

Heartwood Workforce Housing – Glulam / CLT and Steel BRB Frames

Susan Jones

Principal Architect, Founder, atelierjones



**CTBUH 2022
Steel-Timber Conference**

ON HEARTWOOD



CTBUH 2022 | Crown Hall, IIT, CHICAGO
STEEL-TIMBER Hybrid Buildings Conference

atelierjones
may 23, 2022

CLTHOUSE, SEATTLE, WA
2010-2015

CLTCHURCH
BELLEVUE, WA
2013-2016

MASS TIMBER MODULAR
SCHOOLS, WASHINGTON STATE
LEGISLATIVE GRANT 2016-17

AIA RESEARCH AWARD
TALL TIMBER CODES 2016-19

MASS TIMBER WORKFORCE HOUSING,
USDA WOOD INNOVATION GRANT
2019-22

NEW LOWER
-CARBON TYPE
IVC BUILDING
PERMITTED 2021

HIGH RISE
ON THE
HIGH PLAINS
TYPE IV- B

DESIGN

2010

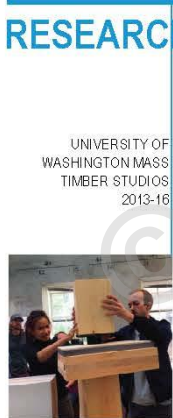
2013

2016

2018

2020-21

2022



UNIVERSITY OF
WASHINGTON MASS
TIMBER STUDIOS
2013-16

ICC TALL WOOD
BUILDING CODE
COMMITTEE
2016-19

FIRE TESTS | RESEARCH
| BUREAU OF ALCOHOL,
TOBACCO AND FIREARMS,
WASHINGTON DC 2017



MASS TIMBER
| DESIGN AND
RESEARCH, BY
SUSAN JONES
2018



TESTIFYING ICC
NATIONAL CODE
HEARINGS
2018



SIGNING
WASHINGTON
STATE TALL
WOOD CODES,
GOVERNOR
INSLEE
2019



TOKYO UL TALK;
TOKYO /NYC FIRE
DEPARTMENTS
2019



FIRE TESTS |
RESEARCH |
RESEARCH INSTITUTE
OF SWEDEN 2020



WHOLE BUILDING
LCA GRANT
THE NATURE
CONSERVANCY,
UW, FOREST
PRODUCTS LAB
2019-21



ICC G-147
PASSED
100%
EXPOSED
CEILING
TYPE IV-B





PROJECT TEAM

Client | Community Roots Housing
Developer | Skipstone
Architect | atelierjones LLC
Structural Engineer | DCI Engineers
General Contractor | Swinerton

HIGHLIGHTS

\$250,000 Wood Innovation Grant Recipient from USDA
Seattle's 1st Mass Timber Middle-Income Housing
Seattle's 1st Mass Timber Type IV-C 8 Story Housing

STRUCTURE

66,445 GSF
126 Units
CLT on Glulam Post & Beam Frame
Steel BRBF Lateral System
Construction Type IV-C

SEATTLE'S FIRST
TYPE IV-C BUILDING

TALL WOOD BUILDING CODE | IBC 2021

HEARTWOOD

TYPE IV-A



270 ft
18 stories
Fully encapsulated

TYPE IV-B



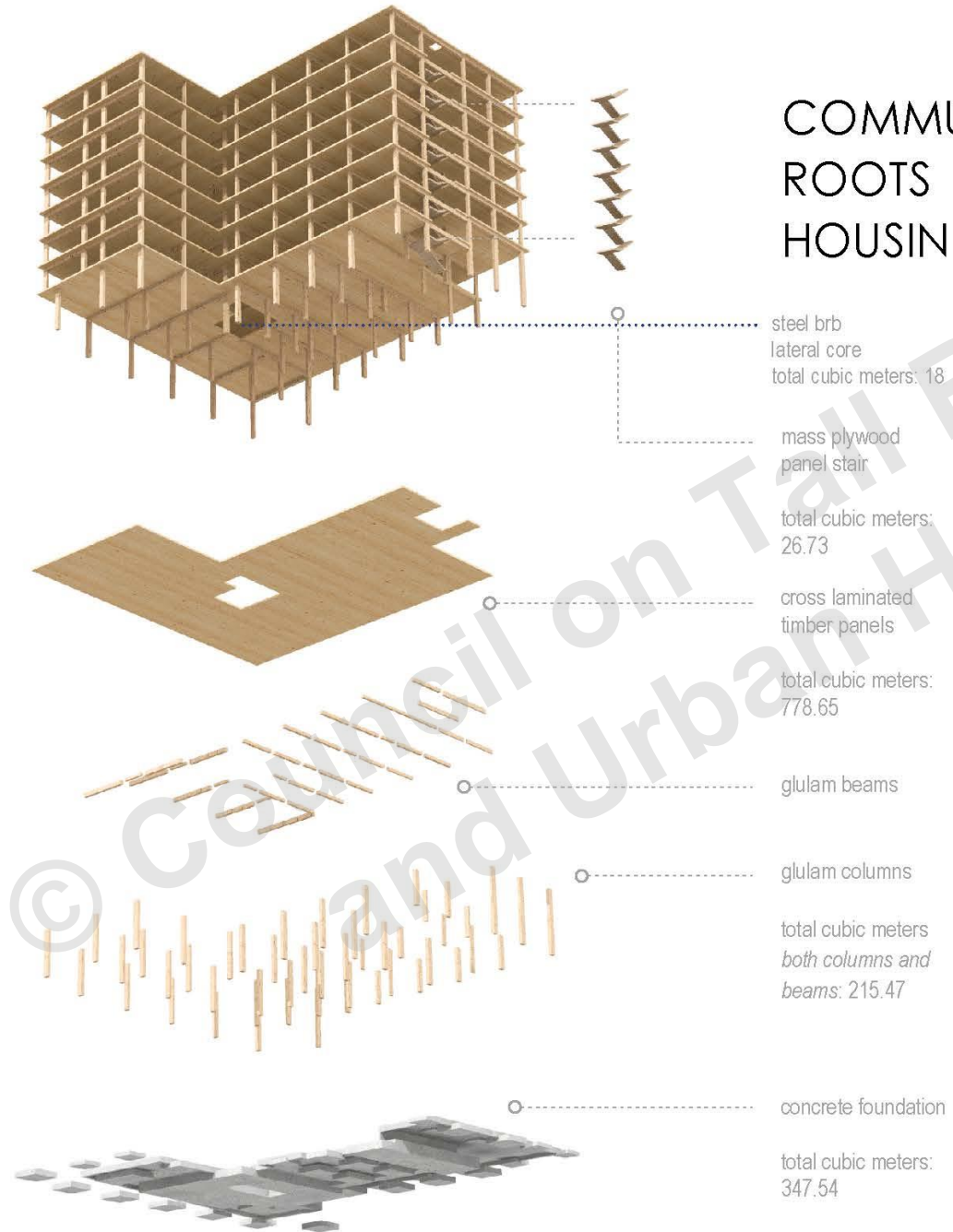
180 FT
12 stories
Partially encapsulated

