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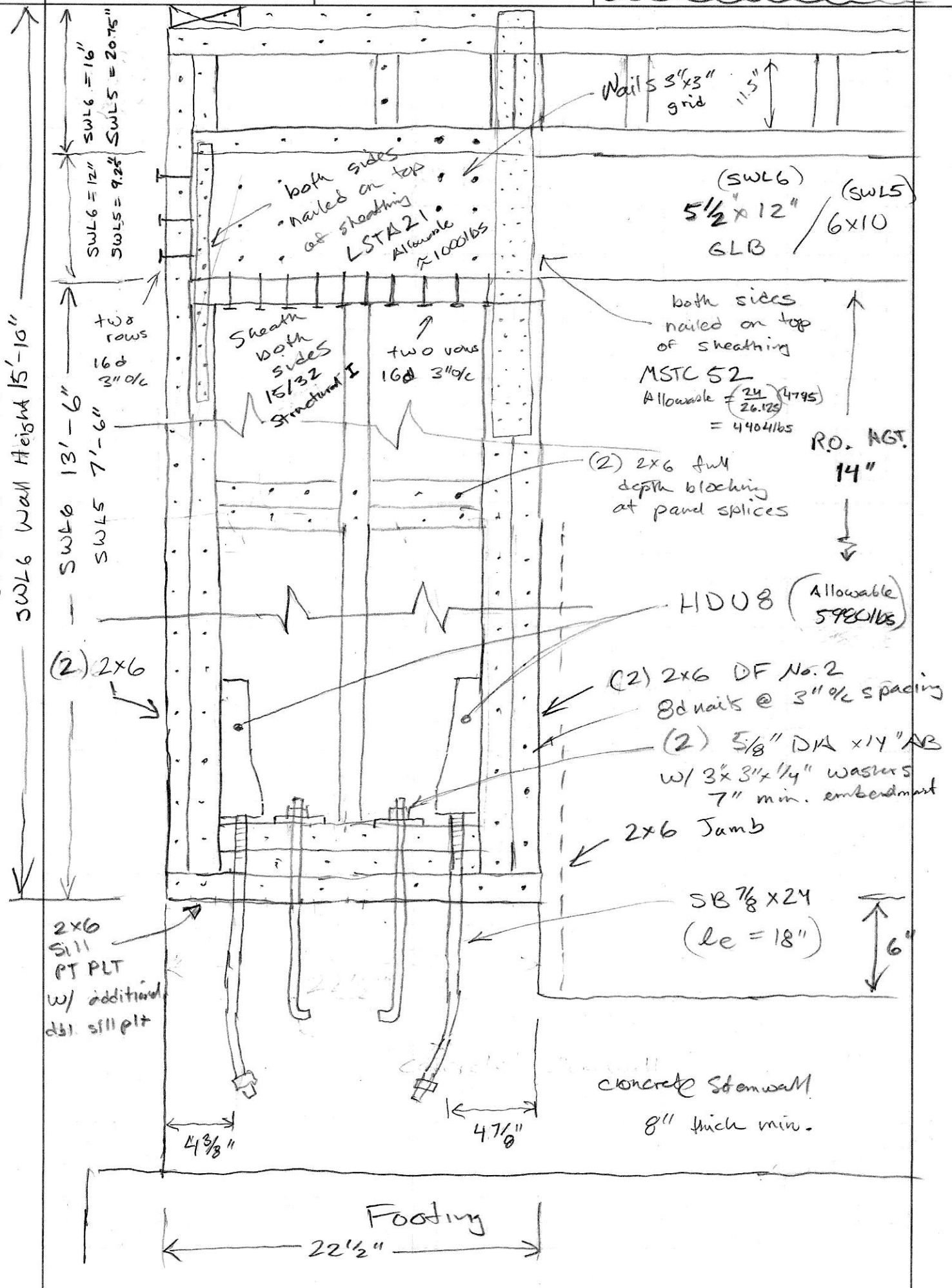
(NTS)

Portal Frame Detail (21)



