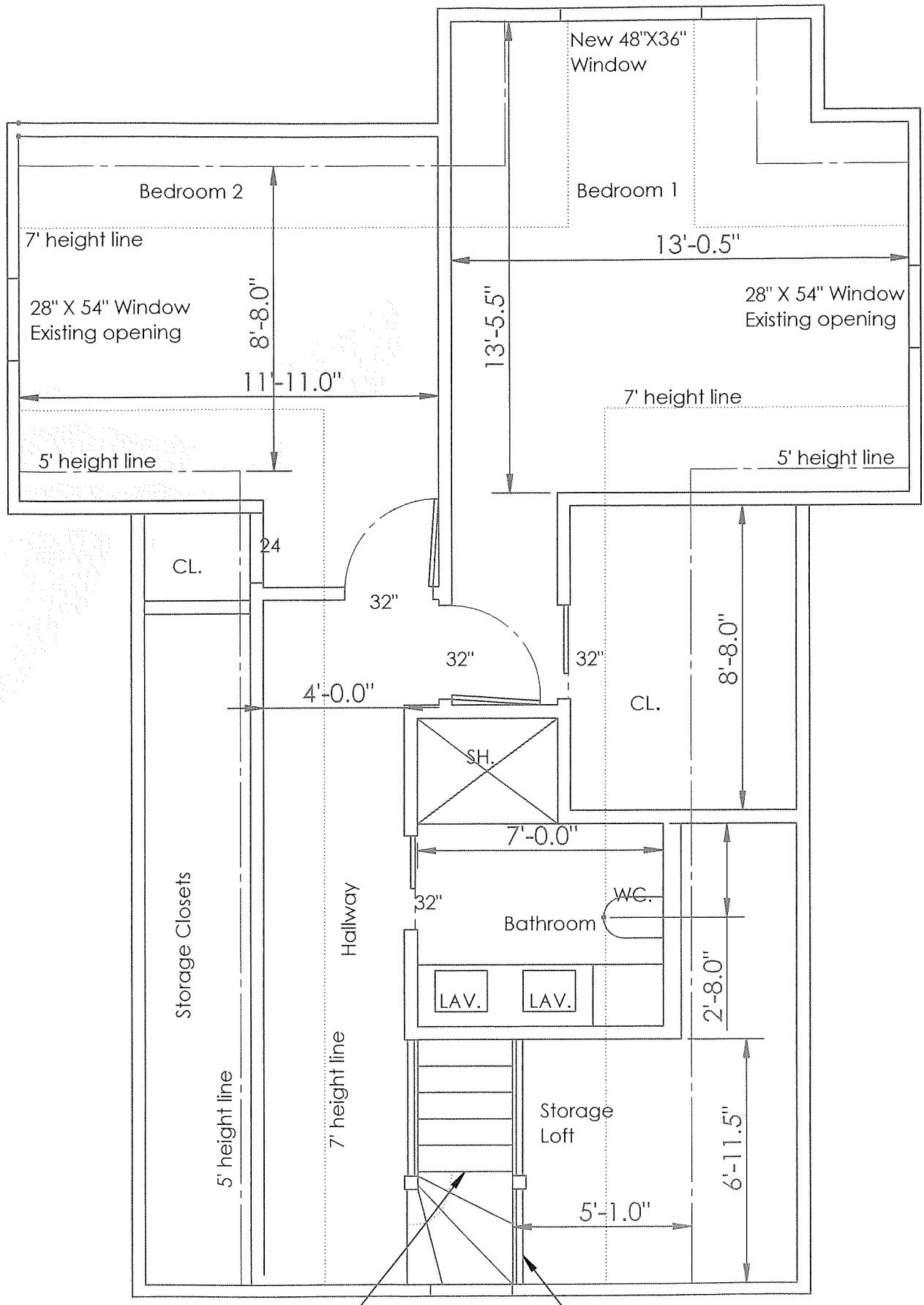
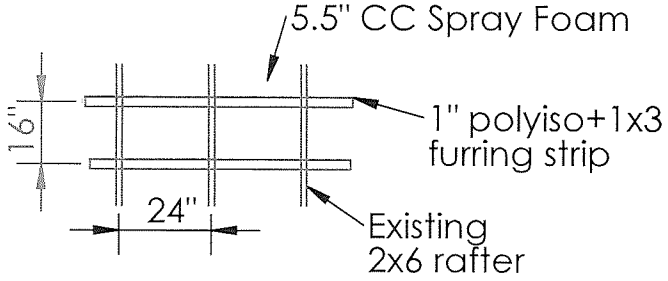
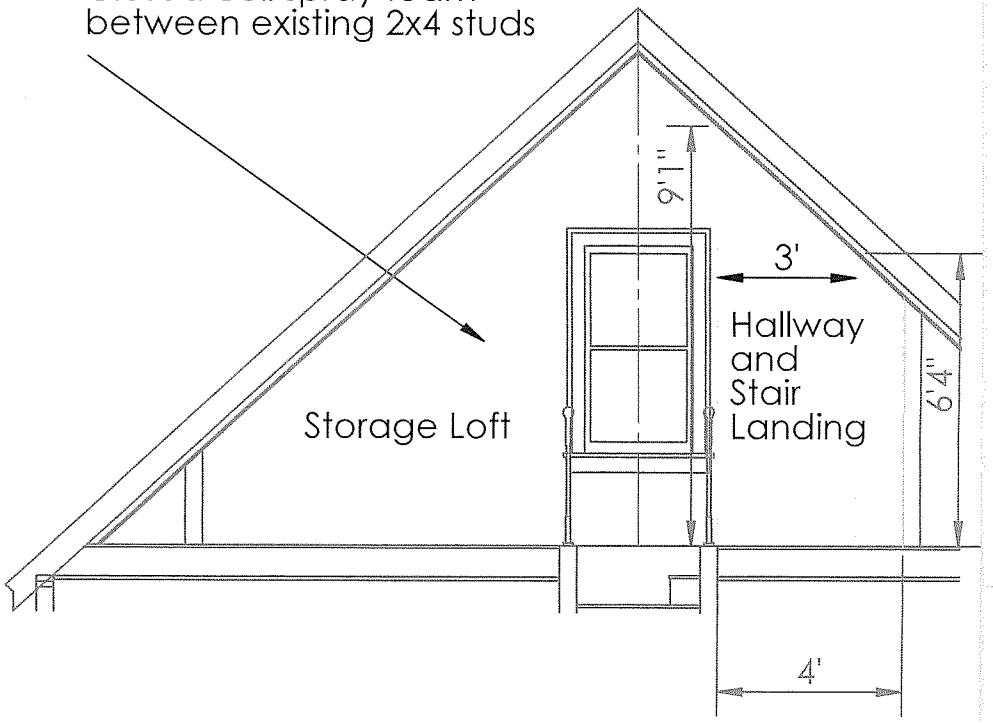