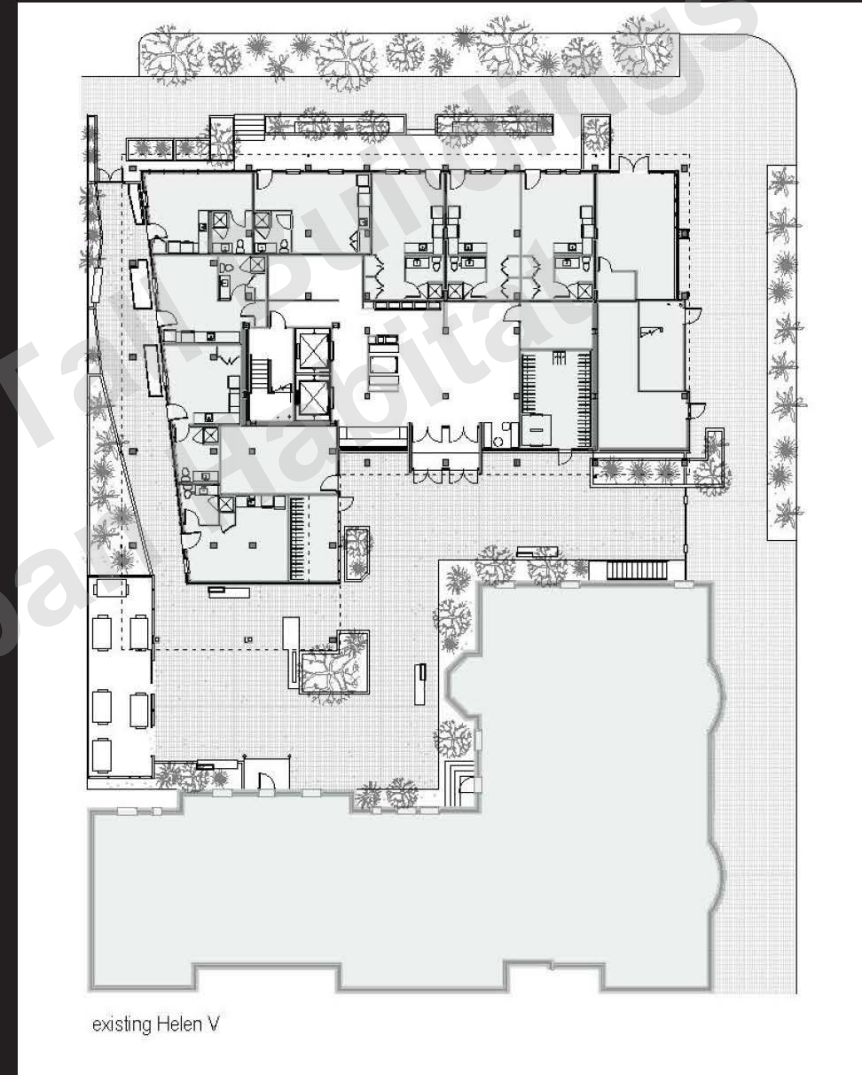
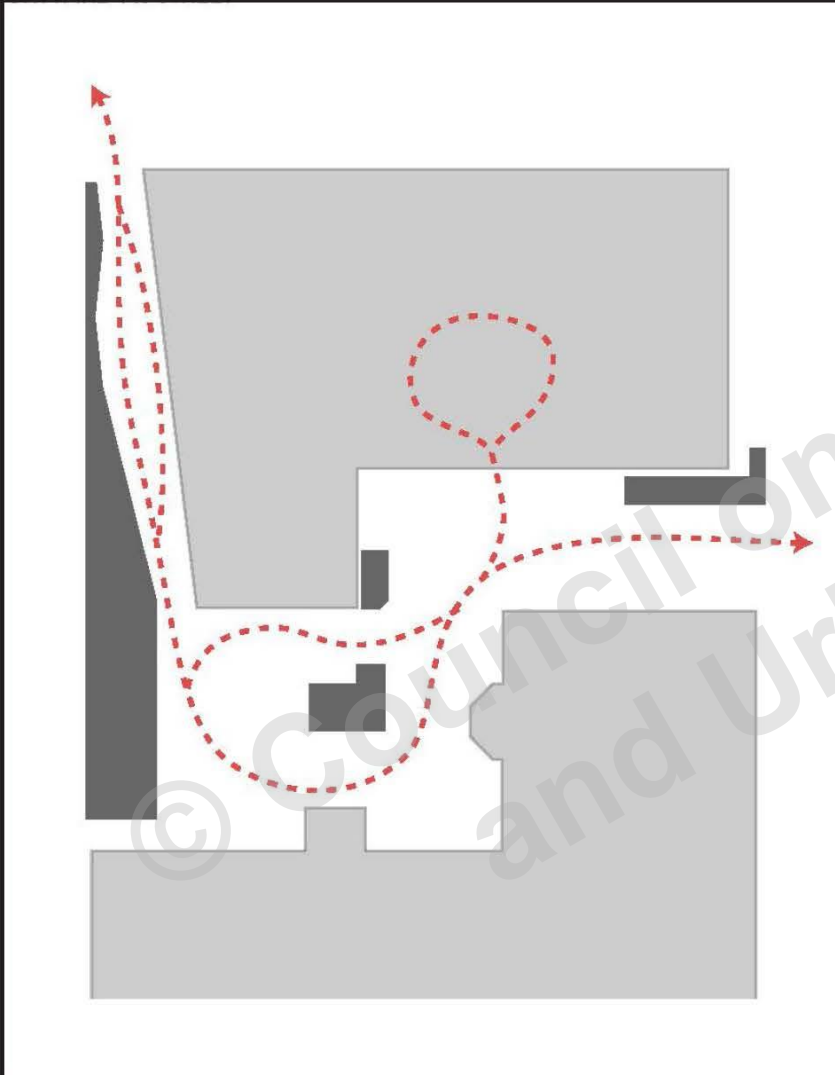
TYPE IV-C

