City of Portland
Reviewed for
Code Compliance
Date:5/29/2025
Permit #: 25-006099-DFS-01-FA

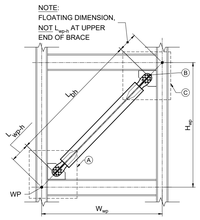
PROJECT:

REED COLLEGE

CUP Renovation & Seismic Upgrade

PORTLAND, OR.

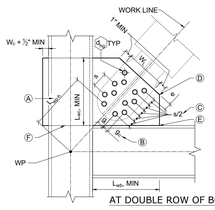
NOTE:
FLOATING DIMENSION, NOT L_{sh}, AT UPPER END OF BRACE



OVERALL PROCEDURE:
◯ CIRCLED NOTES ARE KEYED ON DETAIL.
Ⓐ LAYOUT BOTTOM BRACE CONNECTION ON GUSSET. (SEE DETAIL 2/-)
Ⓑ ESTABLISH UPPER-MOST BOLT-HOLE, LOCATED AT DISTANCE L_{sp} FROM LOWER-MOST BOLT-HOLE.
Ⓒ LAYOUT UPPER BOLT-HOLE PATTERN SIMILAR TO LOWER BOLT-HOLE PATTERN. (SEE DETAIL 2/-)
D SEE DETAIL 4/- WHERE CONCRETE BLOCKOUT WILL BE REQUIRED.

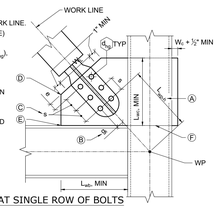
NOTE:
FOR MINIMUM BOLT TENSIONING PROCEDURE SEE DETAIL 3/-.

BOLTED GUSSET OVERALL LAYOUT PROCEDURE 1
SCALE: NTS



AT DOUBLE ROW OF BOLTS

GUSSET LAYOUT PROCEDURE:
Ⓐ ESTABLISH LOCATION OF 1st BOLT LINE ALONG WORK LINE.
Ⓑ ESTABLISH INNER AND OUTER (WHERE APPLICABLE) BOLT ROW OFFSETS WITH g AND g_o.
Ⓒ LAY OUT BOLT HOLE PATTERN USING HOLE SIZE (d_h), SPACING (s), AND EDGE DISTANCE (e) AS SHOWN.
Ⓓ W_u + 2 x MIN RETURN, GUSSET EDGE WIDTH PERPENDICULAR TO WORK LINE.
Ⓔ RETURN TO BEAM AND/OR COLUMN AND VERIFY MIN WELD LENGTH (INCLUDING DEDUCTIONS FOR CLIP AND WELD START/STOP) IS MAINTAINED.
Ⓕ SLOT GUSSET THROUGH COLUMN. INDICATED WELD SIZE REQUIRED ON BOTH SIDES OF COLUMN AND BOTH SIDES OF GUSSET (4 TOTAL WELDS)



AT SINGLE ROW OF BOLTS

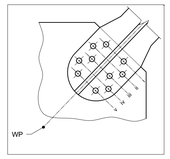
BOLTED HSS GUSSET LAYOUT PROCEDURE 2
SCALE: NTS

BOLT TENSIONING PROCEDURE
Bolts shall be torqued to achieve the appropriate bolt tension as set forth in the erector's approved procedures. As a minimum, the following items shall be adhered to:

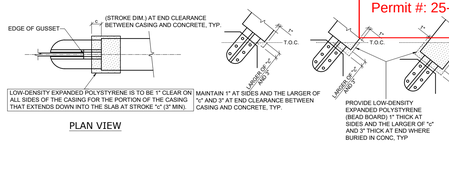
A. Starting with the most rigid part of the connection (Row '1') and continuing to the least rigid part of the connection (Row 'x'), bring all bolts to snug-tight condition.
B. Recheck snug-tight condition of bolts in rows '1' and 'ii', re-tighten as necessary.
C. Torque bolts in Row '1' to appropriate level of tension using approved procedure.
D. Re-check snug tight condition of bolt in row 'iii'.
E. Torque bolts in Row 'ii' to appropriate level using approved procedure.
F. Continue alternating check of snug tight condition of next-to-nearest row and torquing nearest row of untorqed bolts as set forth in steps D & E until end of brace is reached and all bolts are at appropriate level of torque.
G. Repeat similar procedure at top end of brace.