SCALE 1/4" = 1'
609 Russell St

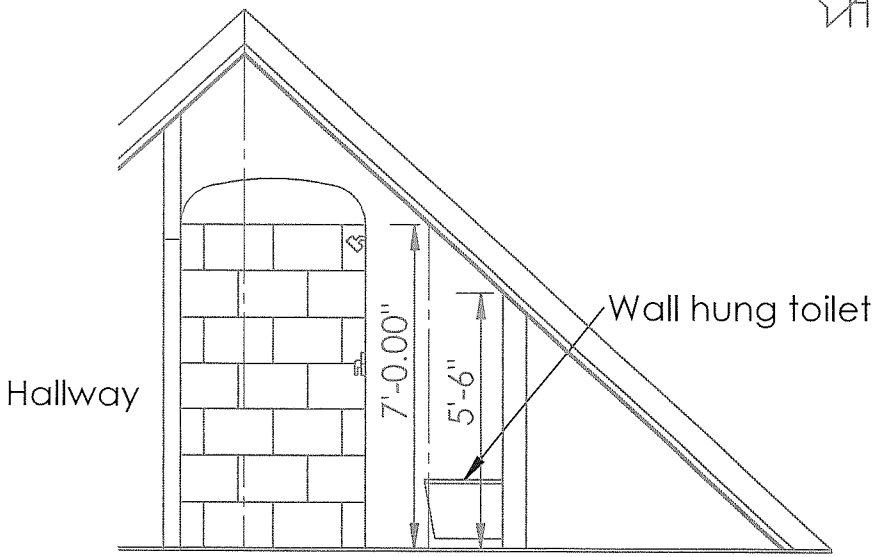
Roof Insulation
- 1" Polyiso strip + 1x3 furring strip perpendicular to existing 2x6 rafters
- Fill existing 2x6 rafter bay with closed cell spray foam



Wall insulation
Closed cell spray foam between existing 2x4 studs



Hallway constrained by existing stair opening. Requires variance for head height

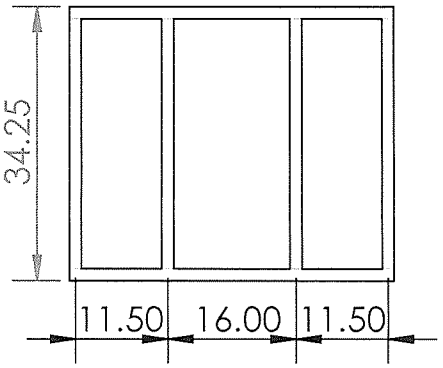


7' clearance above all bathroom fixtures

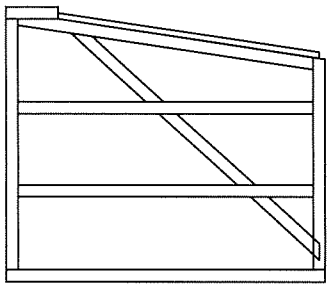
TITLE: Stair landing, hallway, bathroom heights

SIZE	DWG. NO.	REV
A	609 Russell	
SCALE: 1:50	WEIGHT:	SHEET 1 OF 1

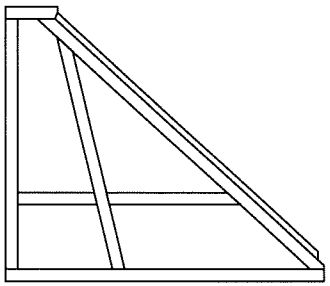
Winders SCALE: 1/4" = 1'



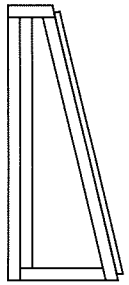
Existing Platform (2x4)



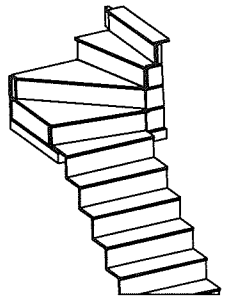
1. First Winder Ripped (2x8)