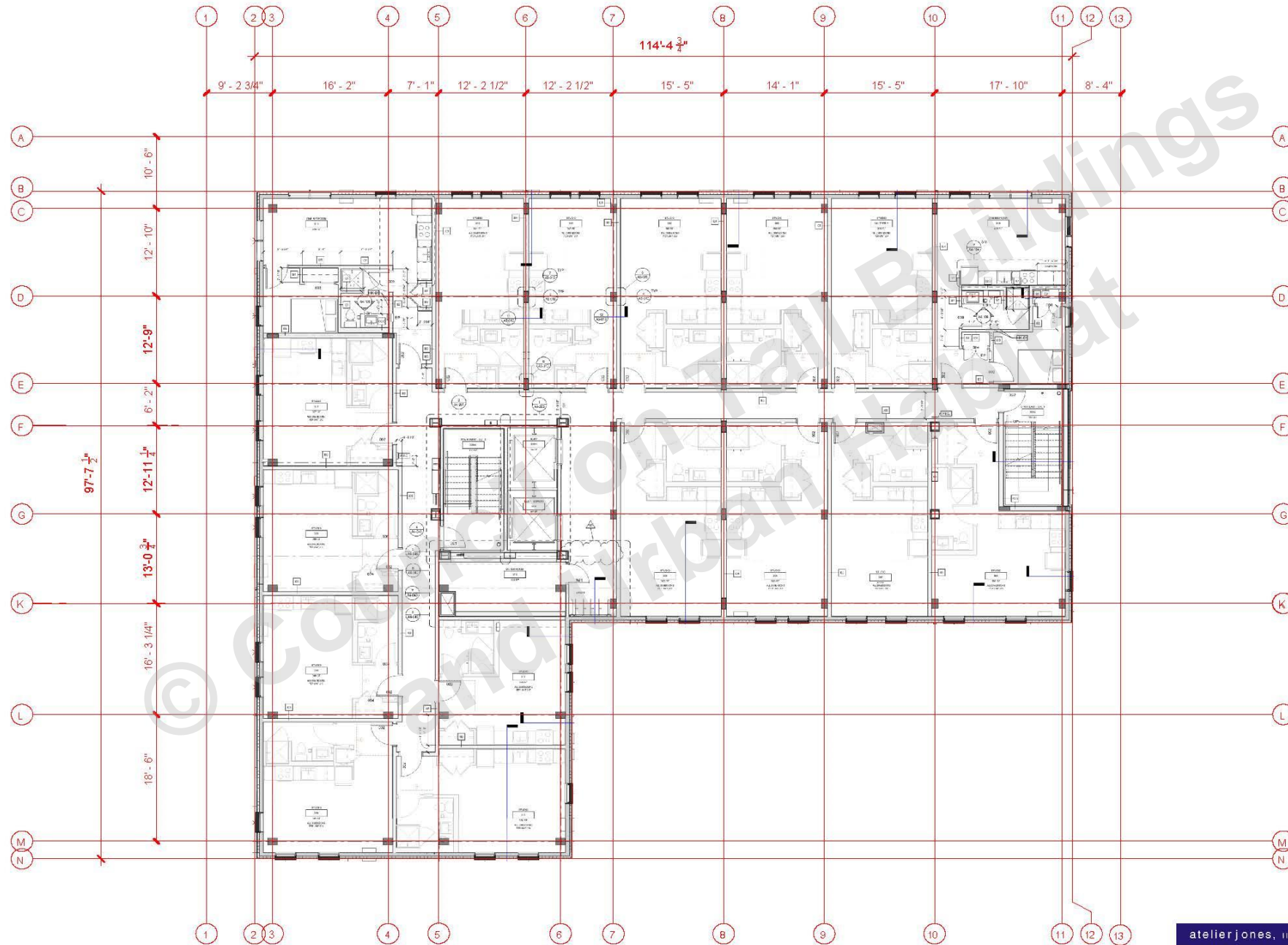


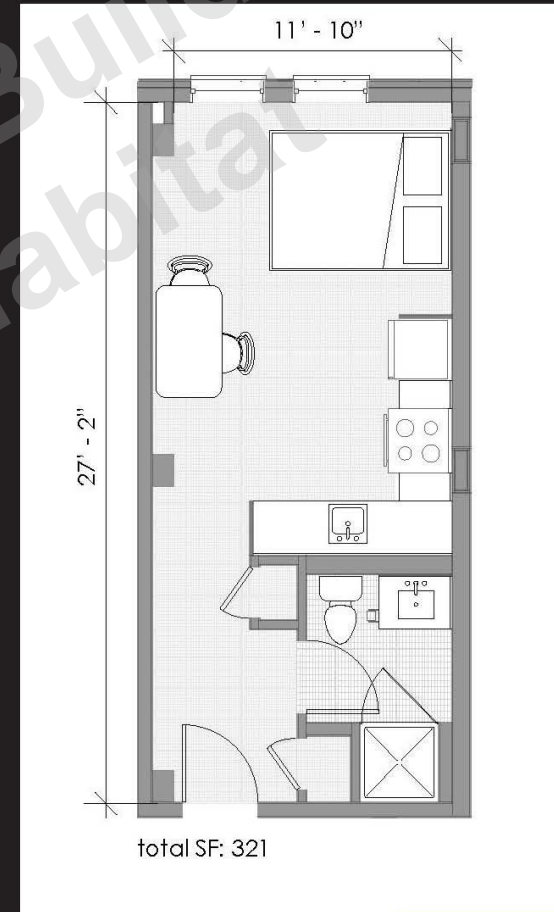
85 FT
8 stories
Fully exposed, 2 Hr FRR

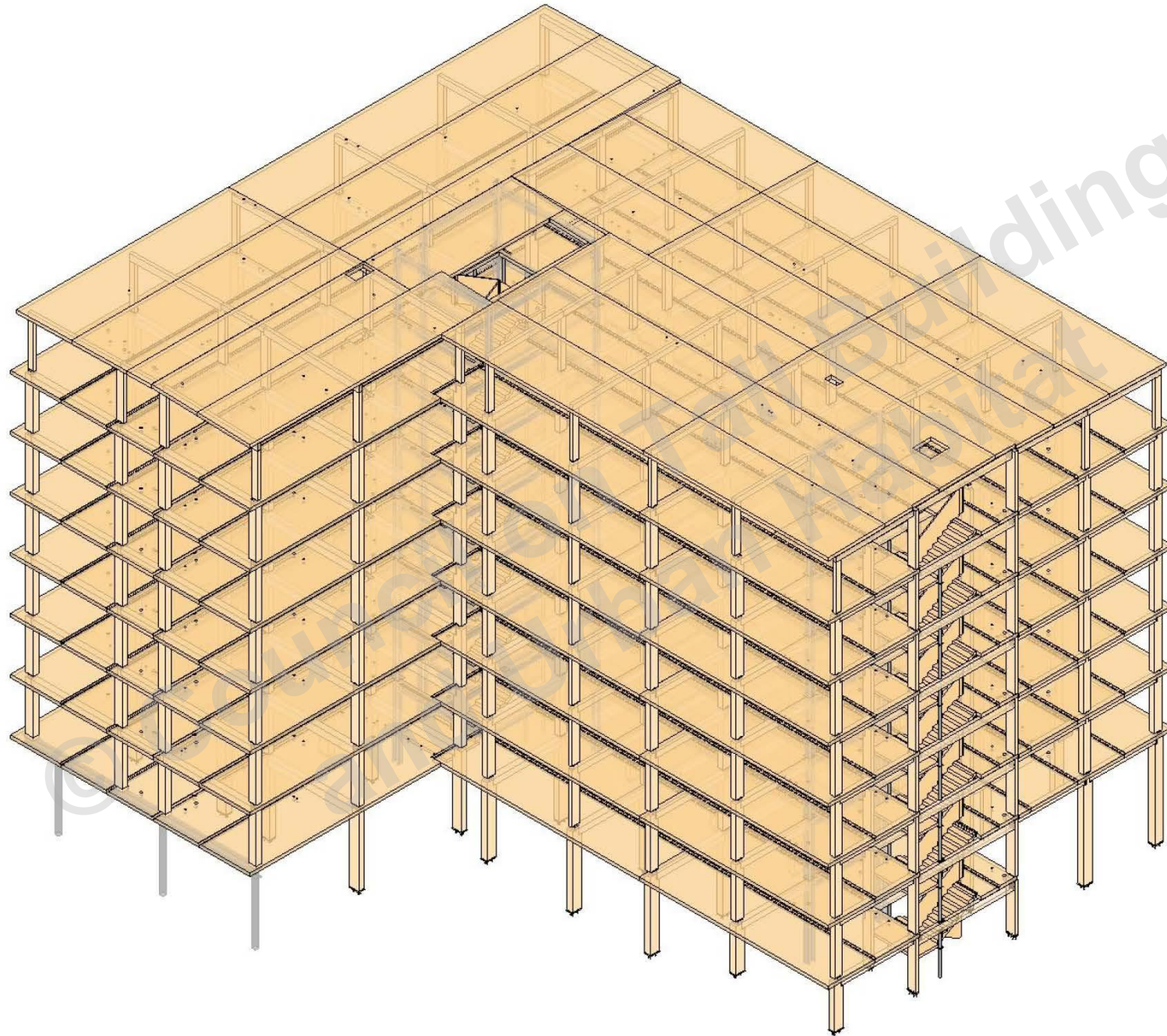
COMMUNITY ROOTS HOUSING

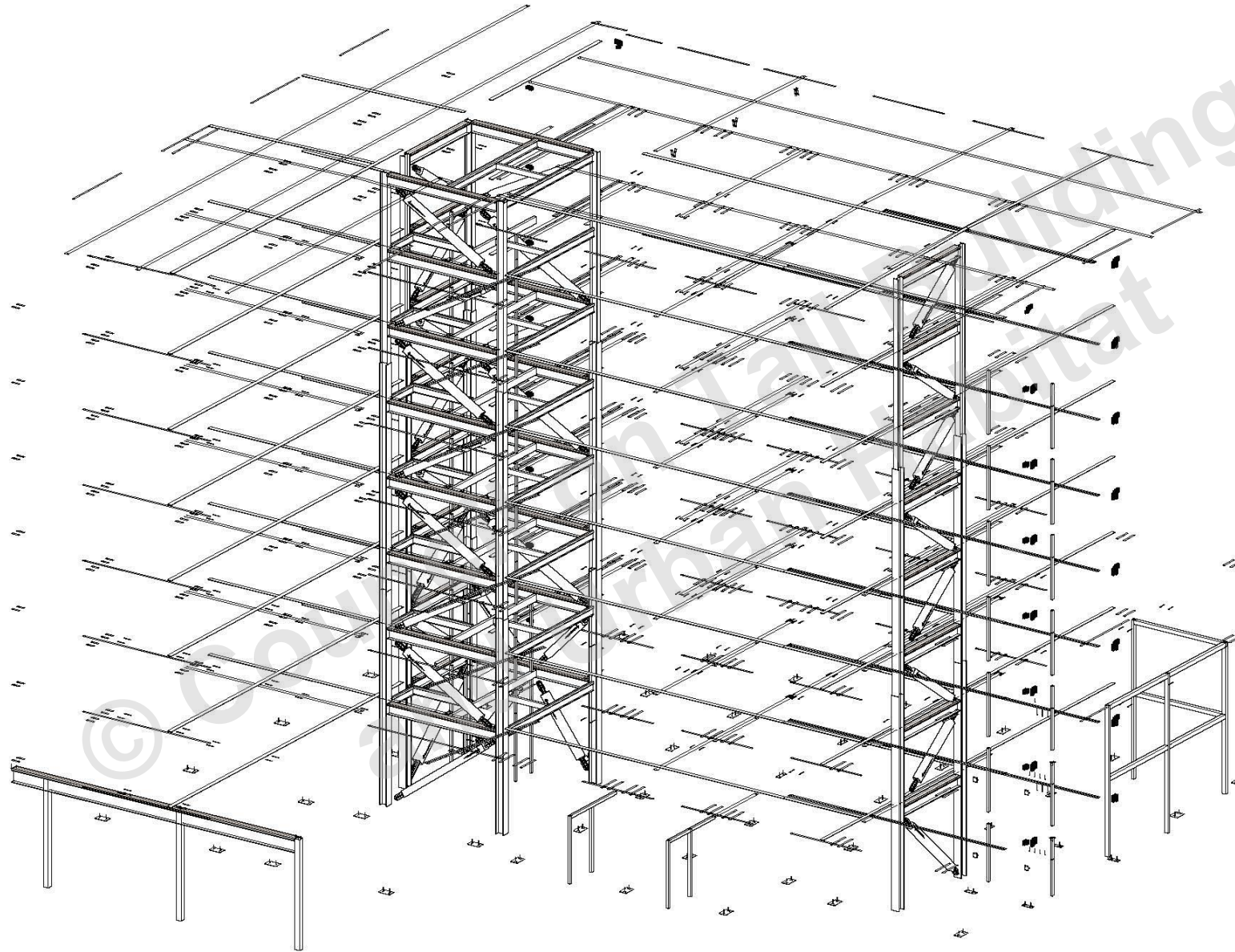


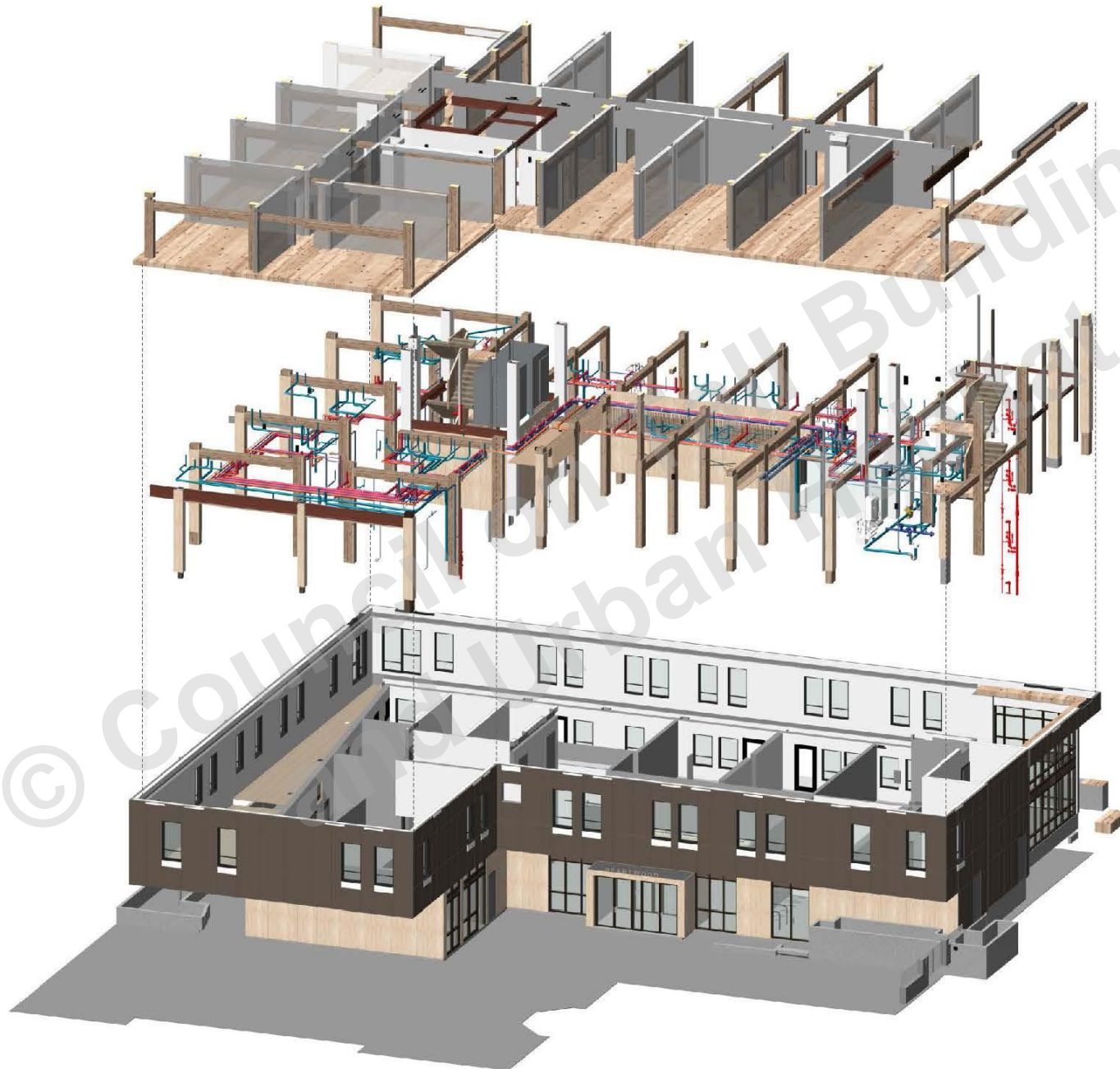


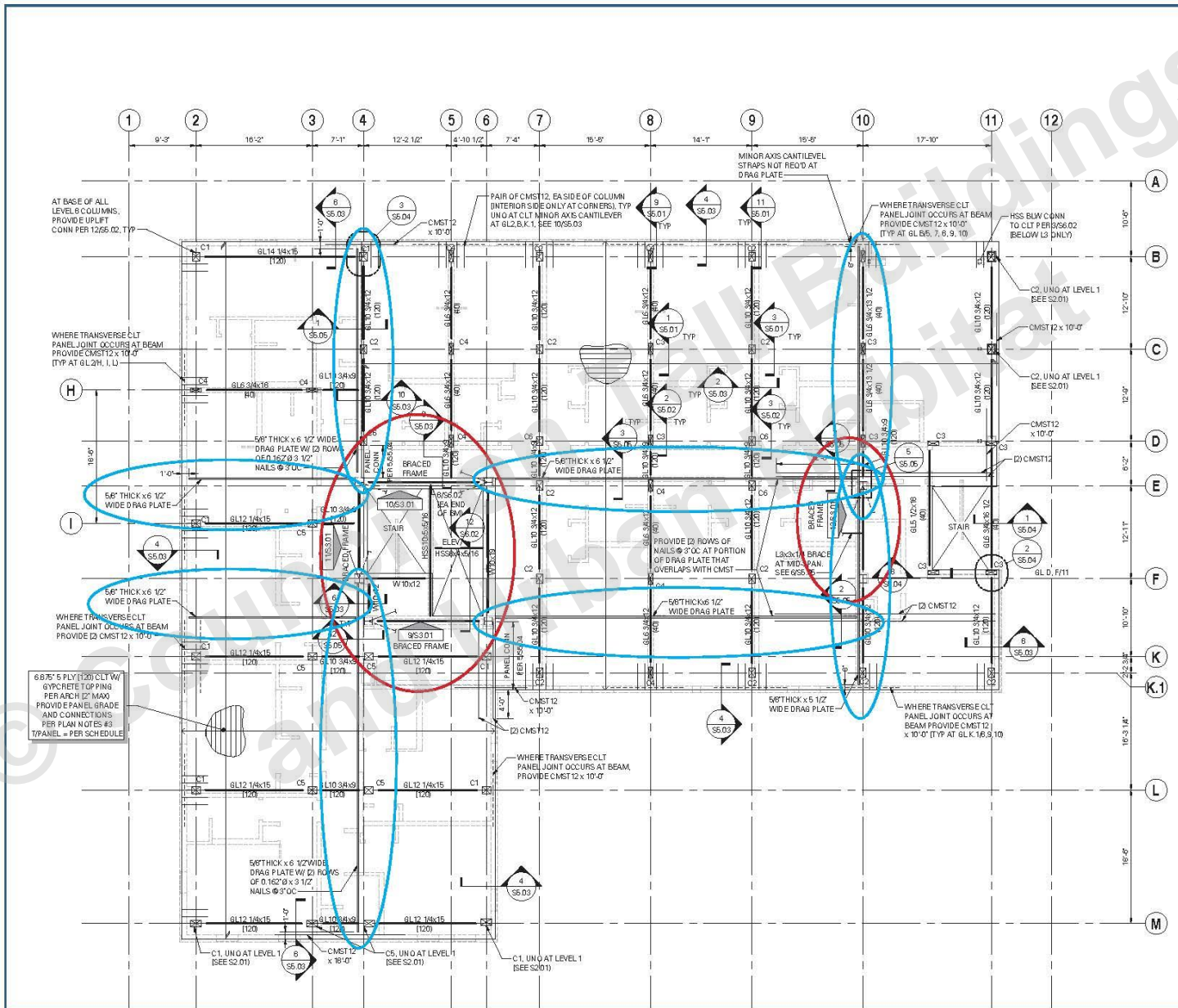


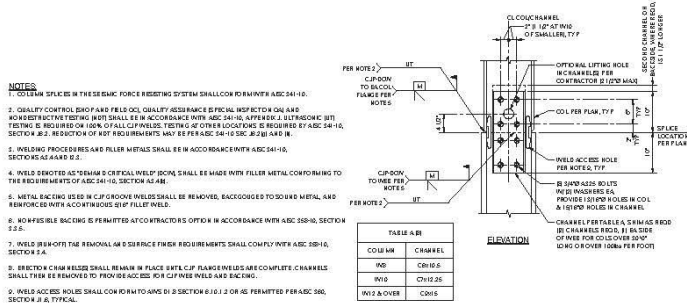




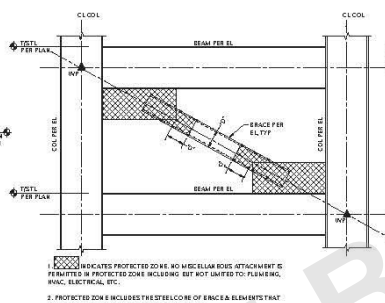








1 TYPICAL COLUMN SPICE - SEISMIC FORCE-RESISTING SYSTEM (SFRS) COLUMNS
SCALE: 1/8" = 1'-0"

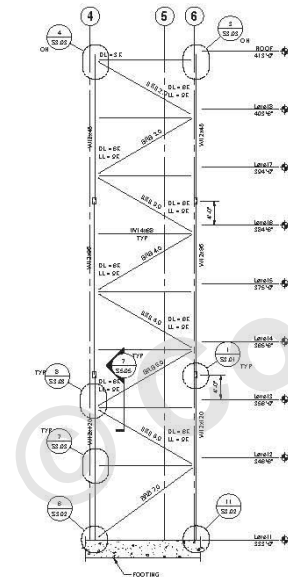


3 PROTECTED ZONES OF BUCKLING RESTRAINED BRACED FRAMES (BRB)
SCALE: 1/8" = 1'-0"

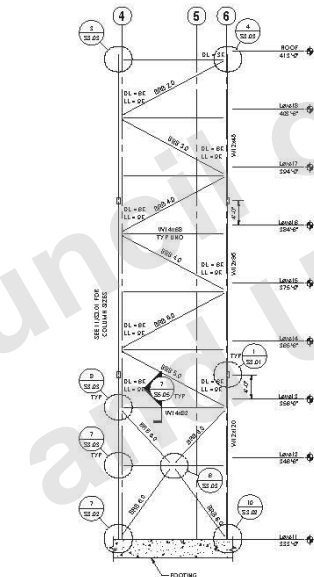
BRACE DESIGNATION	STEEL COR. AREA IN SQ. IN.	STIFFNESS FACTOR (K)	CONTROLLING BRACE PER DIM.	MAX. CAGING FACTOR (K)
BRB 1.0	2.0	1.27	---	---
BRB 2.0	3.0	1.38	---	---
BRB 3.0	4.0	1.47	---	---
BRB 4.0	5.0	1.57	---	---
BRB 5.0	6.0	1.67	---	---
