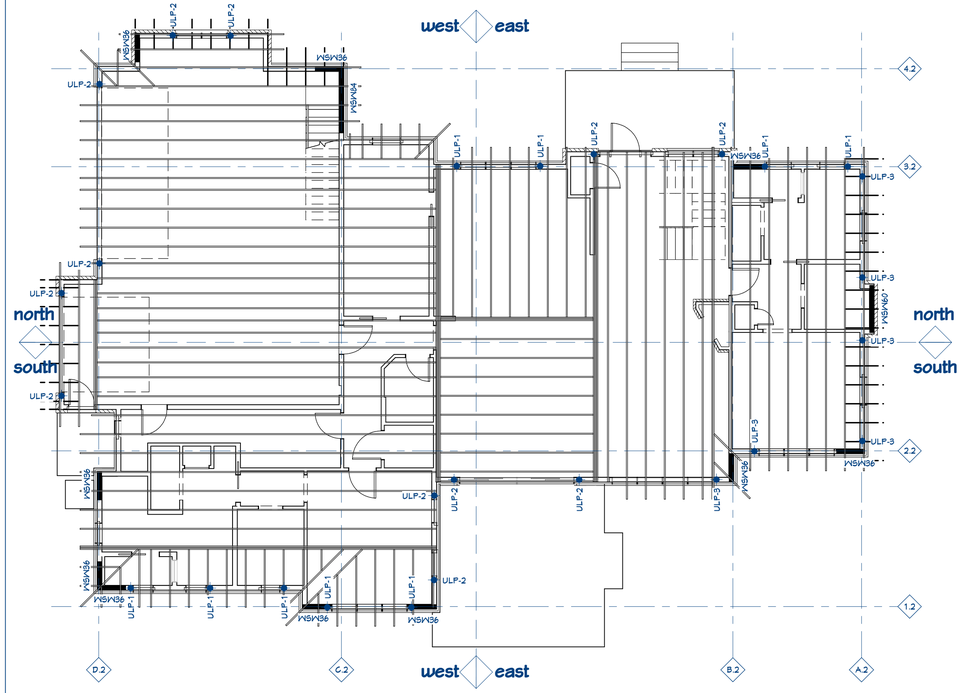
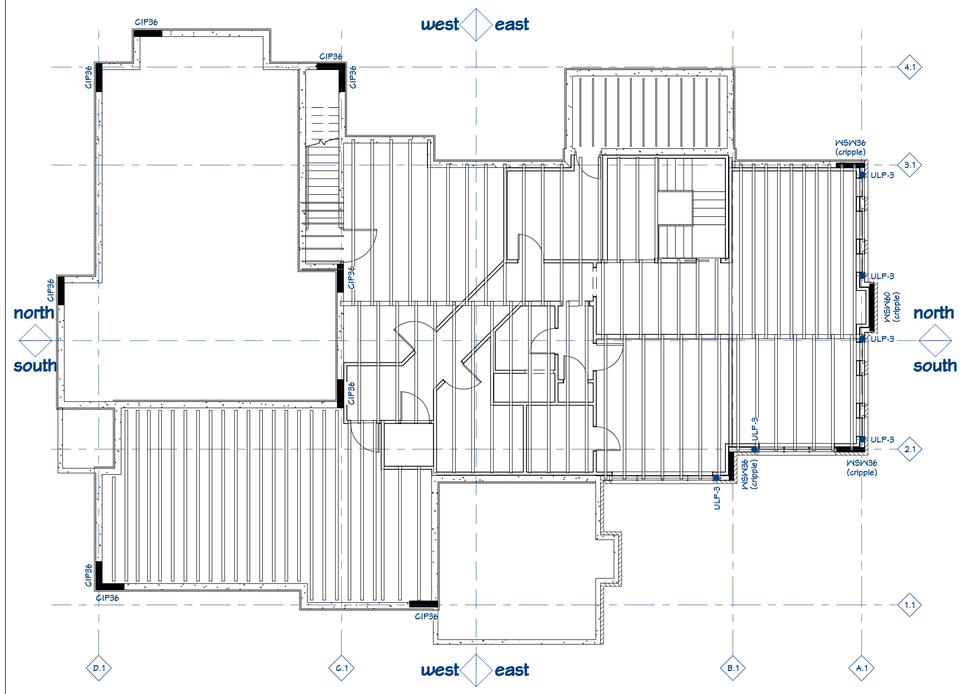


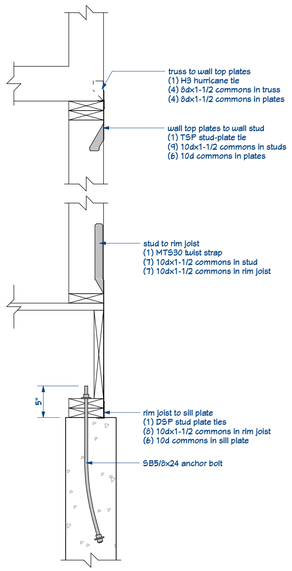
1 story 2 (1st floor) lateral load path bracing plan

1/8" = 1'-0"