2. Second Winder (2x8)

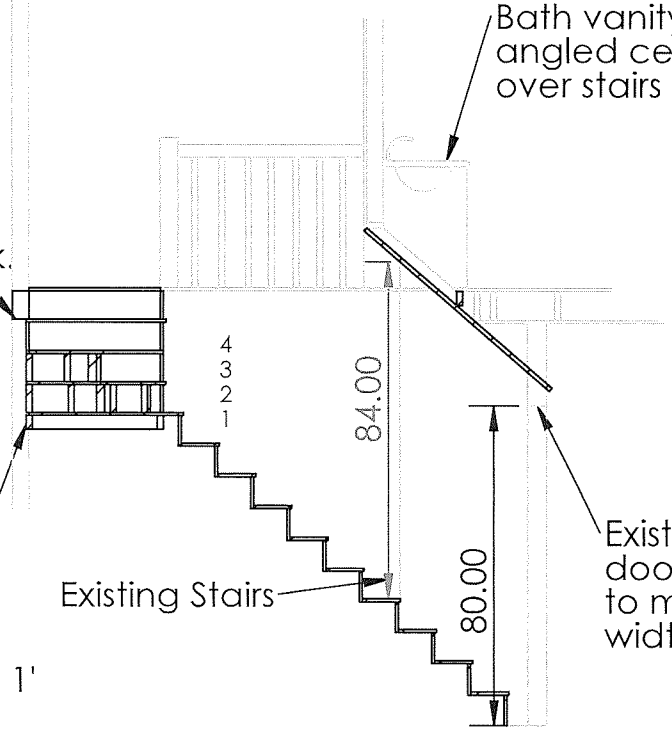


3. Third (2x8)



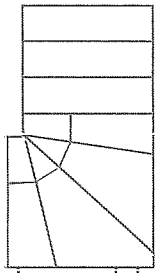
3D View

New winder boxes built on top of existing platform. Ripped 2x8s with 3/4 Plywood deck. Detail above

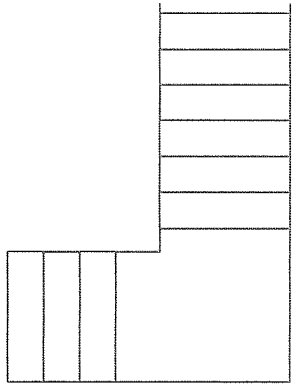


SCALE: 1/8" = 1'

4. Top



New layout to rise quicker and meet appropriate landing head height



Old layout with platform

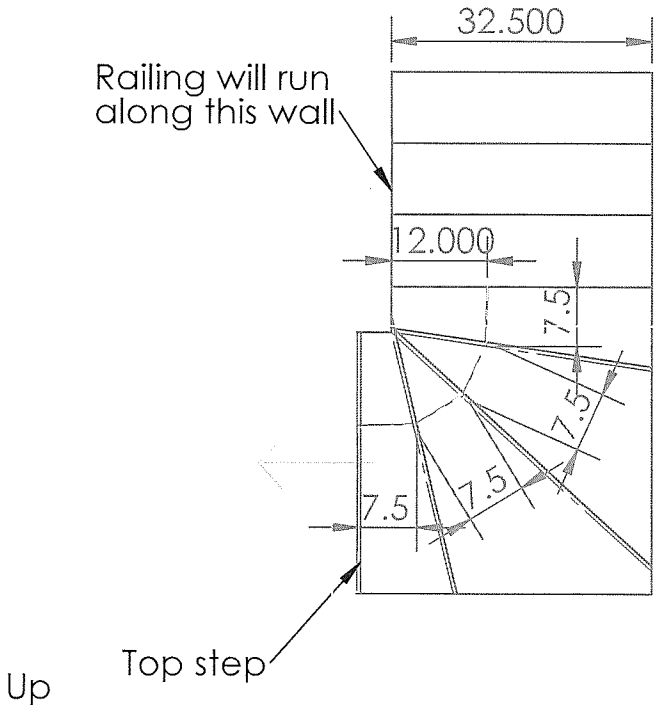
TITLE:

Winder Stair Details

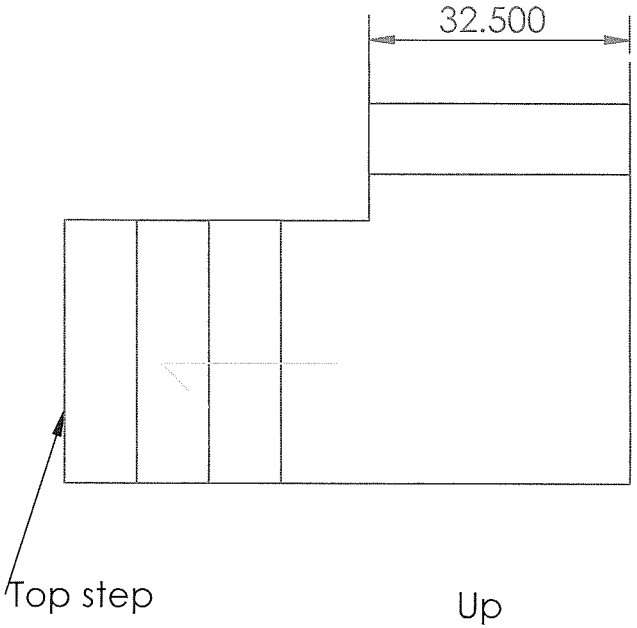
SIZE	DWG. NO.	REV
A		

SCALE: 1:48 WEIGHT: SHEET 1 OF 1

New Stair Layout



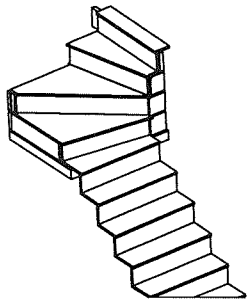
Existing stair layout



Each winder tread 7.5" depth at 12" from the center post in the line of travel

Straight Tread depth 9.5"
Tread height 7.75"