BRB 6.0	7.0	1.77	---	---
BRB 7.0	8.0	1.87	---	---
BRB 8.0	9.0	1.97	---	---

- NOTES:**
1. STIFFNESS FACTOR (K) SHALL BE WITHIN 5% OF THE VALUES NOTED ABOVE.
 2. RATIO OF MAX. COMPRESSIVE TO MAX. TENSILE FOR RANGE OF DEFORMATION CORRESPONDING TO 1/4" STORY DRIFT, SHALL BE 1.0 MAX.
 3. RATIO OF MAX. TENSILE TO MAX. COMPRESSIVE FOR RANGE OF DEFORMATION CORRESPONDING TO 1/4" STORY DRIFT, SHALL BE 1.0 MAX.
 4. COR. STEEL SHALL BE A36 OR A572.
 5. C/WG. MAY BE SQUARE OR RECTANGULAR.
 6. BRACE AREA FACTORS AT CONNECTORS TO GUEST PLATE ARE INDICATED ON BRACE FRAME ELEVATIONS AND DET. 101.

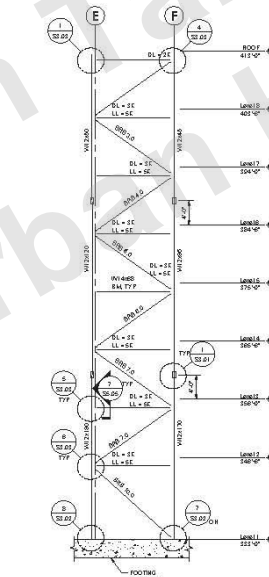
4 BRACE INFORMATION
SCALE: 1/8" = 1'-0"



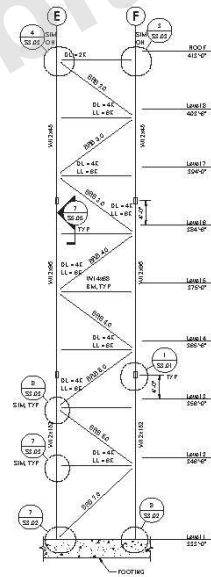
9 BRACED FRAME ELEVATION ALONG GRID F.5
SCALE: 1/8" = 1'-0"



10 BRACED FRAME ELEVATION ALONG GRID D.9
SCALE: 1/8" = 1'-0"



11 BRACE FRAME ELEVATION ALONG GRID 3.9
SCALE: 1/8" = 1'-0"