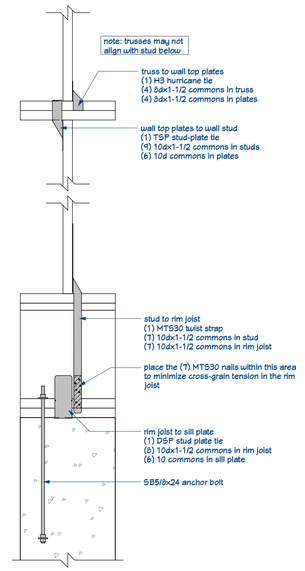


2 story 1 (basement) lateral load path bracing plan

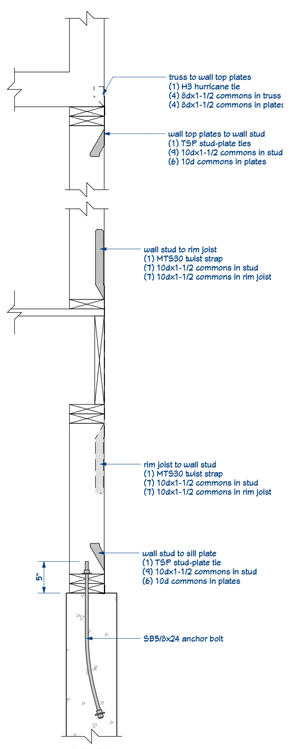
1/8" = 1'-0"



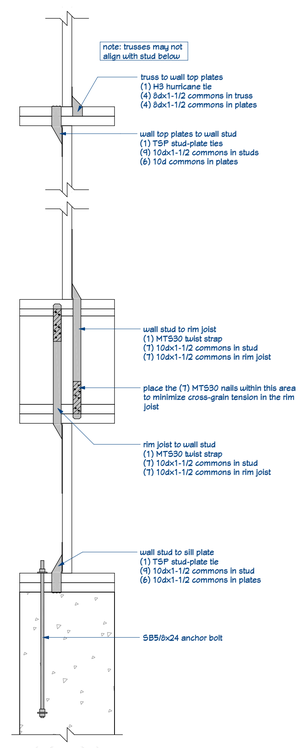
ULP-1 section



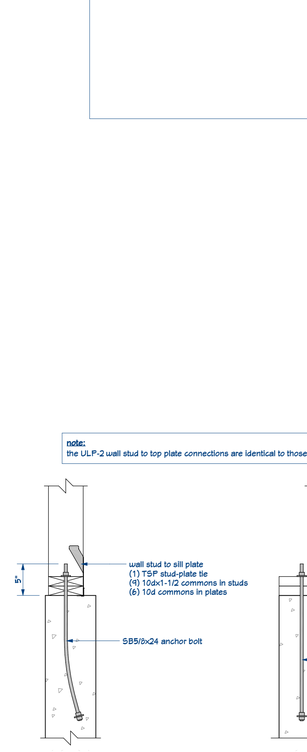
ULP-1 elevation



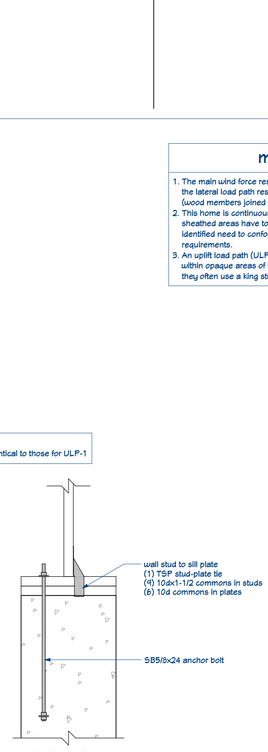
ULP-3 section



ULP-3 elevation



ULP-2 section



ULP-2 elevation

3 uplift load path details

1" = 1'-0"

main wind force resisting system: load path parameters and design

prescriptive braced panel design and selection per IBC 2009

design story shear

for simplicity the story shears which result from the greatest evaluated total (see design parameters and evaluations, shown in red) are applied to the structure in each direction

lateral load path bracing methods

WSP panels: wood structural panels over framing with a gypsum wall board interior finish

- maximum height-to-width panel aspect ratio is 3.5:1
- APA structural 1 grade, 7/16" sheathing on SPF#2 studs at 16" on-center, all panel edges blocked, fastened to studs with 8d common nails spaced 3" on-center at panel edges and 6" on-center in the field
- gypsum wall board, 5/8" panels on SPF#2 studs at 16" on-center, all panel edges blocked, fastened to studs with type W or S #6x1-1/4 screws at 4" on-center at panel edges and blocking
- wood structural panel shear capacity, Vw = 550 lb
- gypsum wall board panel shear capacity, Vg = 160 lb
- specific gravity adjustment factor for spruce-pine-fir studs, g = 0.42
- wind design increase factor, w = 1.4
- cripple design adjustment factor, c = 0.85
- V = (Vw+Vg)*g*w = 915 lb/ft [cripple walls: Vc = V*c = 778 lb/ft]