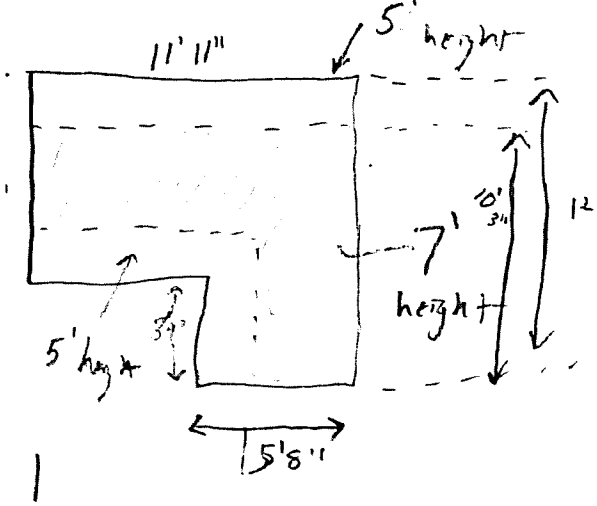
SCALE: 1/2" = 1'



3D View

TITLE: Winder Stairs Details		
SIZE A	DWG. NO.	REV
SCALE: 1:24	WEIGHT:	SHEET 1 OF 1

Smaller Bedroom (2)



< 5' height

11'11" x 8'8" + 5'8" x 3'4" − 8" x 2.5'

143" x 104" + 68" x 40" − 8" x 30"

= 17,357 in² → 120.5

< 7' height

5'2" x 11'11" + 5'1" x 3'3"

62" x 143" + 61" x 39"

= 11,245 in² → 78 ft²

50% over 7'?

$\frac{< 7' \text{ height}}{< 5' \text{ height}} = \frac{78 \text{ ft}^2}{122.2 \text{ ft}^2} =$ 64% > 7' height ✓

Glass Area

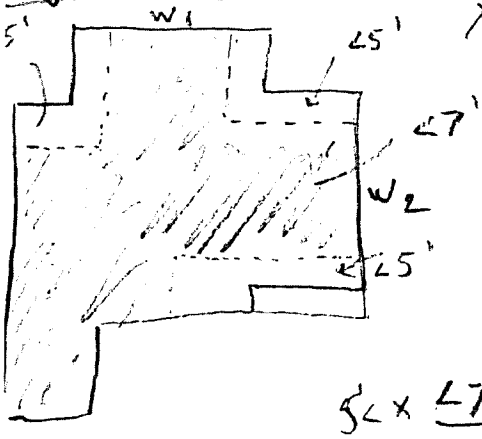
8% x 120.5 = 9.64 ft²

Windows = 61" x 23"

= 9.74 ft²

glass area > 8% ✓

Larger Bedroom (1)



X > 7' = 3'7" x 5'11" + 13'.5" x 5'2" + 6'.5" x 3'

+ 2'5" x 16.5"

43" x 71" + 161" x 62" + 72.5" x 36" + 29" x 16.5"

3053 + 9982 + 2610 + 478.5

= 16,123.5 in² → 112 ft² > 7'

Window Glass

122+48 x 8% = 13.6 ft² req

W2 = 9.74 ft² (same as above)

W1 = 19 in x 31"

= 4.09 ft²

W1 + W2 = 13.8 ft²

glass area > 8% ✓

5< x < 7' 5'11" x 3'4" − 4'2" x 1'6.5"

+ 5'11" x 6' 1.5" − 4'2" x 4'4"

+ 8'8" x 2'5" − 8" x 6'3"

71 x 40 − 50 x 18.5 → 2840 − 925 = 1915

71 x 73.5 − 50 x 52 → 5218.5 − 2600 = 2618.5

104 x 29 − 8 x 75 → 3016 − 600 = 2416

6950 in² → 48 ft²

$\frac{X > 7'}{< X < 7'} = \frac{122}{122+48}$

= 72%

< 7' height ✓

Main Girder Structural Calcs for Attic Conversion

609 Russell St

Max Brennan

Summary

Existing girder not sufficient with existing spans

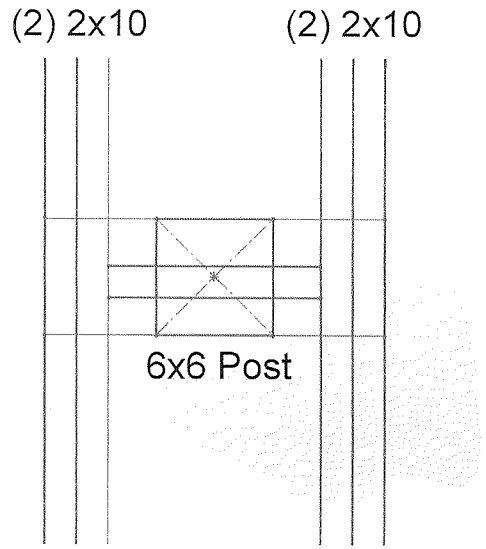
Add 3 new columns to reduce span lengths to acceptable with existing girder

Add LVL to one span to increase strength to acceptable

Calculations show 3.5"x5.5" LVL okay for column-top "mini" beams to support girder

For 3 new columns and replace for 1 existing column

Existing Basement Girder



Top View

Built up from (2) sistered 2x10 spaced 10" from (2) sistered 2x10 with 2x10 blocking in between. (4 total 2x10 parallel)

Supported by 6x6 posts with 4 span lengths: 10' , 8.25' , 8.5' , 10.5'

10.5' span supports one side of house and is (3) sistered 2x10

House is 26' wide → 40L/10D = 650 plf per floor

With 2 floors → W = 1300 plf.

