the web required to reduce constraint.

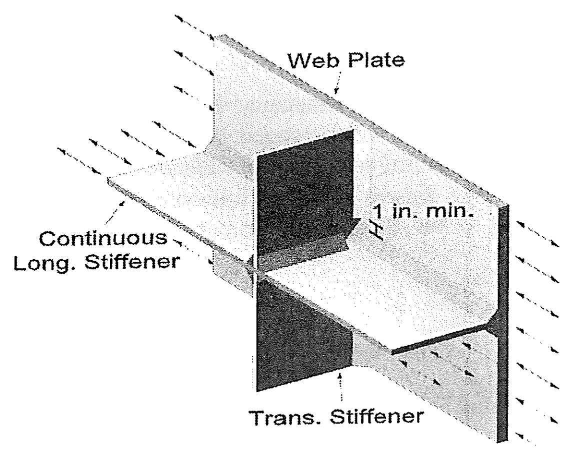


Figure C6.6.1.2.4-1—A Weld Detail where the Longitudinal Stiffener Is Continuous

6.6.1.2.5—Fatigue Resistance

Except as specified below, nominal fatigue resistance shall be taken as:

- For the Fatigue I load combination and infinite life:

$$(\Delta F)_n = (\Delta F)_{TH} \qquad (6.6.1.2.5\text{-}1)$$

- For the Fatigue II load combination and finite life:

C6.6.1.2.5

The requirement on higher-traffic-volume bridges that the maximum stress range experienced by a detail be less than the constant-amplitude fatigue threshold provides a theoretically infinite fatigue life. This requirement is reflected in Eq. 6.6.1.2.5-1.

The fatigue resistance above the constant amplitude fatigue threshold, in terms of cycles, is inversely proportional to the cube of the stress range, e.g., if the stress range is reduced by a factor of 2, the fatigue life increases by a factor of 2^3. This is reflected in Eq. 6.6.1.2.5-2.

$$(\Delta F)_n = \left(\frac{A}{N}\right)^{\frac{1}{3}} \qquad (6.6.1.2.5\text{-}2)$$

in which:

$$N = (365)(75)n(ADTT)_{SL} \qquad (6.6.1.2.5\text{-}3)$$

where:

A = constant taken from Table 6.6.1.2.5-1 (ksi^3)

n = number of stress range cycles per truck passage taken from Table 6.6.1.2.5-2

$(ADTT)_{SL}$ = single-lane *ADTT* as specified in Article 3.6.1.4

$(\Delta F)_{TH}$ = constant-amplitude fatigue threshold taken from Table 6.6.1.2.5-3 (ksi)

In the AASHTO 2002 Standard Specifications, the constant amplitude fatigue threshold is termed the allowable fatigue stress range for more than 2 million cycles on a redundant load path structure.

The fatigue design life has been considered to be 75 years in the overall development of the Specifications. If a fatigue design life other than 75 years is sought, a number other than 75 may be inserted in the equation for *N*.

Figure C6.6.1.2.5-1 is a graphical representation of the nominal fatigue resistance for Categories A through E′.

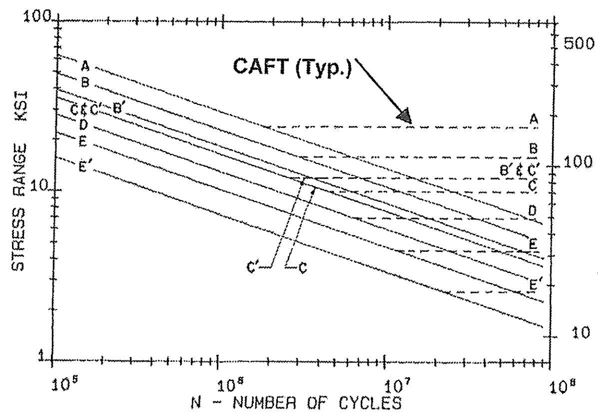


Figure C6.6.1.2.5-1—Stress Range Versus Number of Cycles

The nominal fatigue resistance for base metal and weld metal at details where loaded discontinuous plate elements are connected with a pair of fillet welds or partial joint penetration groove welds on opposite sides of the plate normal to the direction of primary stress shall be taken as:

$$(\Delta F)_n = (\Delta F)_n^c \left(\frac{0.65 - 0.59\left(\frac{2a}{t_p}\right) + 0.72\left(\frac{w}{t_p}\right)}{t_p^{0.167}} \right) \leq (\Delta F)_n^c \qquad (6.6.1.2.5\text{-}4)$$

where:

$(\Delta F)_n^c$ = nominal fatigue resistance for Detail Category C (ksi)

$2a$ = length of the non-welded root face in the direction of the thickness of the loaded plate (in.) For fillet welded connections, the quantity ($2a/t_p$) shall be taken equal to 1.0.

t_p = thickness of loaded plate (in.)

Eq. 6.6.1.2.5-4 accounts for the potential of a crack initiating from the weld root and includes the effects of weld penetration. Therefore, Eq. 6.6.1.2.5-4 is also applicable to partial joint penetration groove welds, as shown in Figure C6.6.1.2.5-2.

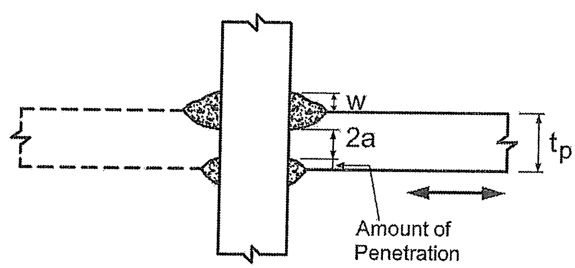


Figure C6.6.1.2.5-2—Loaded Discontinuous Plate Element Connected by a Pair of Partial Joint Penetration Groove Welds

The effect of any weld penetration may be conservatively ignored in the calculation of $(\Delta F)_n$ from Eq. 6.6.1.2.5-4 by taking the quantity ($2a/t_p$) equal to 1.0. The nominal fatigue resistance based on the crack initiating from the weld root in Eq. 6.6.1.2.5-4 is limited to the nominal fatigue resistance for Detail Category C, which assumes crack initiation from the weld toe. The development of Eq. 6.6.1.2.5-4 is discussed in Frank and Fisher (1979).