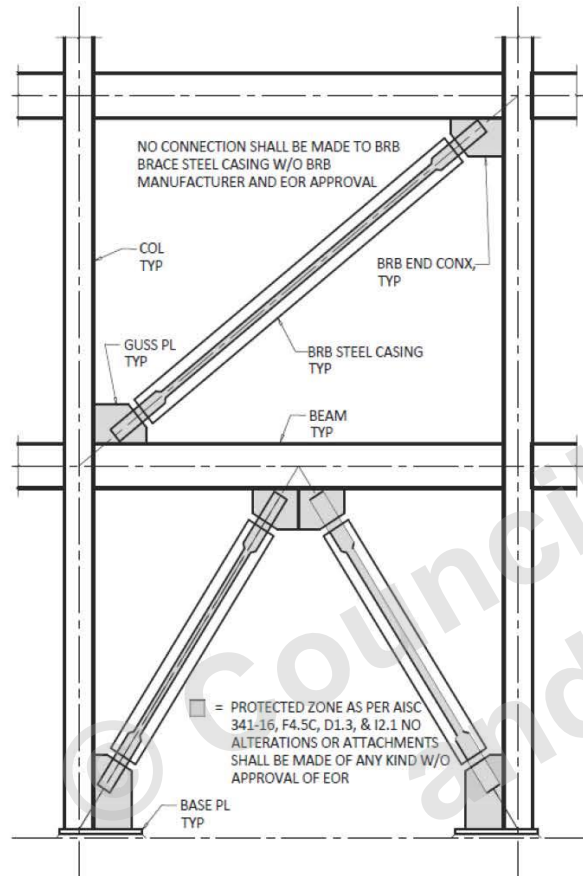
12 BRACE FRAME ELEVATION ALONG GRID 10
SCALE: 1/8" = 1'-0"



No.	Description	Exp.
1	FLUOR CHECK ENGINEER	1/1/2025
2	FLUOR CHECK ENGINEER	1/1/2025
3	FLUOR CHECK ENGINEER	1/1/2025
4	FLUOR CHECK ENGINEER	1/1/2025

CAPITOL HILL HOUSING
1323 E UNION ST
STRUCTURAL - BRACED FRAME ELEVATIONS AND DETAILS

Project Number	19031-0182
Date	2021.10.29
Revised	
Checked	
Set Release	100% CD SET
Issue Date	2021.10.29



BRBF PROTECTED ZONES



DRAWING INDEX

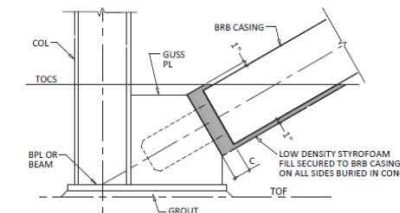
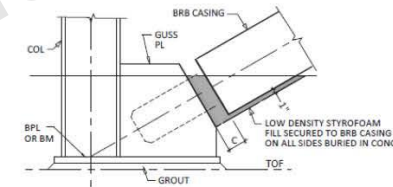
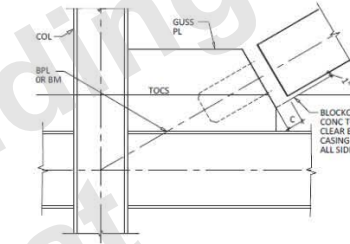
SB-00 - GENERAL NOTES	SB-02D - DSG, SB, CX & BOLT SCHS - BOLT
SB-01 - TYP SB DWG & DTLs - BOLT	SB-03A - TYP GUSS CONX DTLs - BOLT
SB-02A - DSG, SB, CX & BOLT SCHS - BOLT	SB-03B - TYP GUSS CONX DTLs - BOLT
SB-02B - DSG, SB, CX & BOLT SCHS - BOLT	SB-04 - PROJ FRAME & DTLs - SBC NOTES
SB-02C - DSG, SB, CX & BOLT SCHS - BOLT	

