



Steel Structures

Ronald O. Hamburger, SE
Simpson Gumpertz & Heger

January 16-17, 2014 - University of California, Los Angeles



AISC 358 – Prequalified Moment Connections for Seismic Applications

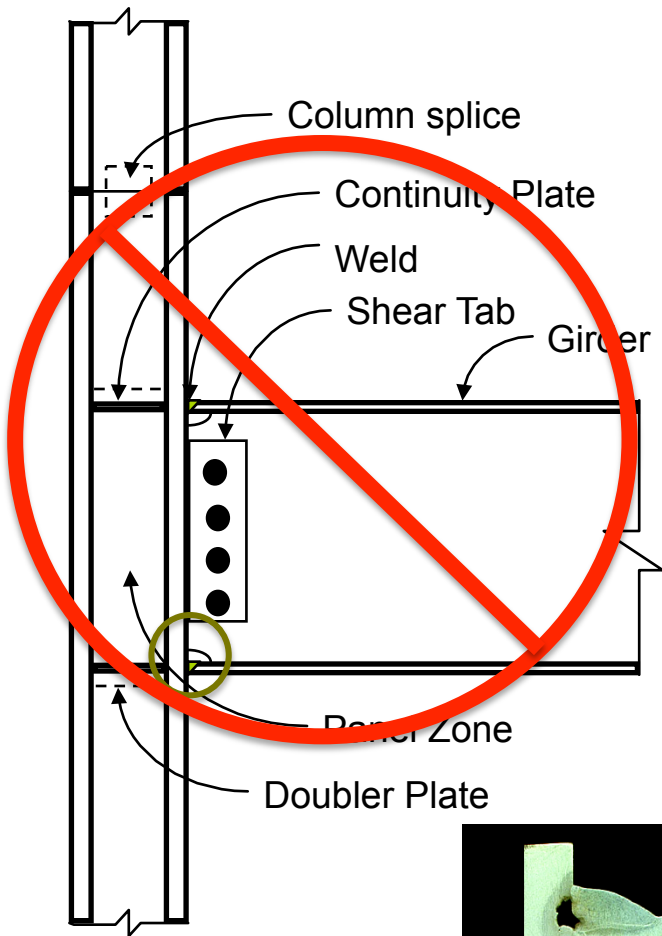
Ronald O. Hamburger, SE
Senior Principal
Simpson Gumpertz & Heger

January 16-17, 2014 - University of California, Los Angeles

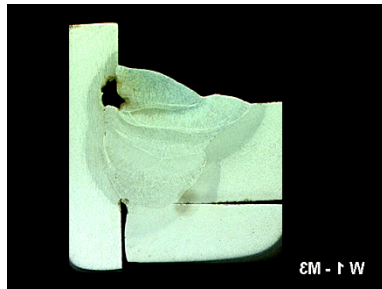
The genesis



Causes

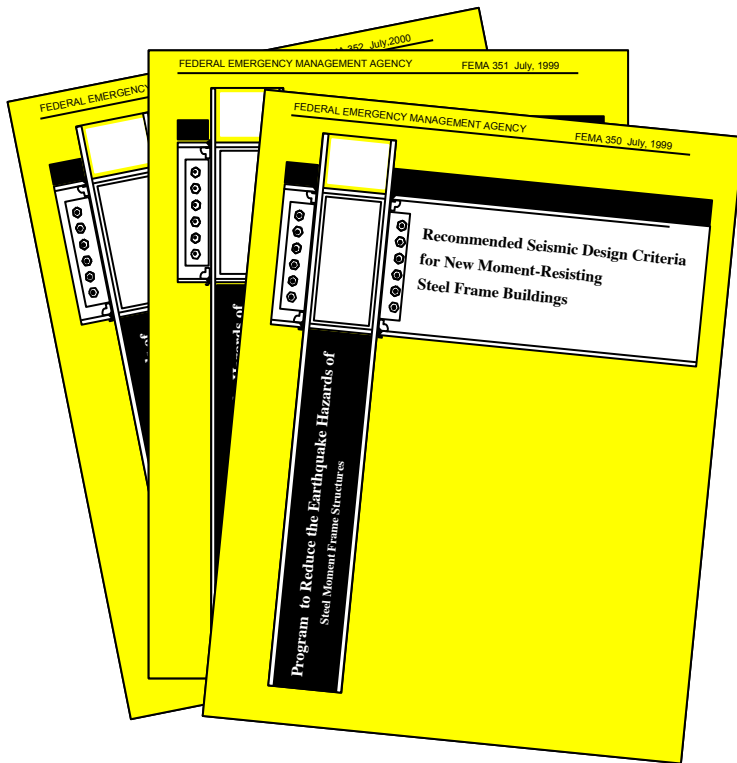


- Connection geometry
 - Stress concentrations
 - Secondary stress (shear carried by flanges)
 - Tri-axial effects
- Materials issues
 - A36 wasn't
- Welding issues
 - Low toughness materials
 - Lack of control on technique
 - Unreliable inspection procedures