GENERAL NOTES:
ALL BOLTED BRACE CONNECTIONS SHALL BE INSTALLED IN ACCORDANCE WITH THE ERECTOR'S APPROVED QUALITY ASSURANCE PLAN. AS A MINIMUM, THE FOLLOWING MUST BE MET:

- Tighten all slip-critical bolts and bolts installed in oversized holes by a method approved by the engineer of record. Provide hardened washers under all turned elements.
- Where ASTM F3125 Gr A490-SC/F2280-TC or stronger bolts are specified in the drawings, provide hardened washer between nut & gusset. Where required by AISC Specifications, provide washer between bolt head & gusset.
- Bolts must be long enough for the threads to be flush with the outside face of the nut after tightening. Thread stickout shall not exceed that allowed by structural drawings.
- Do not reuse bolts, nuts, or washers.
- TC bolts must be in the as-delivered, clean and lubricated condition when torqued, per RCSC requirements. If left installed on the brace but in an untorqued and exposed condition for any period of time, a pre-installation verification must be performed or the bolts must be replaced.



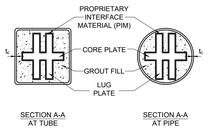
MINIMUM BOLT TENSIONING PROCEDURE 3
SCALE: NTS

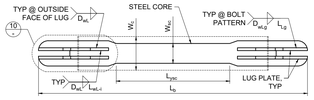


PLAN VIEW

INDICATED CLEARANCES REPRESENT BLOCKOUT CONDITIONS REQUIRED FOR FINAL INSTALLED STATE OF BRB. LARGER BLOCKOUTS MAY BE REQUIRED FOR INSTALLATION. LOW-DENSITY EXPANDED POLYSTYRENE PROVIDED BY OTHERS.

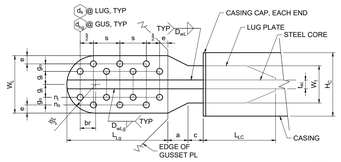
BRB CASING BURIED IN CONCRETE - TYPICAL DETAIL 4
SCALE: NTS





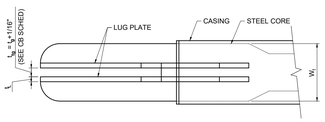
PLAN VIEW

TYPICAL CORE PLATE DETAIL 6
SCALE: NTS



ELEVATION VIEW
DOUBLE BOLT ROW

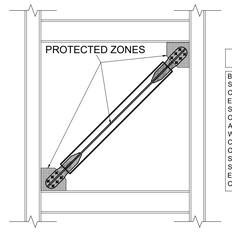
TYPICAL END CONNECTION DETAIL 8
SCALE: NTS



NOTE: BOLT HOLES IN CONNECTION LUGS ARE STANDARD HOLES.

PLAN VIEW

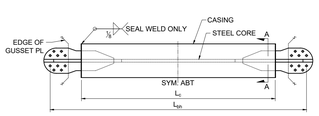
TYPICAL END CONNECTION DETAIL 10
SCALE: NTS
WELD PLACEMENT AWAY FROM k-AREAS



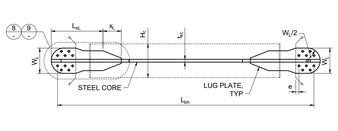
SHADED REGIONS INDICATE PROTECTED ZONES

BRB PROTECTED ZONES SHALL INCLUDE THE STEEL CORE AND CONNECTION ELEMENTS AND SHALL SATISFY THE REQUIREMENTS OF SECTION F4.5c OF AISC 341. ADDITIONALLY, ATTACHMENTS WHICH PENETRATE THE CASING (SCREWS, PAF, ETC) OR ANY ATTACHMENT SUPPORTING OVER 50 LBS SHALL BE APPROVED BY THE ENGINEER OF RECORD AND COREBRACE.

PROTECTED ZONES - AISC 341 13
SCALE: NTS

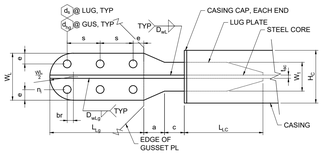


TYPICAL CORE AND CASING CONFIGURATION 5
SCALE: NTS



ELEVATION VIEW

TYPICAL CORE PLATE DETAIL 7
SCALE: NTS



ELEVATION VIEW
SINGLE BOLT ROW

TYPICAL END CONNECTION DETAIL 9
SCALE: NTS

NOTE: BOLT HOLES IN CONNECTION LUGS ARE STANDARD HOLES.