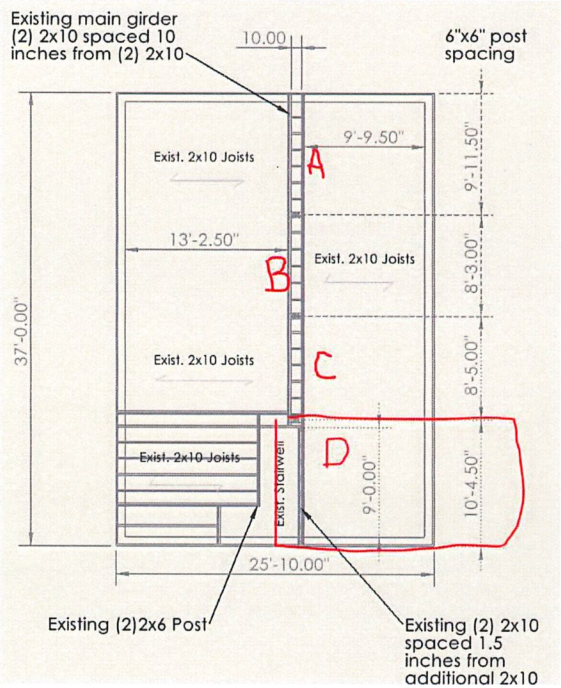
S for (4) 2x10 = 21.4 in^3 * 4 = 85.6 in^3
fb = M_allow/S
M_allow = 962.5 lb/in^2 * 85.6in^3 * [1ft /12in] (962.5 psi from handout)
M_allow = 6866 [ft-lb]

M_allow = W * L_allow^2 / 8
L_allow = sqrt(M_allow * 8 / W)
L_allow = sqrt(6866 * 8 / 1300)

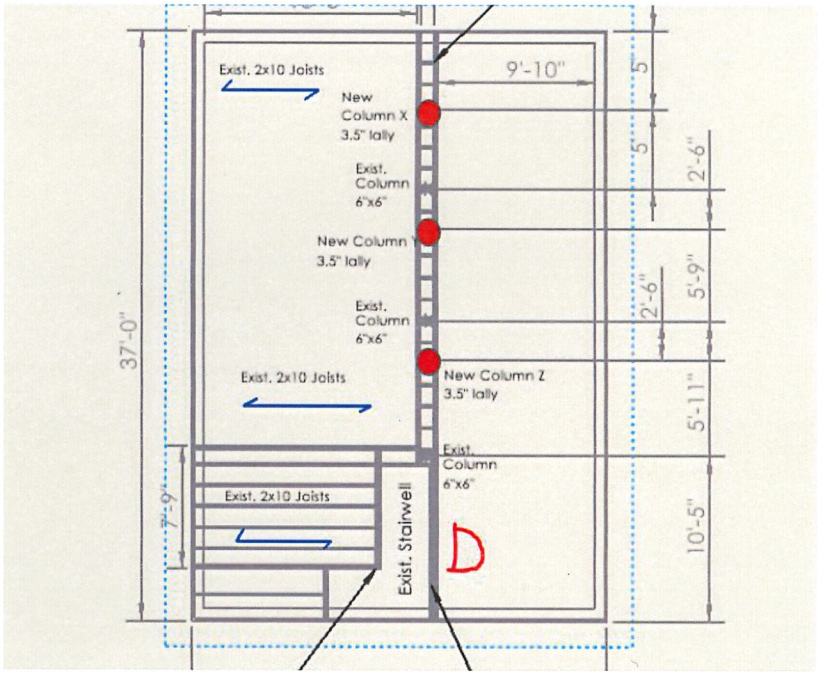
L_allow = 6.5' (allowable span is 6.5' with existing girder design supporting two floors)

Current spans not acceptable.
Add columns to make maximum girder span <6.5'

Existing Column Spans

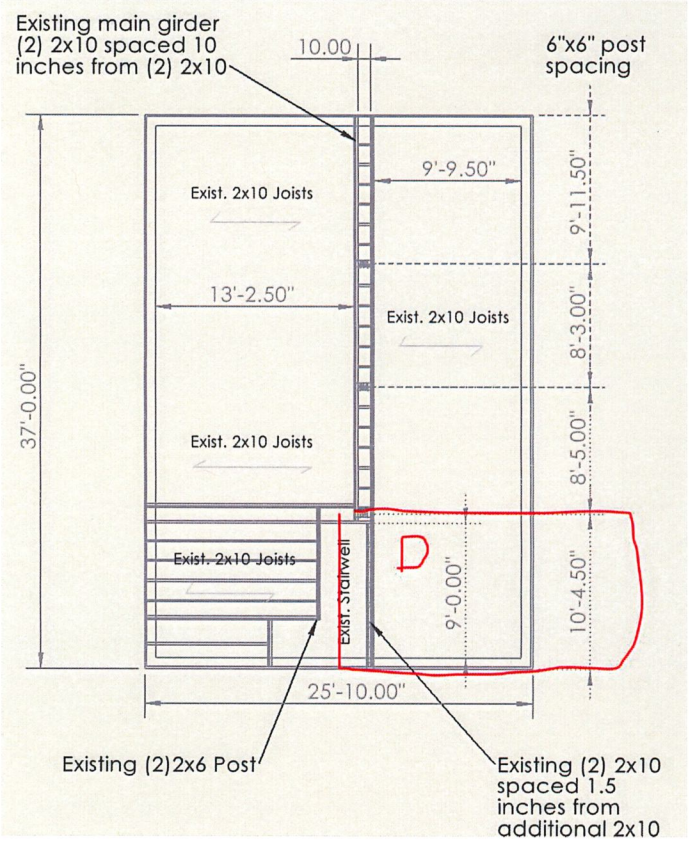


New Columns



Add 3 new columns so that maximum span is 5'11" except span D (see next page)