SAC Steel Project

FEMA 350 – FEMA 353



- AISC 341 Seismic Provisions for Steel Buildings
- AISC 358 Prequalified Connections for Special and Intermediate Steel Moment Frames
- AWS D1.8 Seismic Supplement to Structural Welding Code

AISC 341 – Conformance demonstration

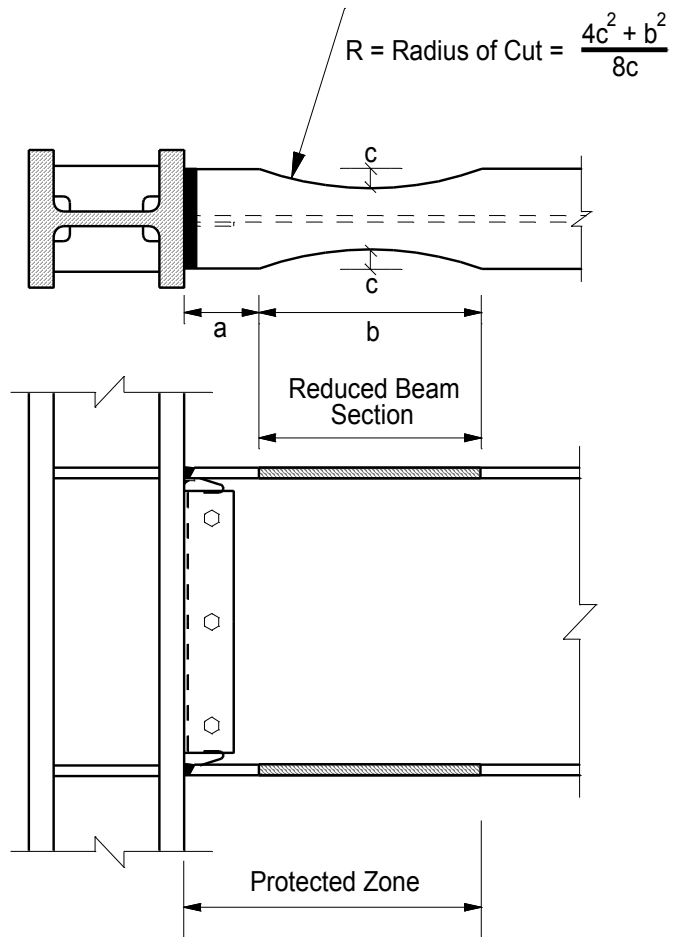
- Connection designed in accordance with AISC 358
- Use of connection qualified in accordance with Section K

Prequalified Connections

**TABLE 2.1.
Prequalified Moment Connections**

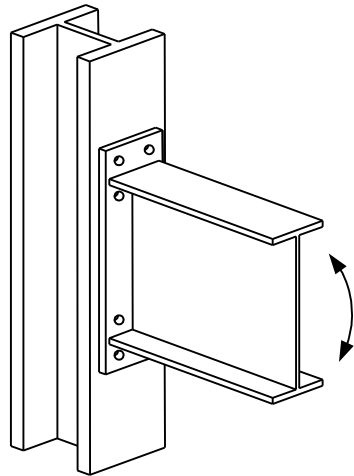
Connection Type	Chapter	Systems
Reduced beam section (RBS)	5	SMF, IMF
Bolted unstiffened extended end plate (BUEEP)	6	SMF, IMF
Bolted stiffened extended end plate (BSEEP)	6	SMF, IMF
Bolted flange plate (BFP)	7	SMF, IMF
Welded unreinforced flange-welded web (WUF-W)	8	SMF, IMF
Kaiser bolted bracket (KBB)	9	SMF, IMF
ConXtech ConXL moment connection (ConXL)	10	SMF, IMF
Sideplate	11	SMF, IMF
Simpson Strong Frame	12	SMF, IMF