NOT USED 11
SCALE: NTS

NOT USED 12
SCALE: NTS

GENERAL NOTES:
G1. SEE PROJECT DRAWINGS FOR ADDITIONAL INFORMATION
G2. DIMENSIONS AND WP LOCATIONS FROM PROJECT DRAWINGS GOVERN. CONTACT COREBRACE PRIOR TO DETAILING IF ANY DISCREPANCIES ARE NOTED.
G3. CORE PL A36 SPECIAL (FY RANGE PROVIDED ON COREBRACE SCHEDULE)
G4. CASING A500 GR B FOR HSS AND A53 GR B FOR PIPE
G5. BRB LUG PLATE (TRANSVERSE STIFFENER) A572 GR 50
G6. GUSSET PL, GUSSET STIFFENER AND REPAD PL A572 GR 50 U.N.0.
G7. ALL STIFFENERS AND DOUBLER PL TO MATCH BEAM AND COLUMN GRADE.
G8. USE ASTM F3125 GR A490-SC/F2280-TC OR ASTM F3148 TNA BOLTS. BOLT HOLES IN GUSSET ARE OVERSIZED. BOLT HOLES IN BRB ARE STANDARD. ***(BOLTS AND WASHERS ARE NOT PROVIDED BY COREBRACE)***
G9. CLASS A (TOOL CLEAN) ALL FAYING SURFACES.
G10. GALVANIZED FAYING SURFACES TO BE HAND WIRE BRUSHED PRIOR TO ERECTION OF BRB.
G11. THE GAP BETWEEN THE BOLTED CONNECTION PLATES AT THE END OF THE BRB SHALL NOT BE INCREASED EXCEPT IN INSTANCES WHERE SPECIFIC APPROVAL AND METHODOLOGY HAVE BEEN PROVIDED BY COREBRACE.

CONNECTION NOTES:
◯ CIRCLED NOTES ARE KEYED ON CONNECTION DETAILS.

1. SEE STRUCTURAL DRAWINGS FOR BM-TO-COL & COL-TO-B.P. CONNECTION, TYP.
2. SEE CONNECTION SCHEDULE FOR CONNECTION DIMENSIONS.
3. SEE COREBRACE SCHEDULE FOR BRB GEOMETRY DIMENSIONS.
4. MAIN STIFF PL EA SIDE AS REQ'D BY STRUCTURAL DRAWINGS OR AS INDICATED ON CONNECTION SCHEDULE. SEE DETAIL 11.
5. FIELD INSTALL STIFF PL AS NECESSARY FOR INSTALLATION OF BRACE.
6. WELD BOTH SIDES. WHERE AVAILABLE WELD LENGTH IS LONGER THAN REQ'D WELD LENGTH, PROVIDE WELD ALONG ENTIRE LENGTH TO WITHIN ¾" OF EDGE OF PL.
7. TOP AND BOTTOM FLANGE LATERAL BRACING AS REQUIRED BY STRUCTURAL DRAWINGS.
8. THROUGH 14 NOT USED
15. SLOT GUSSET THROUGH COLUMN. INDICATED WELD SIZE REQUIRED ON BOTH SIDES OF COLUMN AND BOTH SIDES OF GUSSET (4 TOTAL WELDS).

Abbreviations

Abt	About	DIA	Diameter	NTS	Not to Scale
Approx	Approximate	DIM	Dimension	PL	Plate
Asc	Area of Steel Core	dc	Depth of column	Req'd	Required
bfb	Width of flange of beam	(E)	Existing	Sched	Schedule
bfc	Width of flange of column	EQ	Equal	SIM	Similar
Bldg	Building	FF	Finished Floor	SYM	Symmetrical
Bm	Beam	FHG	Full-Height Gusset	Stiff	Stiffener
Bot	Bottom	Flng	Flange	tfb	Thickness of flange of beam
B.P.	Base Plate	Galv	Galvanized	tfc	Thickness of flange of column
BRB	Buckling-Restrained Brace	Gsst	Gusset	T&B	Top and Bottom
CB	CoreBrace	Info	Information	T.O.F.	Top of Footing
CJP	Complete Joint Penetration	LVL	Level	T.O.C	Top of Concrete
C_L	Centerline	MAX	Maximum	twb	Thickness of web of beam
Col	Column	MIN	Minimum	TYP	Typical
Conc	Concrete	N&FS	Near and Far Side	UNO	Unless Noted Otherwise
Conn	Connection	Nom	Nominal	WP	WORK POINT

REFERENCED CODES:
- AISC 360, 341, 358.
- AWS D1.8

BRB ENGINEERING DESIGN RESPONSIBILITY IS LIMITED TO THE FOLLOWING:
- COMPLETE BRB DESIGN BASED ON Asc PROVIDED IN STRUCTURAL DRAWINGS.
- DESIGN GUSSET PLATE AND CONNECTION OF BRB TO GUSSET PLATE.
- DESIGN CONNECTION OF GUSSET TO FRAME COLUMNS & BEAMS/BASE PLATES.