CIP panels: cast-in-place concrete wall sections

- 8" nominal thickness (min)
- panel shear capacity, V = 1,200 lb/ft

lateral load path bracing, transverse directions

story	V(design)	line	panel	solution	V(allow)
2	21,202 lb	A.2	(1) WSW60	5 x 915	4,575 lb
		B.2	(1) WSW36	3 x 915	2,745 lb
		C.2	(1) WSW84	7 x 915	6,405 lb
		D.2	(3) WSW36	9 x 915	8,235 lb
				total =	21,960 lb
1	23,540 lb	A.1	(1) WSW60	5 x 778	3,940 lb
		B.1	(1) WSW36	3 x 778	2,334 lb
		C.1	(2) CIP36	6 x 1,200	7,200 lb
		D.1	(3) CIP36	9 x 1,200	10,800 lb
				total =	24,224 lb

lateral load path bracing, longitudinal directions

story	V(design)	line	solution	solution	V(allow)
2	14,561 lb	1.2	(3) WSW36	9 x 915	8,235 lb
		2.2	(1) WSW36	3 x 915	2,745 lb
		3.2	(1) WSW36	3 x 915	2,745 lb
		4.2	(1) WSW36	3 x 915	2,745 lb
				total =	16,470 lb
1	18,376 lb	1.1	(2) CIP36	6 x 1,200	7,200 lb
		2.1	(1) WSW36	3 x 778	2,334 lb
		3.1	(1) WSW36	3 x 778	2,334 lb
		4.1	(2) CIP36	6 x 1,200	7,200 lb
				total =	19,068 lb

design roof uplift

for simplicity the design value for vertical pressures is taken as the maximum of the evaluated reference corners (see design parameters and evaluations, shown in red); the roof diaphragm is connected to the upper story using Simpson wood construction connectors at each truss bearing and assumes trusses spaced at 24" on center, therefore uplift resistance is measured by the number of truss connections along the entire length of exterior wall; the solution calculated is typically very conservative, but this is desirable because:

- the most leeward edge of the roof diaphragm will be in compression and the connectors along this edge will not contribute
- connections at hip trusses and jacks may not fully contribute

wall length	connection	solution	U(design)	U(allow)
309 ft	(1) H3 hurricane tie	154 x -290 lb	-22,262 lb	-44,660 lb

uplift load path bracing method

uplift load paths are used to tie the roof diaphragm and each story to the foundation; each path is designed to resist a portion of the design value and are distributed to spread the load as evenly as practicable (paths are typically located on either side of headed openings)

ULP-1: from roof through the first story and thus to the foundation

path	solution	U(path)
wall top plates to wall stud	(1) TSP stud plate tie	-873 lb
wall stud to rim joist	(1) MTS30 twist strap	-860 lb
rim joist to sill plates	(1) DSP stud plate tie	-775 lb
sill plates to foundation	SBS/8x24 anchor bolts*	-6,675 lb

∴ the controlling value for *ULP-1* is U(path) = -775 lb

ULP-2: from roof through the first story at flush entry and thus to the foundation

path	solution	U(path)
wall top plates to wall stud	(1) TSP stud plate tie	-873 lb
wall stud to sole/sill plates	(1) TSP stud plate tie	-873 lb
sill plates to foundation	SBS/8x24 anchor bolts*	-6,675 lb

∴ the controlling value for *ULP-2* is U(path) = -873 lb

ULP-3: from roof through the first story and knee wall and thus to the foundation

path	solution	U(path)
wall top plates to wall stud	(1) TSP stud plate tie	-873 lb
wall stud to rim joist	(1) MTS30 twist strap	-860 lb
rim joist to knee wall stud	(1) MTS30 twist strap	-860 lb
knee wall stud to sill plates	(1) TSP stud plate tie	-873 lb
sill plates to foundation	SBS/8x24 anchor bolts*	-6,675 lb

∴ the controlling value for *ULP-3* is U(path) = -860 lb

* maximum anchor bolt spacing is 72" on-center when using a double sill plate, and 48" on-center when using a single sill plate; the uplift load path is allowed to fail anywhere within the anchor bolt spacing span

load path	capacity	solution	U(allow)	U(total)	U(design)
ULP-1	-775 lb	9 x -775	6,975 lb	6,975 lb	-
ULP-2	-873 lb	12 x -873	10,476 lb	17,451 lb	-
ULP-3	-860 lb	6 x -860	5,160 lb	22,611 lb	22,262 lb

mwfrs plan notes

1. The main wind force resisting system (MWFRS) consists of two components: the lateral load path resisting elements (shear panels) and uplift load paths (wood members joined with metal construction connectors).
2. This home is continuously sheathed with wood panel sheathing, but not all sheathed areas have to be constructed as shear panels - only the wall lengths identified need to conform to the special shear panel blocking and nailing requirements.
3. An uplift load path (ULP) may or may not fall within a shear panel. ULPs occur within opaque areas of the exterior wall - they do not fall within openings, but they often use a king stud on either side of an opening.

Construction Drawings

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608-833-3400 www.bourildesign.com

revision index	
date	reason
2018.09.25	const dwgs

project #18010
contact: Robert Lackore
robl@bourildesign.com
608-833-3400

A3.1

mwfrs plan

as indicated