Reduced beam section (RBS)

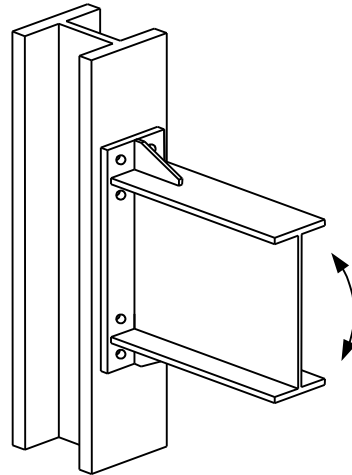


- W36 or shallower
- <300 #/ft
- $t_f < 1\text{-}3/4''$
- Clear span to depth ratio
 - SMF – 7
 - IMF – 5
- Beam b_f/t_f per AISC 341, b_f determined at center 2/3 of RBS section
- Bracing required unless structural slab provided

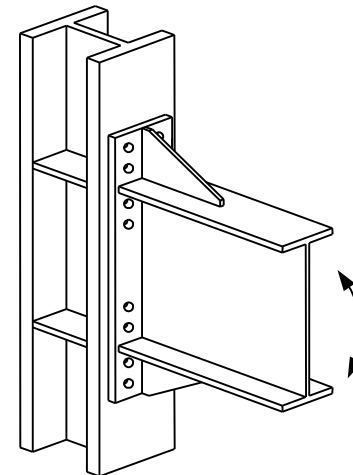
Stiffened and Unstiffened Extended End Plate Connections



4 Bolt Unstiffened
(4E)



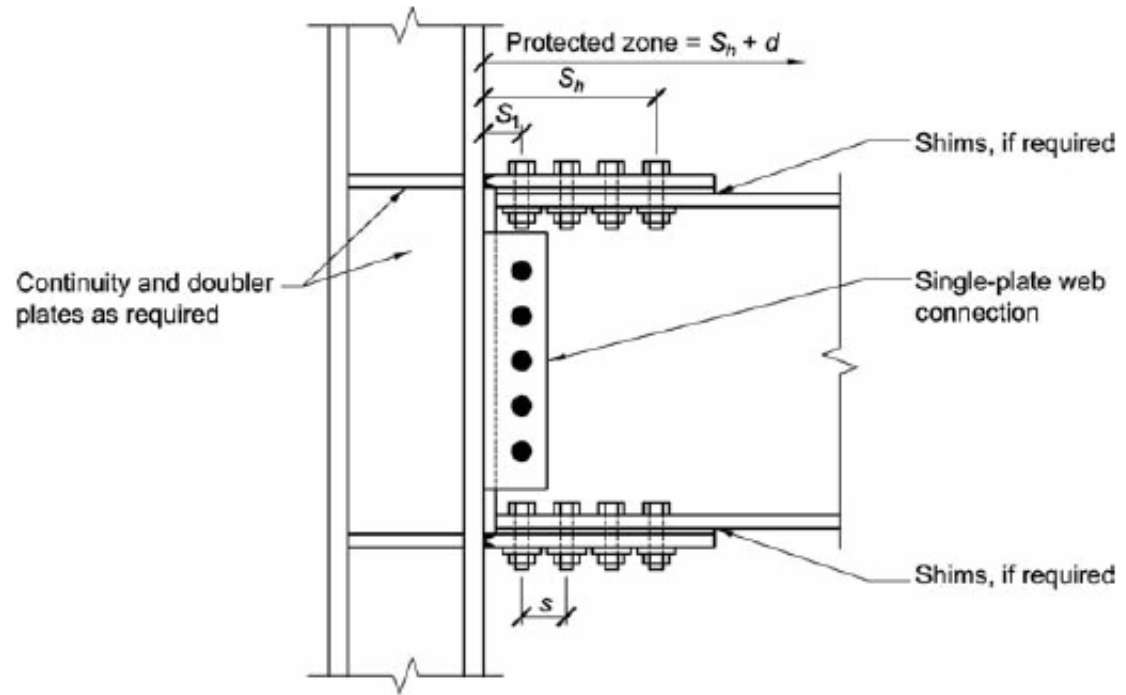
4 Bolt Stiffened
(4ES)