Span D



Previous Existing:

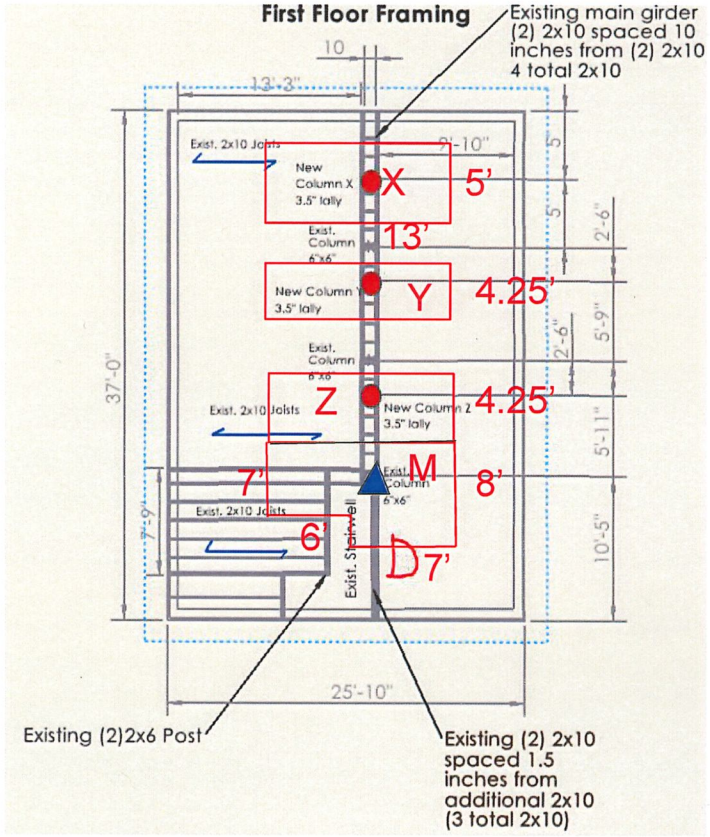
First floor: 11': @ 40 L 10 D = 550 plf → half to beam = 275 plf
2nd floor: 11' wide @ 40L 10D = 550 plf → half to beam = 275 plf
Stairwell: 3' @ 40L/10D / half to beam = 75 plf
W = 625 plf
L = 10.5' span
M_calc = W * L^2 / 8
625 * 10.5^2 / 8
8610 ft-lb (load not allowable with current (3) 2x10 built up beam and 10.5' span.

Add (2) 9.25"x1.75"LVL (ignore contribution from (3) 2x10s
M_calc = 8610 ft-lb (from above)

S for 9.25"x1.75"LVL → S = b*d^2 / 6 = 1.75 * 9.25 ^2 . 6 = 25 in^3

fb = M_calc/Sreq → Sreq = M_calc / fb
Sreq = 8610 ft-lb / 3000lb/in^2 * [1ft /12in] (Fb = 3000 from vendor)
Sreq = 34.4 in^3

(2) 9.25"x1.75"LVL has S of 50 in^3 and can support 625 plf for 10.5' span



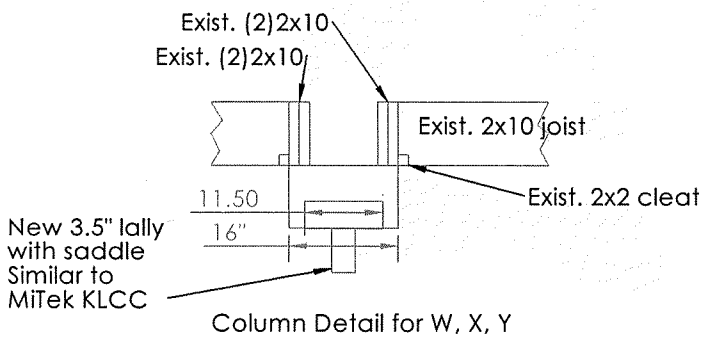
Tributary area for column X
13' x 5' = 65 sqft * (40L/10D) = 3250 lbs
x2 floors = 6500 lbs
→ requires 20" dia footing

Tributary area for Y and Z
13' x 4.25' = 55.5 sft * (40L/10D) = 2775 lbs
x2 floors = 5550 lbs
→ requires 19" dia footing