CoreBrace™
SUPERIOR SEISMIC PERFORMANCE
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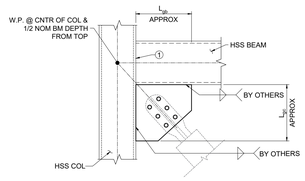
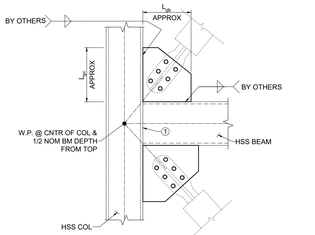
West Jordan, Utah 84081
(801) 280-0701



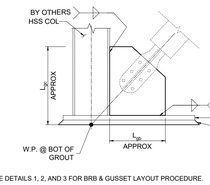
A SEE DETAILS 1, 2, AND 3 FOR BRB & GUSSET LAYOUT PROCEDURE.

TYPICAL CONNECTION AT BRACE TOP 14
SHOWN AT HSS COLUMN
SCALE: NTS



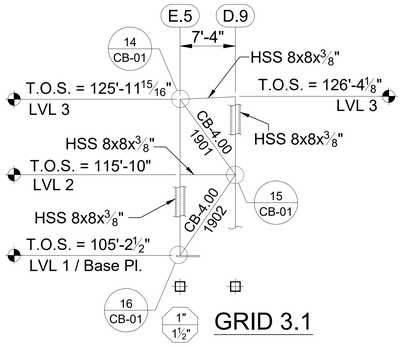
A SEE DETAILS 1, 2, AND 3 FOR BRB & GUSSET LAYOUT PROCEDURE.

TYPICAL CONNECTION AT BRACE TOP & BOTTOM 15
SHOWN AT HSS COLUMN
SCALE: NTS



A SEE DETAILS 1, 2, AND 3 FOR BRB & GUSSET LAYOUT PROCEDURE.

TYPICAL CONNECTION AT BASEPLATE 16
SHOWN AT HSS COLUMN
WP AT BOT OF GROUT
SCALE: NTS



BRB ELEVATIONS 17
SCALE: NTS

CB-ID #	EOR-ID #	Line	Grids #	Lvls #	Mark #	Qty #	L_o in	Casing L_c in	Casing Shape 1 or p	Casing Profile	H_c in	W_c in	t_c in	W_L in	W_1 in	L_{sL} in	x_L in	L_{LG} in	a in	c in	L_{LC} in	t_L in	$D_{wl,g}$ #	$D_{wl,L}$ #	$L_{wl,c}$ in	n_i #	n_o #	g in	s in	e in	b_r in	L_{ysc} in	L^*_{ysc} in	W_{sc} in	t_{sc} in	A_{sc} in²	K_{eff} K/in	K_f (K$_{eff}$/K$_{wp}$)	P_{ysc} kip	F_{ysc} Min ksi	F_{ysc} Max ksi	CB Wt lb
CB-4.00	BRB-4.00	3+	E.5-D.9	2	1901	1	127 8/16	88.25	t	□	8	8	0.2500	7.50	4.98	25.38	3.73	12.38	4.00	3.00	9.73	0.63	4.00	4.00	12.73	3	0	0.00	4.00	1.63	0.99	69.29	69.29	4.000	1.00	4.00	1271	1.65	156	39	46	865
CB-4.00	BRB-4.00	3+	E.5-D.9	1	1902	1	129 8/16	90.25	t	□	8	8	0.2500	7.50	4.90	25.38	3.63	12.38	4.00	3.00	9.63	0.63	4.00	4.00	12.63	3	0	0.00	4.00	1.63	0.99	71.49	71.49	4.000	1.00	4.00	1236	1.64	156	39	46	879
						2																																			