8 Bolt Stiffened
(8ES)

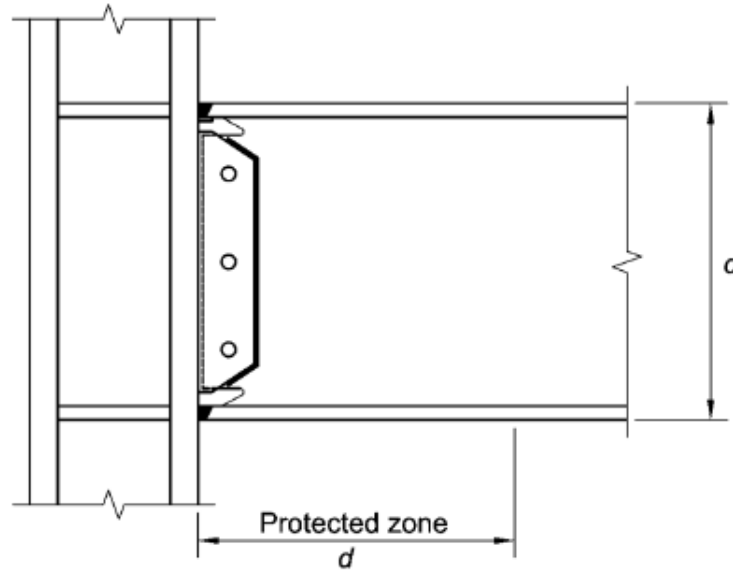
- Beams flanges up to 12-1/4" x 1"
- Beam depths – 14" to 55"

Bolted Flange Plate (BFP)



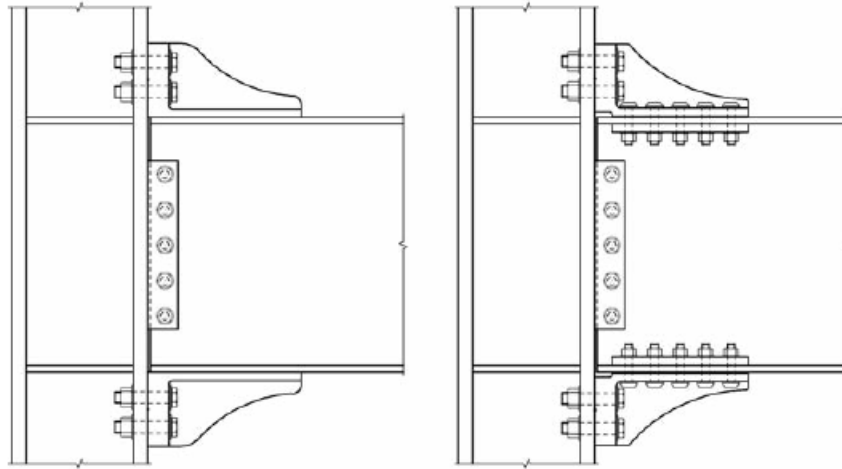
- Beams $< W136 \times 150$
- $t_f \leq 1"$
- Span to depth ratio < 9 for SMF, 7 IMF

Welded Unreinforced Flange (WUF-W)



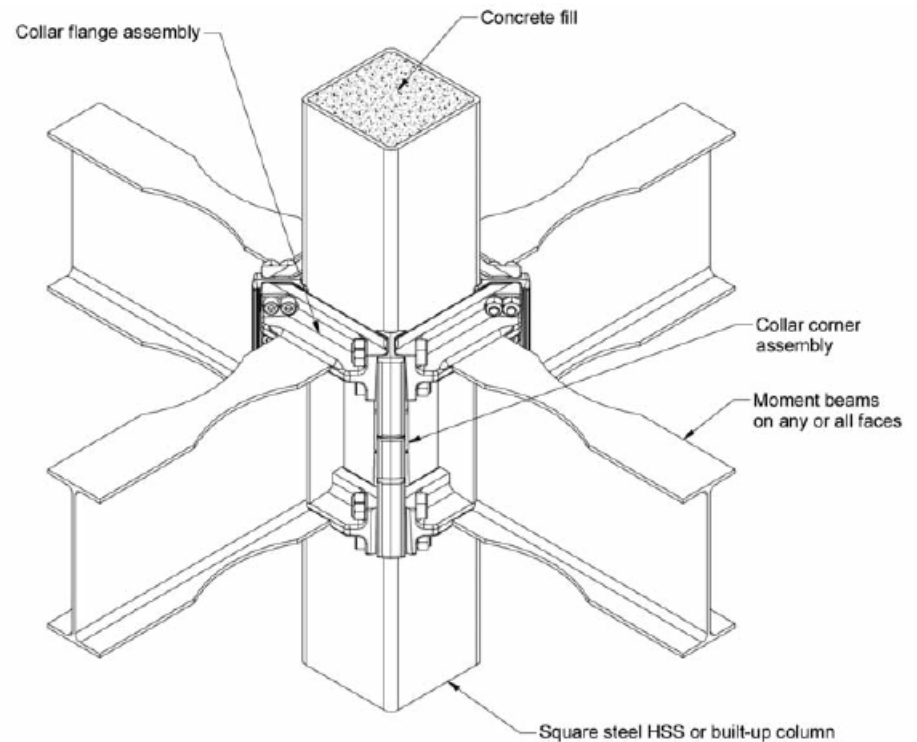
- Beams $< W136 \times 150$
- $t_f \leq 1''$
- Span to depth ratio < 7 for SMF, 5 IMF