ABBREVIATIONS

ADDTL = ADDITIONAL	DIA = DIAMETER	STL OR S = STEEL
bf = BEAM FLANGE	DTL(S) = DETAIL(S)	SB = SEISMIC BRACE
B/ = BOT OF	DWG = DRAWING	SBC = SEISMIC BRACING CO.
BM = BEAM	EL = ELEVATION	SCH(S) = SCHEDULE(S)
BOT = BOTTOM	FB = FLAT BAR	STF = STIFFENER
BPL = BASEPLATE	FLG = FLANGE	S = BM/COL WEB STF PL RQD
BRB = BUCKLING RESTRAINED	FTG = FOOTING	t = THICKNESS
BRACE	GRT = GROUT	tf = t OF FLG
CL = CENTER LINE	GUSS = GUSSET	T/ = TOP OF
COL = COLUMN	HTS = HEIGHT FROM T/S	tw = THICKNESS OF WEB
CONC OR C = CONCRETE	INFO = INFORMATION	TYP = TYPICAL
CONX OR CX = CONNECTION	LVL = LEVEL	UNO = UNLESS NOTED
Db = DEPTH BM	MAX = MAXIMUM	OTHERWISE
Dc = DEPTH COL	MIN = MINIMUM	W = WALL
DB = DECK BEARING	PL = PLATE	WP = WORK-POINT
	RQD = REQUIRED	WPW = WORK POINT WIDTH

GENERAL NOTES

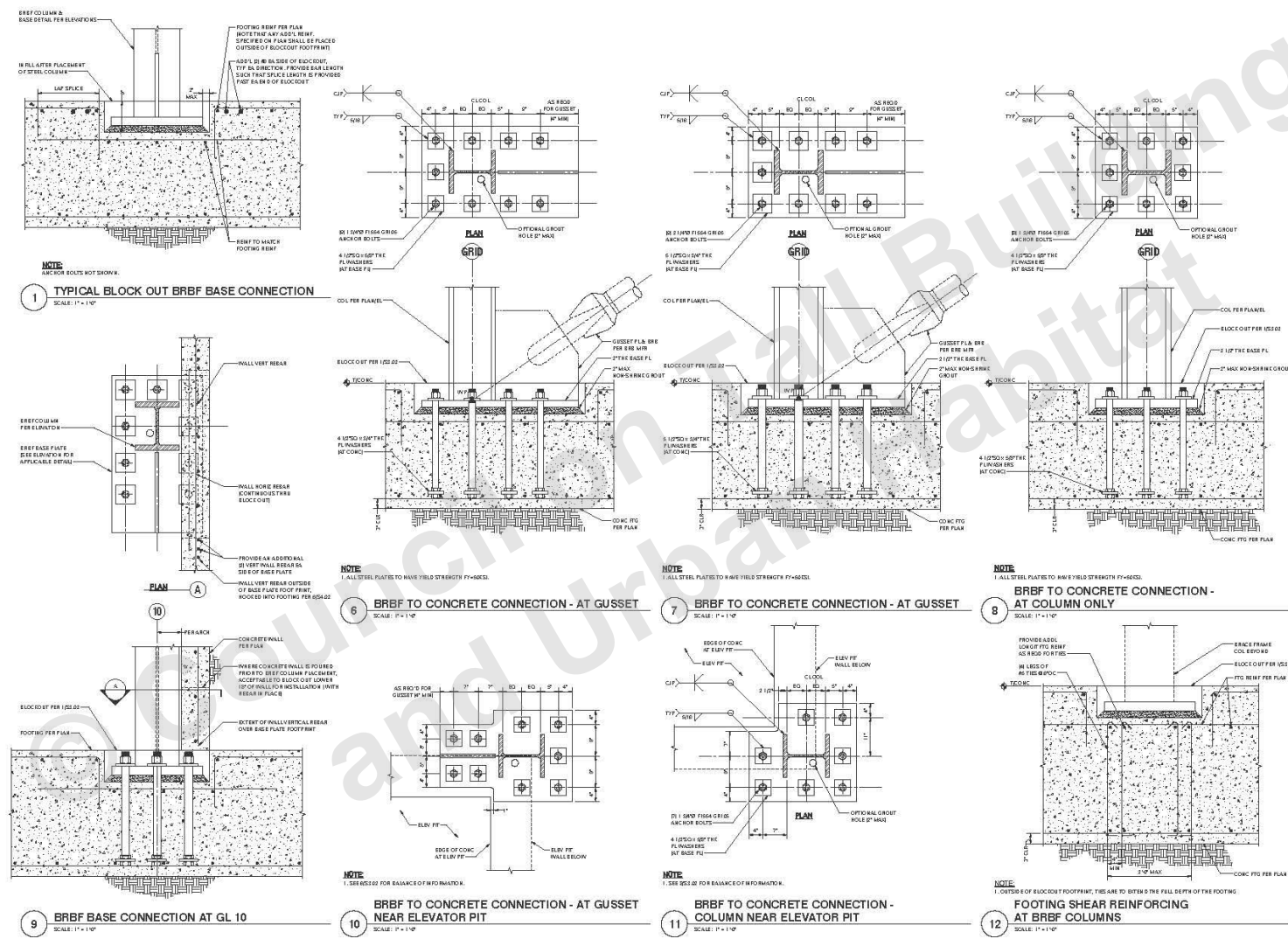
- CORE PL A36 CONTROLLED YIELD STRENGTH ($38 \leq F_y \leq 46$ KSI).
- CASING A500 GR B OR A53 GR B OR SIMILAR.
- STF, GUSS, & PADDLE PLS A572 GR 50 OR SIMILAR.
- BOLTS A490 SC CLASS A. TENSION PROCEDURE BY ERECTOR. ERECTION BOLTS ONLY AT WELD CONX.
- PINS AISI 1045 COLD DRAWN F_y 85 KSI MIN OR SIMILAR.
- GUSS & CONX OF GUSS TO FRAME MEMBERS REQUIREMENTS ARE SUBJECT TO FINAL COORDINATION WITH SBC.
- SBC DESIGN IS BASED ON A_{sc} PROVIDED BY PROJECT ENGINEER OF RECORD (EOR) & LIMITED TO BRB_s, BRB CONX TO GUSS, & GUSS CONX TO FACE OF COL_s, BM_s & BPL_s. BEAM FLANGE BRACING AT GUSSET CONX BY PROJECT EOR
- PROJECT CONSTRUCTION DOCUMENTS SUPERCEDE REQUIREMENTS IN THESE DOCUMENTS.



BURIED CASING REQUIREMENTS

(BY OTHERS)

STEEL BRB LATERAL SYSTEM



atelierjones, llc

814 Pine Street
Floor Two
Seattle, Washington 98101
T: 206.624.9965
F: 206.624.9957
www.atelierjones.com

COMMUNITY ROOTS
10.15.19

SKIP STONE

SWINERTON

EDCI
EDCI 201 Multi-High Steel & Timber 500
Portland, Oregon 97205
P: 503.242.7465
www.edciexpo.com
edci@edciexpo.com
edciexpo.com

SEATTLE BUILDING DEPARTMENT

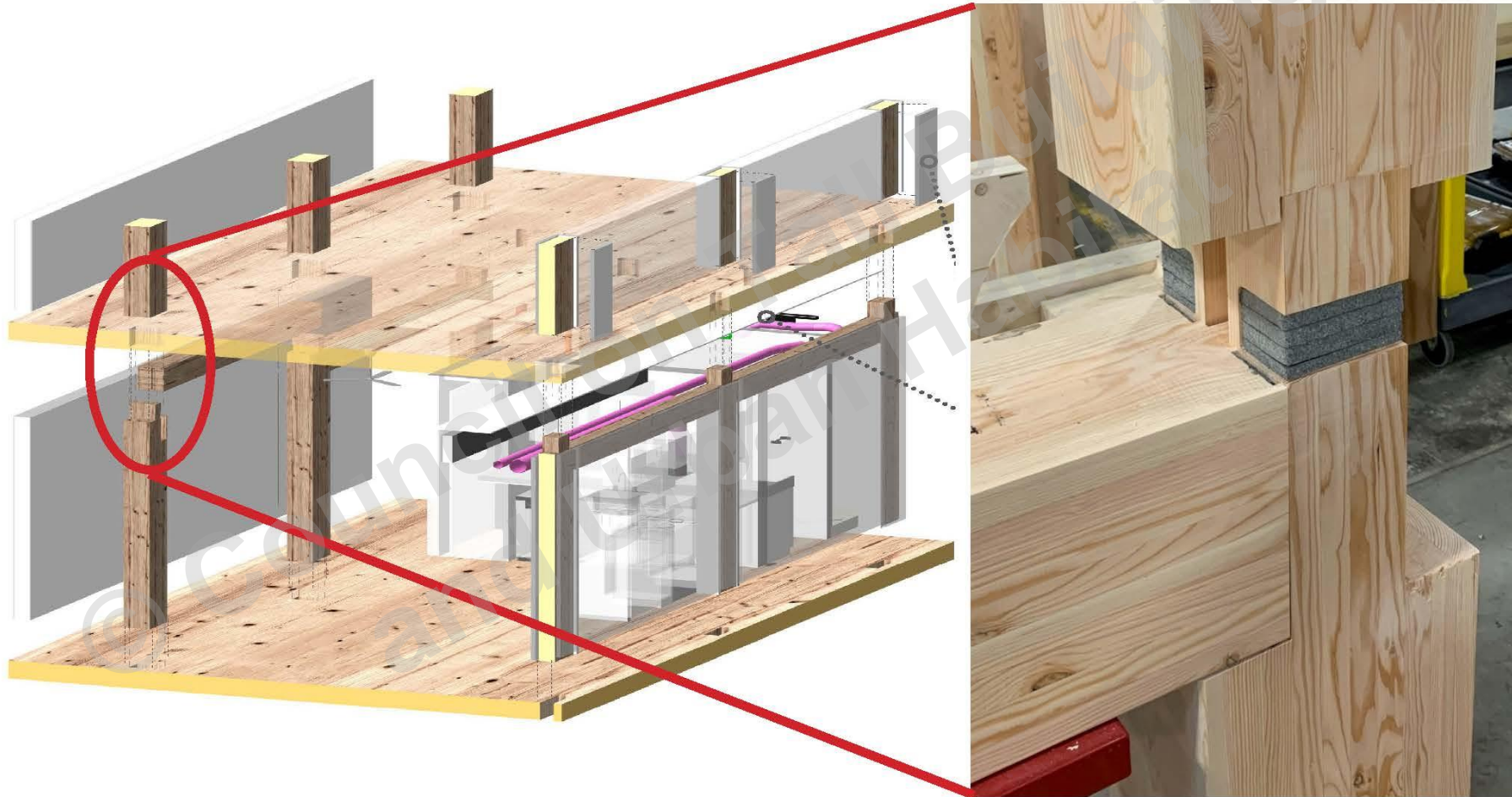
CAPITOL HILL HOUSING
1323 E UNION ST
STRUCTURAL - BRACED FRAME DETAILS