Garage Portal Frame Analysis

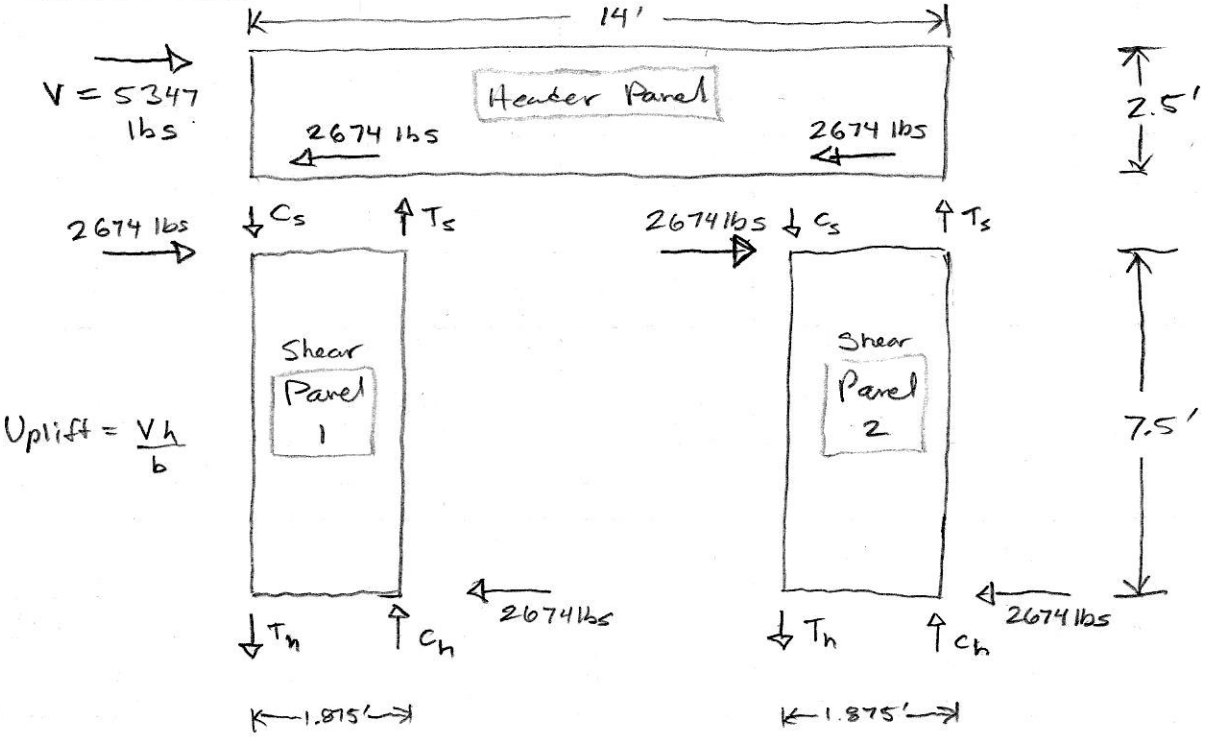
See diagram on page (21) for dimensions and specific details of construction:

1.) We assume that we will sheath both sides of portal frame with 7/16 OSB w/ 8d nails spaced at 3" o/c in all members edge and intermediate with double 2* blocking at seams.

2.) We also assume that the total uplift force from the applied shear load will be equally shared by the holdowns at the sill plate and the tension straps / studs at the shear panel / header interface.

3.) We neglect any tensile capacity offered by the OSB at shear panel / header interface (conservative)

SWL 5: "FBD"



From assumption #2 : Uplift = $T_n + T_s$

$$\text{Uplift} = \frac{2674 \text{ lbs} \times 7.5 \text{ ft}}{1.875 \text{ ft}} = 10,696 \text{ lbs}$$

$$T_n = C_n = T_s = C_s = \frac{\text{Uplift}}{2} = \underline{5348 \text{ lbs}}$$

Check allowables of hardware & connections

A.) HDU8 allowable = 5980 lbs > 5348 lbs $\Rightarrow$ OK

B.) MSTC52 allowable = $4745\left(\frac{24}{26.125}\right)$ = 4400 lbs

assume straps installed interior / exterior of wall :

(2X) MSTC52 = 8800 lbs > 5348 lbs $\Rightarrow$ OK

c.) At shear panel #2 tension load is taken by DF No. 2 stud (2x6) and two LSTA21 straps.

for 2x6 stud : $A_t = 1.5 \times 5.5 = 8.25 \text{ in}^2$

$F'_t = F_t (C_D)(C_F) = 575 (1.6)(1.3) = 1196 \text{ psi}$

$P_{allow} = F'_t A_t = (1196)(8.25) = \underline{9867 \text{ lbs}}$

LSTA21 allowable = 1235 lbs

Then : Straps + stud = 2 (1235) + 9867 = 12,337 > 5348 $\Rightarrow$ OK

d.) Bearing on sill plate : $C_b = 1.0$ (conservative)

$F'_{c\perp} = 625 \text{ psi } (1)(1)(1)(1) = 625 \text{ psi}$

$A_b = 2(5.5)(1.5) = 16.5 \text{ in}^2$

$f'_{c\perp} = \frac{C_n}{A_b} = \frac{5348 \text{ lbs}}{16.5 \text{ in}^2} = 324 \text{ psi} < 625 \text{ psi} \Rightarrow$ OK

Unit Shear Check :