Kaiser Bolted Bracket™ (KBB)



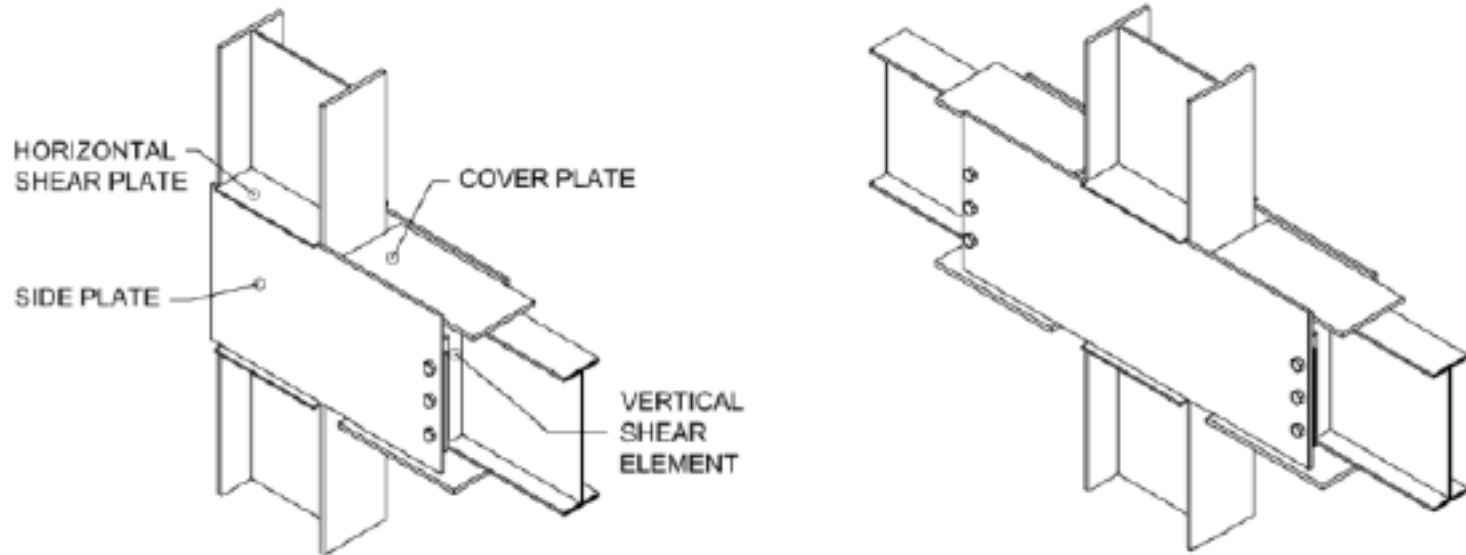
- Beams < W33 x 130
- $t_f \leq 1''$
- $b_f > 6''$
- Span to depth ratio < 9 for SMF, IMF