S3.02

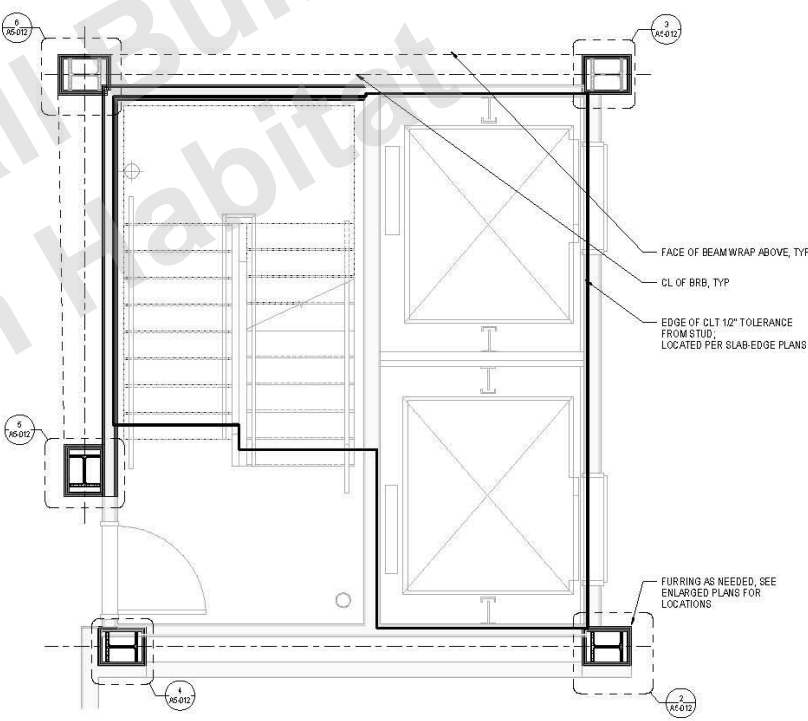
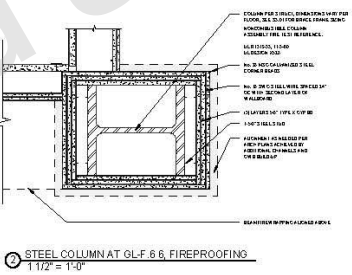
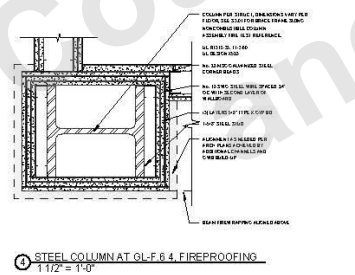
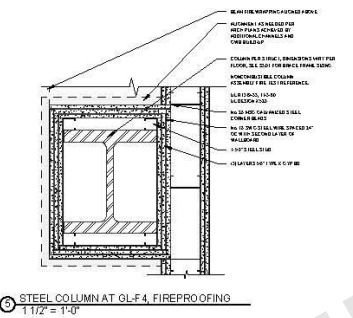
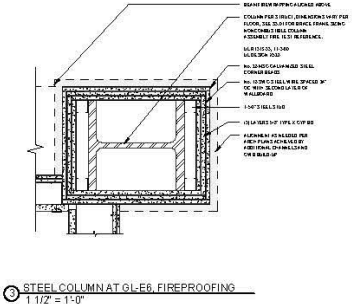
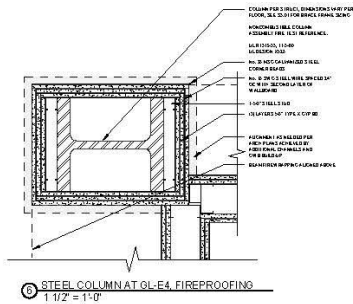
No.	Description	Rev
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2	PLAN CHECK RESPONSE	1/10/21
3	PLAN CHECK RESPONSE	1/10/21
4	PLAN CHECK RESPONSE	1/10/21

Trans number: 19031.0102
Rev: 2021.10.20
Drawn by: [blank]
Checked by: [blank]
Scale: 100% CD SET
Issue Date: 2021.10.20

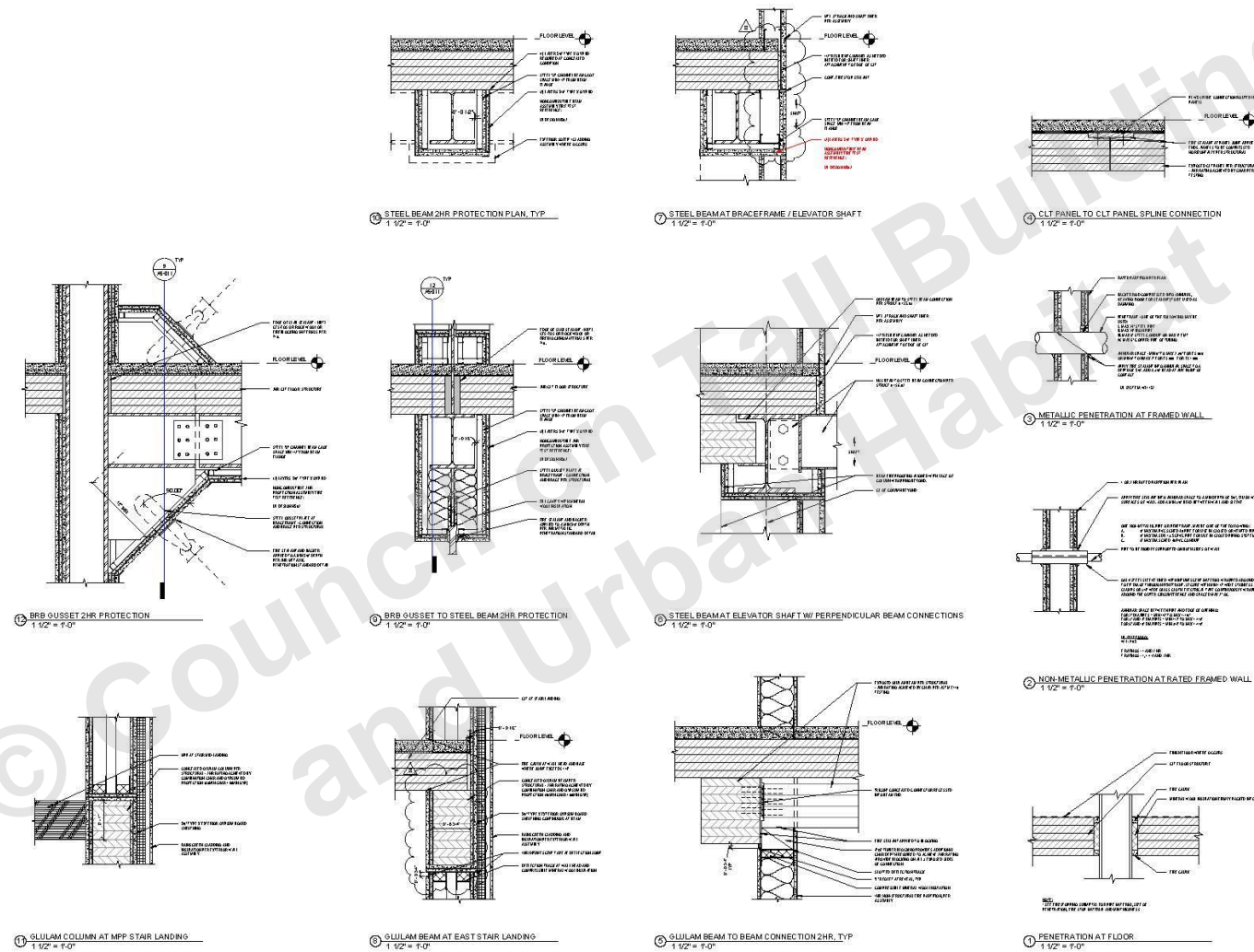
STEEL BRB TO CONCRETE



2HR FRR | TALL WOOD



2HR FRR | STEEL BRB



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Floor Two
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www.atelierjones.com

COMMUNITY ROOTS
HOUSING

SKIP
STONE

SWINERTON

EDCI
ENGINEERS

WV Engineering, Inc.