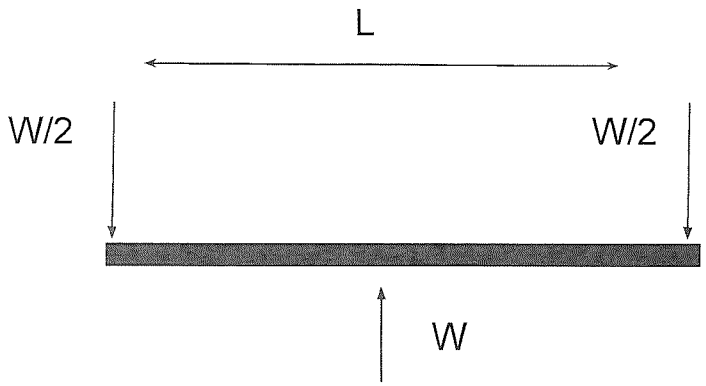
Tributary area for existing column M
7' x 6' + 8 * 7 = 98 sqft * (40L/10D) = 4900 lbs
x2 floors = 9,800 lbs
Subtract stairs area (only count once)
- 3' x 4' = 12 sqft * 40L/10D = 600 lb
= 9,200 lbs
→ okay with existing standard footing

Use 24" dia x 12" thickness footings for each new column X,Y,Z

New Column X, Y, Z Detail



Column Detail for W, X, Y



Highest loaded new column is M: 9200 lbs.
Calculate needed crossmember size for new columns:

Moment:
Mmax = W * L / 4 (Beam with center point load supported on both ends)
W = 9200 lb L = 16" = 1.333'
Mmax = 9200 * 1.333' / 4 → 3066 lb-ft

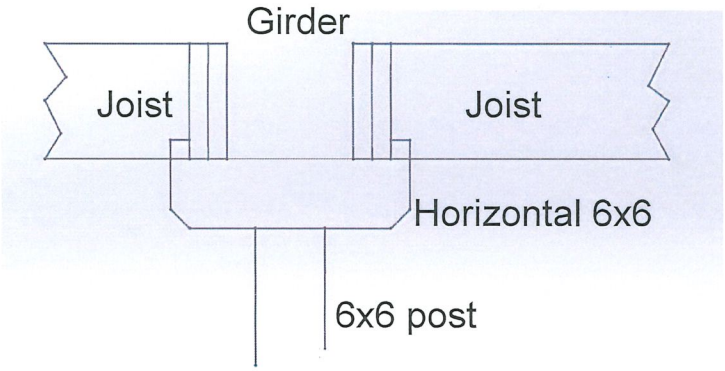
fb = Mmax/Sreq
Sreq = Mmax/fb
(fb allowable = 3330 psi (Weyerhaeuser 5.5 LVL))
Sreq = 3066 lb-ft * (12 in / 1 ft) / 3330 lb/in^2 → 11 in^3

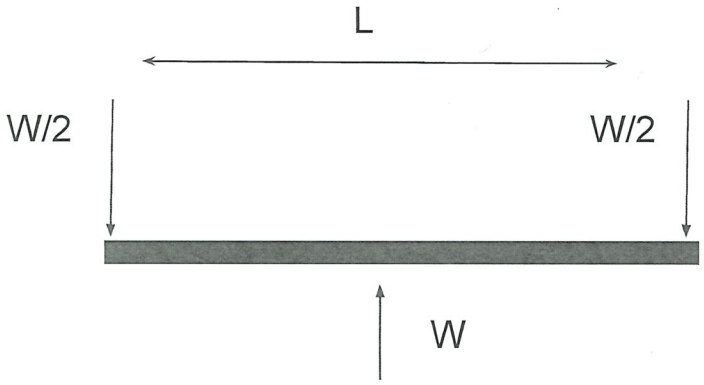
S for (2) 1.75" x 5.5' LVL is 17.6 in^3 > Sreq so this solution works for 9200 lb loaded column

Horizontal Shear:
Vmax = w * L / 2
Vmax = 9200 lb * 1.333' / 2 = 6133 lb

Fv = 3 * Vmax / 2 / A
A = 2 * 1.75" * 9.25" = 32.5 in^2
Fv = 3 * 6133 lb / 2 / 32.5 in ^2 → 94.5
285 allowed per manufacturer literature so okay (Weyerhaeuser)

Existing Column M Detail





Highest loaded new column is X: 9200 lbs.
Calculate crossmember loading (horizontal 6x6 on 6x6 post)

Moment:
Mmax = W * L / 4 (Beam with center point load supported on both ends)
W = 9200 lb L = 16" = 1.333'
Mmax = 9200 * 1.333' / 4 → 3066 ft-lb

Current 6x6. Assume data for (3) 2x6
fb = Mmax/Sreq
Sreq = Mmax/fb
(fb allow = 1137 psi – permit office handout)
Sreq = 3066 lb-ft * (12 in / 1 ft) / 1137 lb/in^2 → 32.4 in^3

S for (3) 2x6 is 22.7 in^3 < Sreq so current column top insufficient

Replace with 3.5"x5.5" LVL on existing 6x6 post for Column M
- Calculations on previous page show this is acceptable

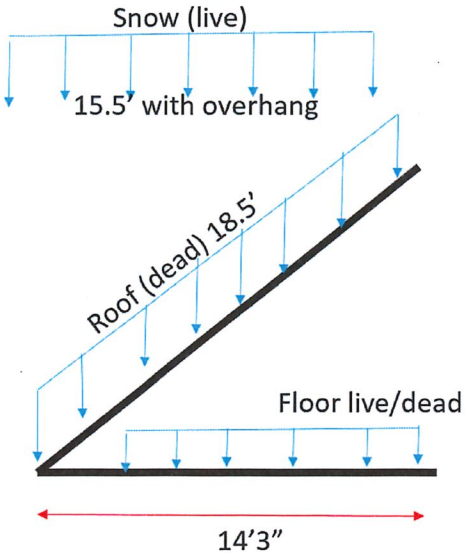
Other two existing columns acceptable as is:
W = 5550 lb → Mmax = 1833 ft-lb
Sreq = 19.3
S for (3) 2x6 is 22.7 so existing horizontal 6x6 is acceptable