ConXL™



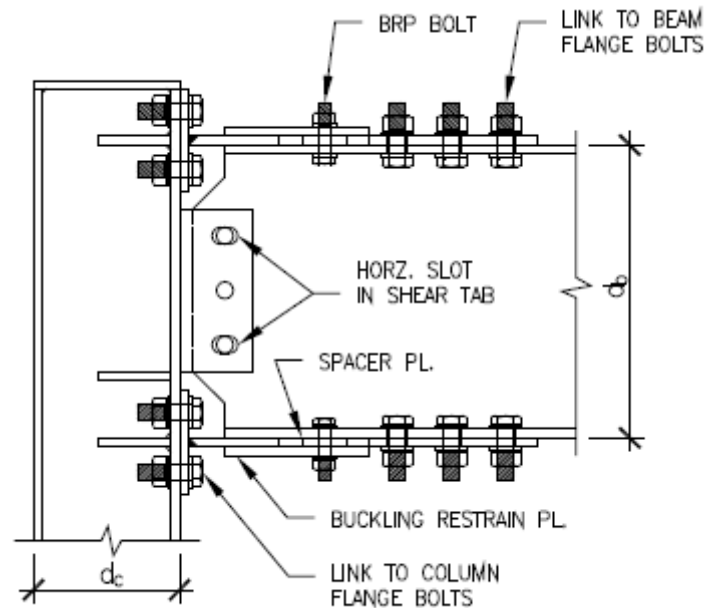
- Columns – HSS 16 or Box 16 x 16
- Beam flanges 12"x1" or smaller
- Beams W15 – W30
- Intended for use in biaxial applications

Sideplate™



- Beams W44x400 or less
- Biaxial applications permitted
- Span to depth ratio < 6 (4.5) for SMF, 3 IMF

Simpson StrongFrame™

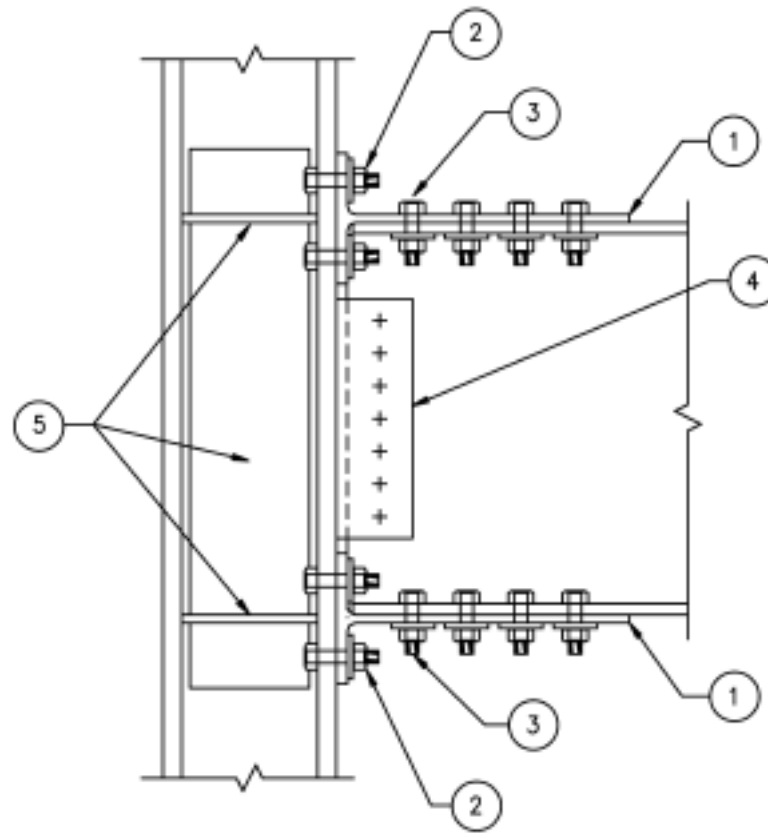


Approval
Pending

- Beams W16 or smaller
- Columns W18 or smaller
- Special compactness and bracing not required