Bergelectric

BLUELINE

THE GREENBUSH
GROUP, INC.

GEOTECH

NO.	DESCRIPTION	DATE
1	ISSUED FOR PERMITTING	10/24/21
2	ISSUED FOR PERMITTING	11/04/21
3	ISSUED FOR PERMITTING	11/04/21

Capitol Hill Housing
1323 E UNION ST
CODE AND FIRE-RATED DETAILS

A5-011
Project Number: 305728
Date: 2021.10.29
Owner: 100% CD SET
Checked by: 100% CD SET
Issue Date: 2021.10.29

2HR FRR | STEEL BRB + TIMBER

atelierjones, llc



EXPERIMENTAL PROGRAM ON NEW BUCKLING-RESTRAINED
BRACES

FINAL REPORT

Chris P. Pantelides, PhD, P.E., S.E.
Joel E. Parks, PhD Candidate

Civil & Environmental Engineering
College of Engineering
University of Utah
Salt Lake City, Utah

July 2016



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EXPERIMENTAL PROGRAM ON SEISMIC BRACING COMPANY
BRB

FINAL REPORT

Chris P. Pantelides, PhD, P.E., S.E.
Anurag Upadhyay, PhD Student

Civil & Environmental Engineering
College of Engineering
University of Utah
Salt Lake City, Utah

July 2017

11 Test Results for BRB-4

BRB-4 was a circular brace with bolted connections at both the top and bottom, as shown in Figure 3.8.

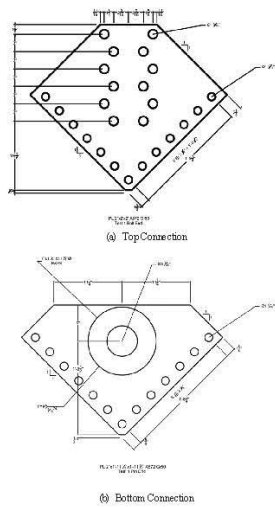


Figure 2.1 Brace Specimen Details BRB-1

4

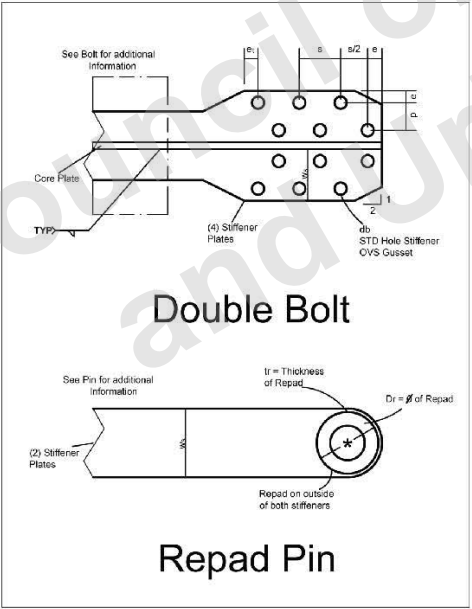


Figure 2.8 Double Bolt and Pin Connection Details for BRB-1



Figure 3.8 BRB-4

13 Test Results for BRB-2

BRB-2 was a circular brace with a welded connection on the top and a bolted connection on the bottom, as shown in Figure 3.3, which also shows the potentiometric position sensor instrument which was used to implement the loading protocol. This BRB was tested as a sub-assembly per AISC 341-10.

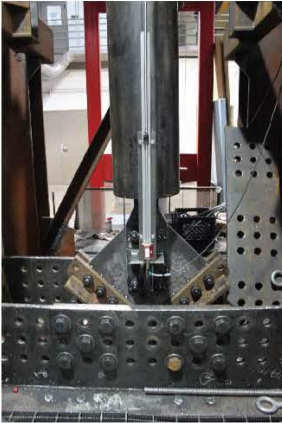
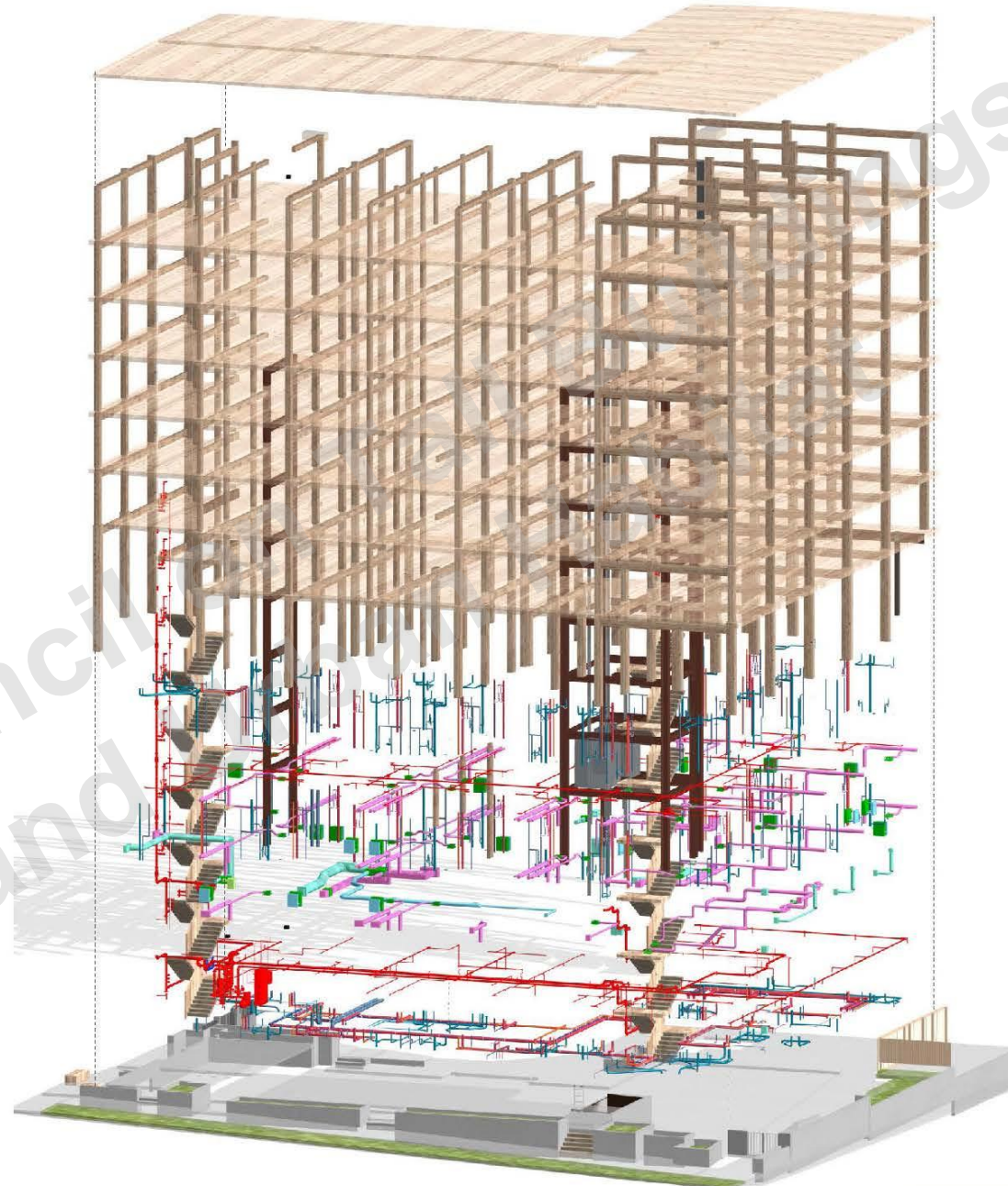


Figure 3.3 BRB-2

MASS TIMBER + STEEL LATERAL HYBRID CONSTRUCTION



ON HEARTWOOD



CTBUH 2022 | Crown Hall, IIT, CHICAGO
STEEL-TIMBER Hybrid Buildings Conference

atelierjones
may 23, 2022