Sum --> 1,744 lbs
Max --> 0,879 lbs

Table of Symbols
- L_o = Length of CB tip to tip
- L_c = Length of casing
- Casing = Size & type of casing
- Type = t = tube (square/rect) and p = pipe (round)
- W_L = Width of Lug
- W_1 = Width at Reduced Section of Lug
- L_{sL} = Total Length of Lug minus Transition (xL)
- x_L = Length from start of lug transition to end of lug transition
- L_{LG} = Length of Lap on Gusset
- a = Gap between core and gusset
- c = Core extension length out of casing
- $L_{wl,c}$ = Length of Lug within Casing (incl. xL)
- t_L = Thickness of lug
- $D_{wl,g}$ = Size of weld at lug to core at bolt pattern # 1/16ths
- $D_{wl,L}$ = Size of weld at lug to core beyond bolt pattern # 1/16ths
- $L_{wl,c}$ = Weld length required at inside face of lug
- n_i = Number of bolts in inner row
- n_o = Number of bolts in outer row
- g = Gauge between outer & inner bolt rows
- s = Bolt Spacing
- e = Typical bolt edge distance
- b_r = Distance to start of radius from first outermost bolt. (If negative it is towards end of CB from bolt.)
- L_{ysc} = Length of yielding core wout allowance for Cntr Stiffener
- L^*_{ysc} = Yield length of core - Yielding Portion Only
- W_{sc} = Width of core at yield section
- t_{sc} = Thickness of core
- A_{sc} = Cross sectional area of core at yield section
- K_{eff} = Effective Stiffness of BRB from WP to WP
- K_f = Axial Stiffness Adjustment Factor
- P_{ysc} = Yield force of CB ($A_{sc} \times F_{ysc_min}$)
- F_{ysc} = Specified yield stress range of core plate

6903 - Reed College Central Plant Upgrade

COREBRACE BRB SCHEDULE 18
SCALE: NTS

CB-ID #	EOR-ID #	Line	Grids #	Lvls #	Mark #	Qty #	W_{wp} in	H_{wp} in	t_{sh} in	$L_{wp,h}$ in	Hole Pattern Information n_i #	n_o #	e in	s in	g_i in	g_o in	d_{hg} in	Gusset t_g in	$F_{y,g}$ ksi	Lug W_L in	t_L in	t_s in	L_{LG} in	$W_{L,Alt}$ in	Bolt Size, Length & Quantities d_b in	G in	L* in	La in	2.00" Qty	4.00" Qty	4.25" Qty	BOTTOM OF BRACE CONNECTION Bm/Col Flange Bot W_b in	L_{wb} in	BOTTOM OF BRACE CONNECTION Bm/Col Flange Top W_t in	L_{wt} in	L_{wc} in	L_{gb} in	TOP OF BRACE CONNECTION W_b in	L_{wb} in	W_t in	L_{wt} in	Ext ?	L_{gt} in	CB Wt lb	Total CB Wt lb
CB-4.00	BRB-4.00	3+	E.5-D.9	2	1901	1	88	121 15/16	122	14 4/16	3	0	1 10/16	4.00	2 2/16	0	1 7/16	1	50	7 1/2	5/8	1	12 6/16	5/8	1 1/8	2.31	3.990	4	-	12	-	By Others				14	18	By Others				14	18	865	865
CB-4.00	BRB-4.00	3+	E.5-D.9	1	1902	1	88	126	124	15 6/16	3	0	1 10/16	4.00	2 2/16	0	1 7/16	1	50	7 1/2	5/8	1	12 6/16	5/8	1 1/8	2.31	3.990	4	-	12	-	By Others				15	23	By Others				14	19	879	879
																													0	24	0														1,744 lbs