Double Tee

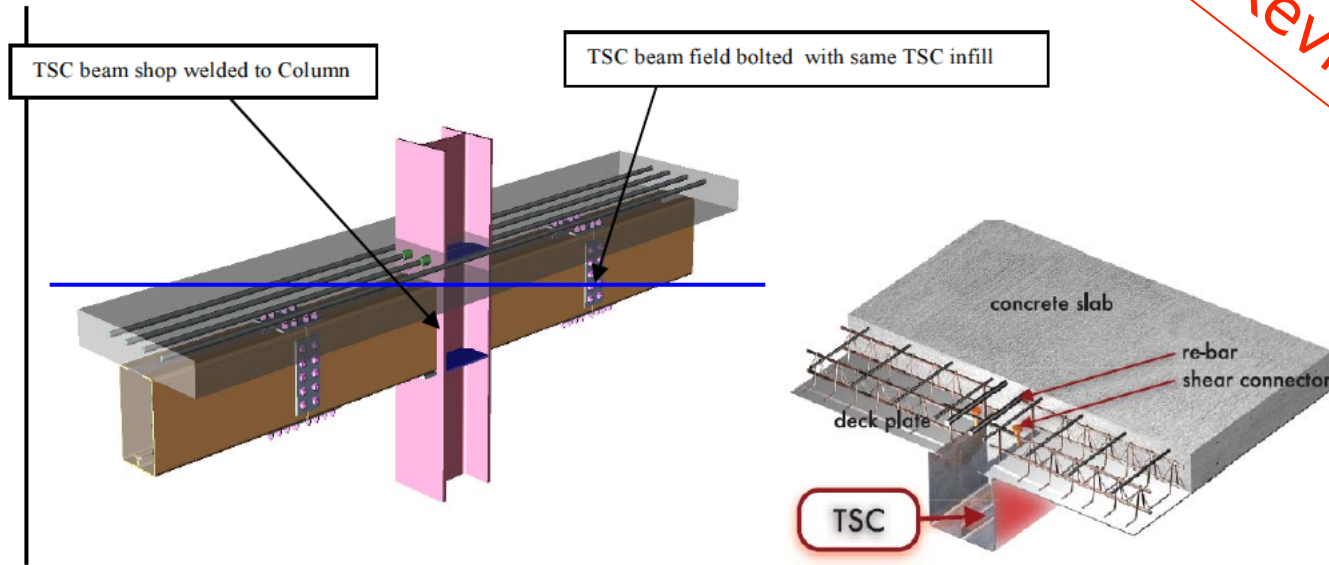
Approval
Pending



- Beams \leq W24
- Weight limited by bolts

SENSE™

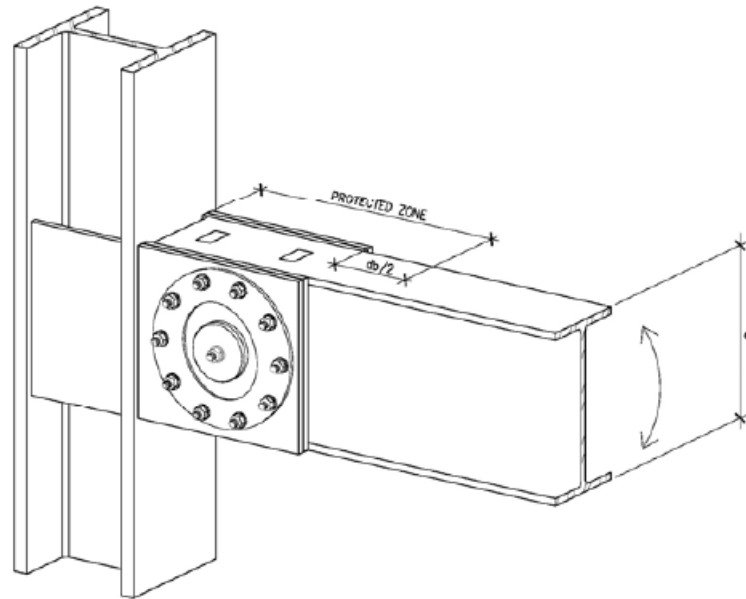
Under Review



- Composite- Cold-formed/concrete beam

Pin Fuse™

Under
Review

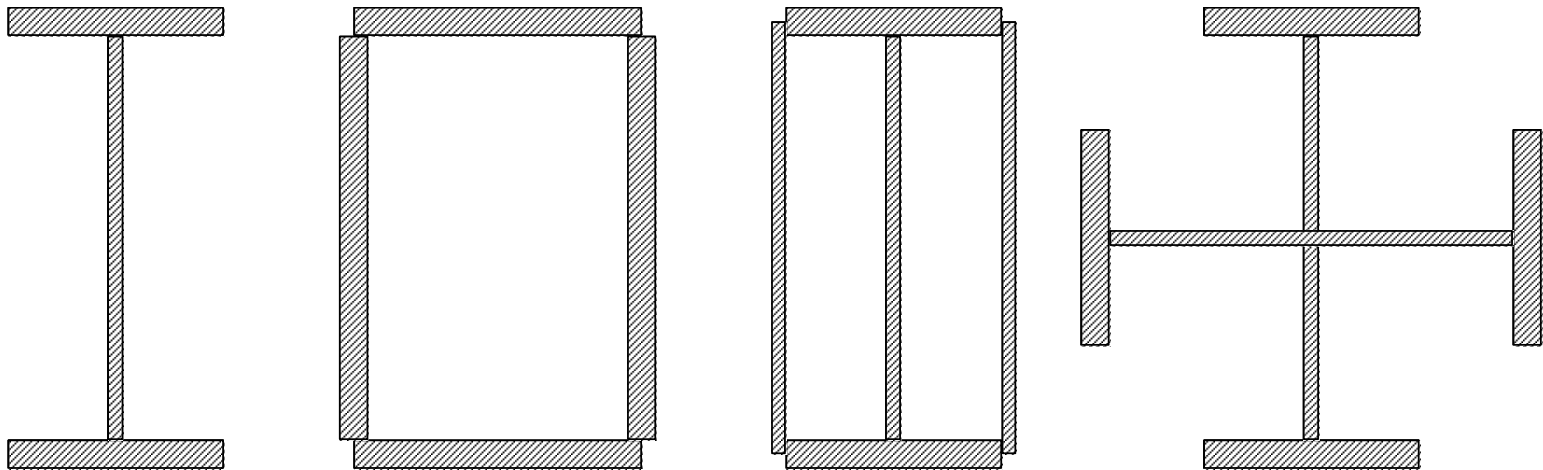


- No limitations on columns or beams
- Damage-resistant

Permissible member profiles

- Columns

- Wide flange, Built-up "H" Shape, Boxed Wide Flange, Built-up Box, Cruciform W Section

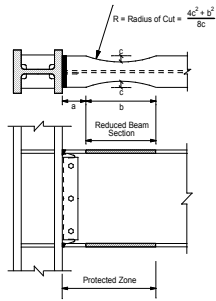


HSS permitted for Sideplate and ConX

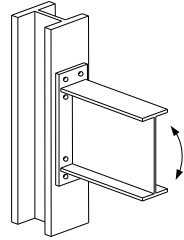
Summary