$v = 2674 \text{ lbs} / 1.875 \text{ ft} = 1426 \text{ plf}$

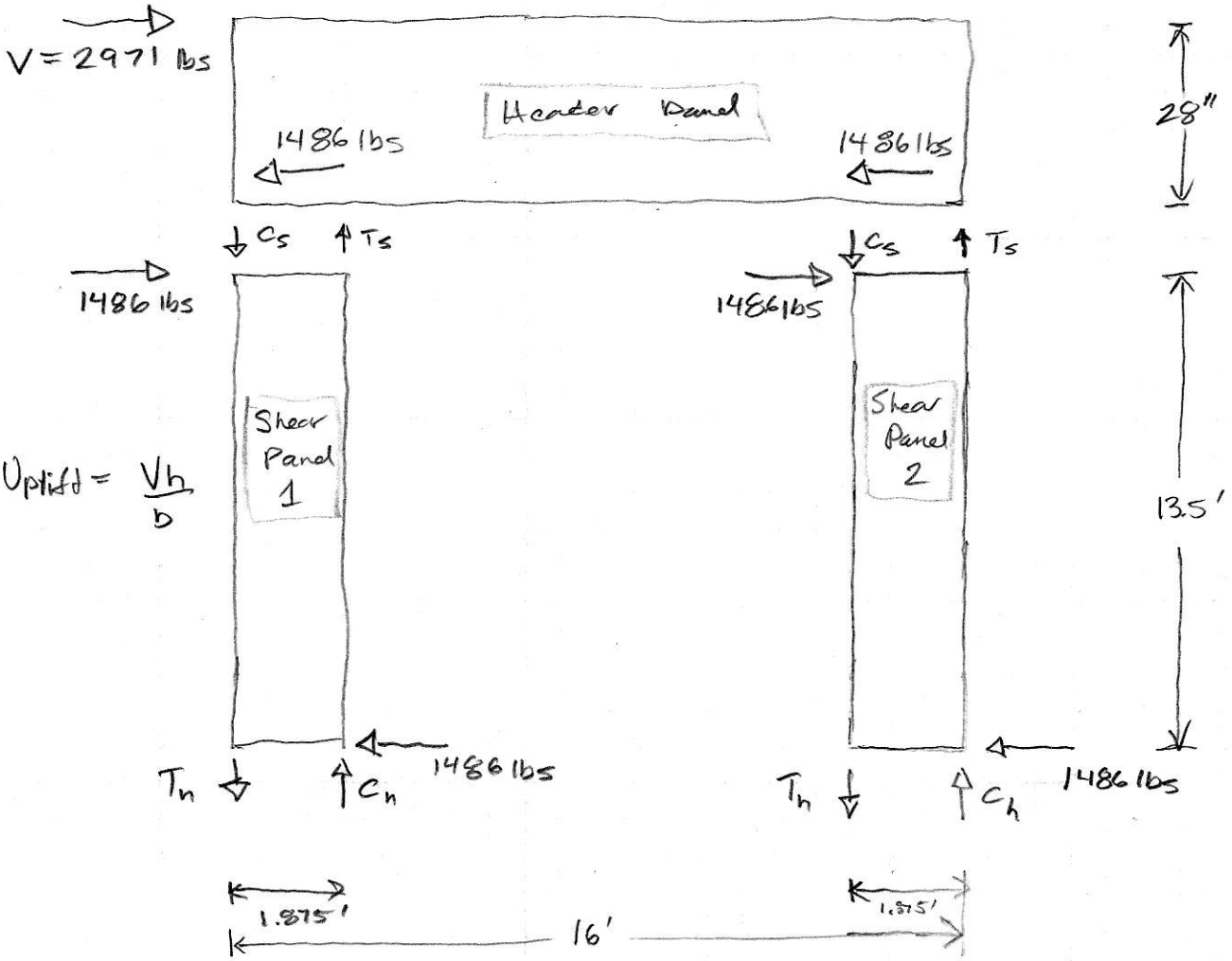
for 15/32 Structural I panel @ 3" o/c spacing

$v_a = \frac{1540\ plf}{2} \times 2 = 1540\ plf > 1426\ plf \Rightarrow OK$

Use 15/32 Structural I sheathing both sides w/8d nails @ 3" o/c edges, 3" o/c field, block all panel edges with 3x or double 2x

header panel will be sheathed both sides for continuity, however center span can be nailed w/ 8d 3" o/c edges, 6" o/c field.

SWL 6 : "FBD"



From Assumption # 2: $\text{Uplift} = T_n + T_s$

$$\text{Uplift} = \frac{1486 \text{ lbs} \times 13.5 \text{ ft}}{1.875 \text{ ft}} = 10{,}699 \text{ lbs}$$

$$T_h = C_n = T_s = C_s = \frac{\text{Uplift}}{2} = 5349 \text{ lbs}$$

Note that this uplift is identical to the values in SWL5. Assuming identical construction with regards to framing and hardware all connection checks are the same as SWL5 and good by inspection.

Unit Shear Check:

$$v = 1486 \text{ lbs} / 1.875 \text{ ft} = 792.5 \text{ plf}$$

for 15/32 Structural I panel @ 3" o/c spacing

$$v_a = \frac{1540 \text{ plf}}{2} \times 2 = 1540 \text{ plf} > 792.5 \text{ plf} \Rightarrow \text{OK}$$

Note that shear capacity is very conservative with this nailing and sheathing grade however for this shearwall we are trying to increase stiffness and minimize deflection so a conservative approach is justified.

Note: that SWL5 Portal Frame falls within envelope of prescriptive standard in IBC whereas SWL6 Portal Frame's height is non-standard hence additional engineering checks and application of sheathing to both sides of portal frames

1) SWL5 for high shear load / unit shear
2) SWL6 for increase of stiffness