Calculate header size required for dining 5'7" Rough opening dining room window using HUD Residential Structural Design Guide 2nd Ed. (Following ASD design methodology)

- Follow Example 5.5 on page 5-62
- Kitchen header is same rough opening but less load

Required header span = 5'7"
Species and grade = SPF No2

Loads on header



Snow load adjustment for sloped roof from SPS 321.27(c):
Cs = 1 - ((a - 30)/40). 11/12 pitch roof = 42.5 deg
Cs = 1 - ((42.5 - 30)/40) = 0.6875
Snow load = 0.6875 * 30 = 20.64 psf

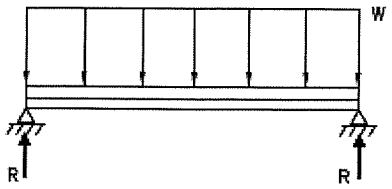
Floor 14'3"

3'6" is inaccessible attic (count as ceiling without storage @ 5 psf live (Table 321.02-1))
10'9" is floor @ 40 psf live (Table 321.02-1)
Half span load supported by interior wall
Floor Live: 3.5 * 5 + 10.75 * 40 = 17.5 + 430 = 447.5 / 2 = 223.75 plf
Floor Dead: 14'3" * 10 psf = 142.5 / 2 = 71.3 plf
Roof Dead: 18.5' * 15 psf = 277.5 plf
Snow: 15.5' * 20.63 psf = 319.8 plf

ASD (allowable stress design) load combination:
D + 0.75L +0.75S =
(71.3 + 277.5) + 0.75(223.75) + 0.75(319.8) = 756.5 plf

Find

Determine header size required



Design values from building permit office handout

Fb = 875 (allowable bending)
Fv = 135 (allowable shear)
Fcperp = 335 psi
E = 1.1x10^6 psi

Lumber Property Adjustments

Cr (repetitive member factor) = 1.2 (2x8 double header per table 5.3 pg 5-13)
- Note 3: two ply built up member of #2 grade use Cr of 1.2

CD = 1.15 (snow load)
- Where more than one load type is specified the load duration factor associated with the shortest duration is applied to the entire combination of loads

CF (size factor) = 1.2 (2x8) from example 5.5 page 5-62
CH (horizontal shear factor) = 2
Cb (bearing area factor) = 1
CL (beam stability factor) = 1.0 laterally supported

Structural Safety Checks:

$f_b \leq F'_b$ basic design check for bending stress

$F'_b = F_b$ x (applicable adjustment factors, per section 5.2.4)

$f_b = \frac{Mc}{I} = \frac{M}{S}$ extreme fiber bending stress caused by bending moment from transverse load

fb < F'b (calculated bending stress has to be less than adjusted allowable bending stress)
F'b = Fb * CD * Cr * CF * CL = (875)(1.15)(1.2)(1.2)(1.0) = 1449 psi
With double top plate Fb increased by 5% (from example 5.5 "Header System Design" on page 5-62
Fb' = 1449 psi * (1.05) = 1521.5 psi (allowable bending stress with adjustment factors)

Mmax = w * L ^ 2 / 8 = 756.5 plf * 5.583 ft^2 / 8 = 2947.5 ft-lb (Maximum moment)

fb = Mmax/Sreq (bending force = moment / section modulus)

1521.5 lb/in^2 = 2947.5 ft-lb * 12in/ft / Sreq

Sreq = 2947.5[ft-lb] * 12[in/ft] / 1521.5 psi

Sreq = 23.25 in^3 (required section modulus)

S 2x8 (Section modulus for 2x8 (matches handout)
S = I / c = b * d^2/6 = 1.5 * 7.25 * 7.25 / 6 = 13.14 in^3

S (2)2x8 = 13.14 * 2 = 26.2 in^3
S (2)2x8 > Sreq
26.2 in^3 > 23.25 in^3 (2)2x8 is okay

Check horizontal shear:
Vmax = w * L / 2 (Load * Span / 2)
= 756.5 plf * 5.583 / 2 = 2111.8 lb

Fv = 3 * V / 2 / A 3 * shear / 2 / Area
= 3 * 2111.8 lb / 2 / 2 / 1.5 in / 7.25 in
= 145.64

F'v = Fv * CD * CH
= 135 * 1.15 * 2 = 310.5 psi

F'v > Fv so (2)2x8 is okay

Bearing
SPS321.25(3)2 Headers greater than 3 feet but less than or equal to 6 feet in length shall be directly supported on each end by the single common stud and a shoulder stud

Check deflection:
DeltaMax = 5wL^4/384/E/I
= 5 * (756.5) * 5.583^4 * (1728 in^3 / ft^3) / 384 / 1.1x10^6 / 47.6 / 2
= 0.158 in deflection

DeltaAll = L / 240 = 5.583 ft * 12in/ft / 240 = 0.279 in allowable

DeltaMax < DeltaAll so (2)2x8 is okay for deflection

(7) FLOOR OPENINGS. Trimmers and headers shall be doubled when the span of the header exceeds 4 feet. Headers which span more than 6 feet shall have the ends supported by joist hangers or framing anchors, unless the ends are supported on a partition or beam. Tail joists (joists which frame into headers) more than 8 feet long shall be supported on metal framing anchors or on ledger strips of at least 2 inches by 2 inches nominal.