- AISC 358 presently has 8 prequalified connections that can be used to satisfy the requirements of connection design in AISC 341.
- CPRP is currently working to extend the standard
 - 2 connections “approval pending”
 - 2 connections “under review”
- Wide range of column profiles and shapes
- Biaxial connections possible

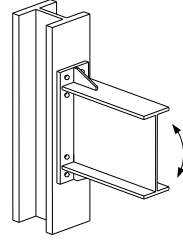
The Connections



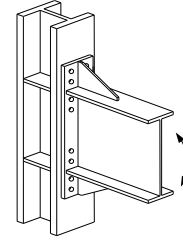
RBS



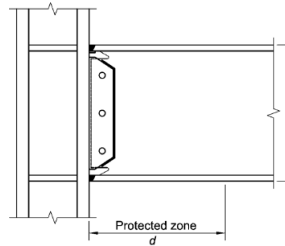
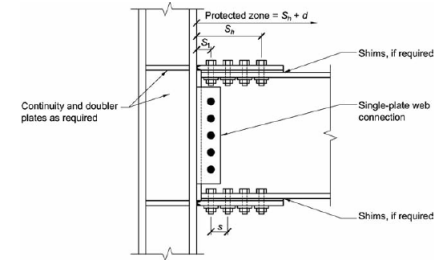
BUEEP



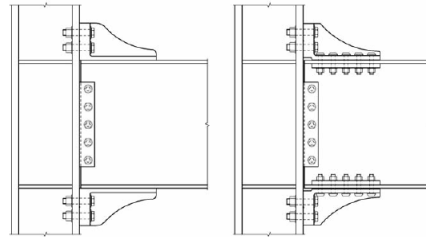
BSEEP



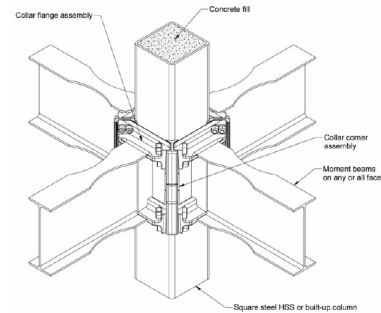
BFP



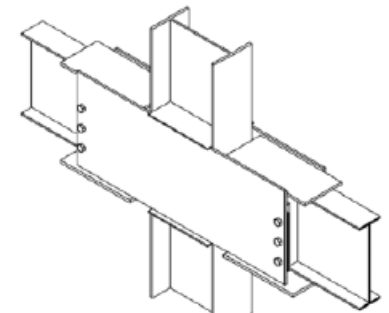
WUF-W



KBB



ConXL



SidePlate