0.87 Ton

Table of Symbols
- W_{wp} = Width of frame bay workpoint (WP) to WP
- H_{wp} = Height of frame bay WP to WP
- t_{sh} = Length of CoreBrace between outermost holes
- $L_{wp,h}$ = Length from bottom WP to center of bottom bolt hole
- n_i = Number of bolts in inner row
- n_o = Number of bolts in outer row
- e = Typical bolt edge distance
- s = Bolt spacing in a row
- g_i = Gauge inner bolt row from CL of CB
- g_o = Gauge between inner and outer bolt rows
- d_{hg} = Diameter of bolt hole in gusset plate
- t_g = Thickness of gusset
- $F_{y,g}$ = Gusset A572 grade
- t_L = Thickness of Lug
- t_s = Thickness of Stiffener on Lug
- L_{LG} = Expected Lap of Lug on Gusset (as Check Only)
- $W_{L,Alt}$ = Alternate continuous weld at lug to gusset
- G = Grip of bolt
- L* = Length of bolt needed with F436 washer only
- La = Suggested length of bolt to order, detailer to verify
- d_b = Bolt diameter (ASTM F3125 GrA490/F2280 SC OR ASTM F3148 TNA WITH CLASS A FAYING SURFACE)
- W_b = Minimum size of gusset weld to beam
- L_{wb} = Minimum length of beam weld
- W_t = Minimum size of gusset weld to column
- L_{wc} = Minimum length of column weld
- L_{gb} = Approximate maximum width of gusset rounded up to nearest inch (At V or Chev, equal to 1/2 gusset width) **NOT USED FOR DETAILING**
- L_{gc} = Approximate maximum height of gusset rounded up to nearest inch **NOT USED FOR DETAILING**
- Ext = If yes, see "extended" gusset detail

6903 - Reed College Central Plant Upgrade
Design Code: AISC 341-16 Seismic Design, AISC 360-16

COREBRACE CONNECTION SCHEDULE 19
SCALE: NTS

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CoreBrace Engineering Design Responsibilities are limited to the following:
- Complete BRB design based on A_{sc} provided by E.O.R.
- Design connection of BRB to gusset.
- Design gusset connection to frame columns, beams and base plates.

General Notes:
1. See "Casing Buried in Concrete Detail" where concrete slab will interfere with required BRB stroke.
2. Structural steel detailer and erection team to consider erectability constraints when determining piece erection sequencing and field welding versus shop welding of stiffeners and gussets.
3. Detail callouts are typical at the given frame location, UNO. See "CB" sheets for typical details.
4. Single-line diagrams do not necessarily represent WP axis of members, see details.
5. Member sizes, dimensions, elevations, and work point locations on CB sheets are shown for coordination only. Project documents shall govern. Verify in field as necessary.
6. See project documents for additional information; more stringent requirements on project documents shall govern.

Symbols Legend:
- X/Y = X = BASE PL THICKNESS; Y = GROUT THICKNESS
- I = INDICATES FRAMING OF GUSSET PL TO COLUMN WEB (WEAK AXIS)
- H = INDICATES FRAMING OF GUSSET PL TO COLUMN FLANGE (STRONG AXIS)
- □ = INDICATES FRAMING OF GUSSET PL TO HSS COLUMN (SLOT GUSSET THROUGH)
- CB-XX = INDICATES BRB WITH CORE AREA SIZE OF XX in²
- T.O.S. = X'-X" = INDICATES TOP OF STEEL BEAM ELEVATION
- 19## = BRACE MARK IDENTIFICATION

PRIMER INFO
BRB SURFACE PREP (ALL LOCATIONS): SSPC-SP6
BRB PRIMER (ALL LOCATIONS): Sherwin Williams Zinc Clad IV (85)

CoreBrace
SUPERIOR SEISMIC PERFORMANCE
20th ANNIVERSARY 2002 - 2022
5789 W. Wells Park Rd.
West Jordan, Utah 84081
(801) 280-0701

REV	DATE	DESCRIPTION
0	2025-04-23	FOR APPROVAL

ADDITIONAL NOTES:

REGISTERED PROFESSIONAL ENGINEER OREGON SEP. 12, 2014 MARK EUGENE CHUMBLEY

APPROVED ■ REVISE & RESUBMIT ☐
REJECTED ☐ APPROVED AS CORRECTED ☐
APPROVAL IS ONLY FOR GENERAL COMPLIANCE WITH THE DESIGN INTENT OF THE CONTRACT DOCUMENTS. THE CONTRACT AND ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING DIMENSIONS, FABRICATION AND CONSTRUCTION TECHNIQUES, COORDINATION OF THEIR WORK WITH THE WORK OF OTHERS, THE SATISFACTORY PERFORMANCE OF THEIR WORK.
JAMES G. PIERSON, INC.
CONSULTING STRUCTURAL ENGINEERS
PORTLAND, OREGON
BY: DATE: 04/25/2025

04/25/2025
Renews: 12/31/2025

SHEET TITLE:
COREBRACE BRACE AND GUSSET CONNECTION DETAILS

DRAWN BY: BP	DATE: 2025-04-23
CHECKED BY: FH	REV #: 0
SCALE: NONE	PROJECT NUMBER: 6903
SHEET NUMBER: CB-01	