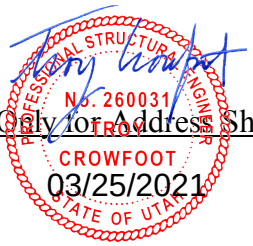
BearGhost Inc.
Structural Engineering
10513 North Iverson Lane, Utah 84003
Phone (801) 360-1200

STRUCTURAL CALCULATIONS

2,099 - One Story
Red Ledges Lot #29
Heber, Utah



Calculations Only for Address Shown Above

March 25, 2021
Job#: 2104

BearGhost Inc.

Design Criteria

Code

2018 International Building Code

Roof

Elevation = 5,771 ft.
Ground Snow = 64 psf
Roof Snow = 45 psf Seismic = 10 psf
Drift Snow = 10 psf Length = 9'-0"
Dead = 25 psf

Live

Live = 40 psf
Dead = 25 psf

Deck

Live = 40 psf
Dead = 25 psf

Walls

Partitions = 10 psf
Exterior walls = 10 psf
Log walls = 30 psf

Wind

V_{3S} = 115 mph Exposure C
(See Wind Sheet)

Seismic

Central Latitude = 40.5137
Central Longitude = -111.3881
0.2 sec. S_S = .537 S_{MS} = .736 S_{DS} = .491 Category D
1.0 sec. S_1 = .190 S_{M1} = .422 S_{D1} = .281 Category D
$V = \frac{S_{DS} * W}{6.5} = .076$ $V = \frac{S_{DS} * W}{3.5} = .140$

Soil Assumed
Q_a = 1,500 psf

WOOD CONSTRUCTION

All phases of work pertaining to wood framing or wood construction shall conform to the requirements listed in Chapter 23 of the 2018 IBC, "INTERNATIONAL BUILDING CODE".

All wood beams, joists and columns shall be #2 Douglas Fir (d.f.) grade lumber or better (U.N.O.) Micro-lam beams shall have a minimum allowable bending stress of 2,600 psi.

All glue laminated timber members shall have the following minimum stress grade lumber:

1. Bending = 2400 psi
2. Tension = 1200 psi
3. Shear = 190 psi
4. Compression parallel to grain = 1650 psi

Glue laminated structural members shall conform to the U.S. Department of Commerce Commercial Standard PS-56 and "AMERICAN INSTITUTE OF TIMBER CONSTRUCTION".

All structural plywood shall be Structural I or Structural II grade.

All plates or other lumber in contact with concrete or within 6 inches of earth shall be Foundation redwood all marked or branded by the Redwood Inspection Service or pressure treated for moisture protection.

Floor joists shall have all blocking, bracing, bridging, and etc. as recommended by the IBC and the manufacturer.

Walls shall run continuous between horizontal support points, unless adequate approved bracing is provided. Horizontal edges of wall sheathing shall be blocked with 2" nominal blocking. Edges of floor and roof sheathing shall be blocked and nailed as indicated on drawings..

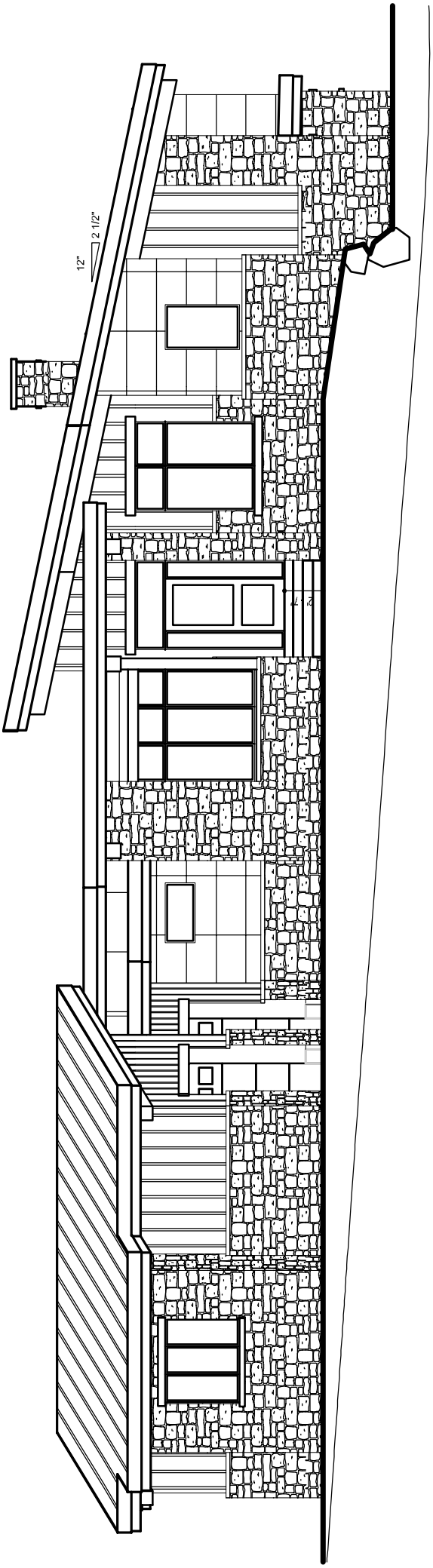
Trusses and/or web joists shall have all blocking, bracing, bridging, and etc. as recommended by the manufacturer.

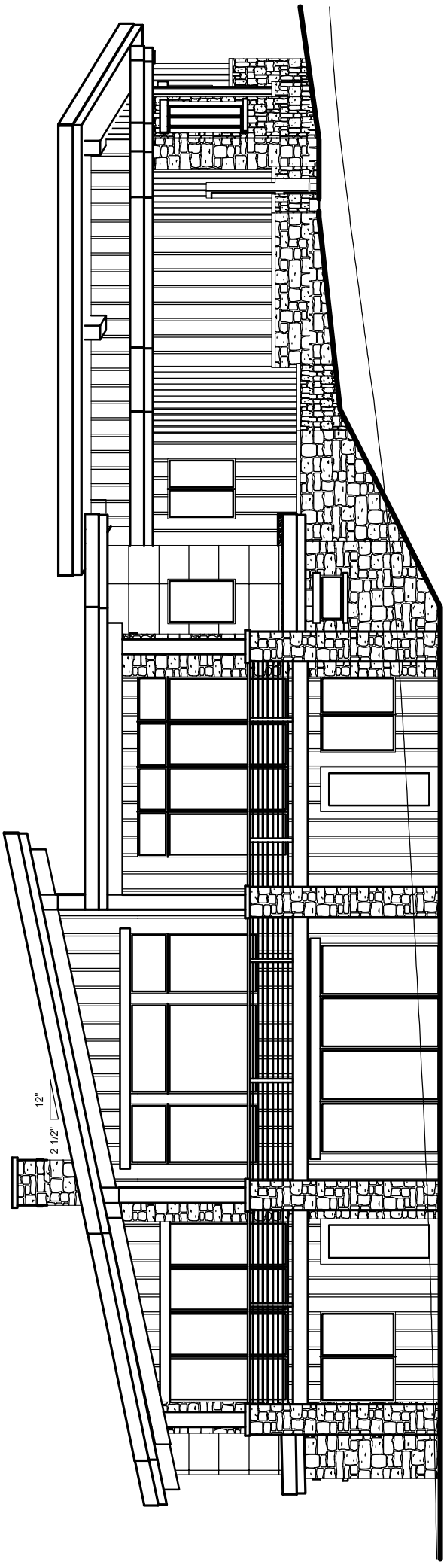
REQUIRED MINIMUM NAILING SCHEDULE: (See IBC Table No. 2304.9.1)

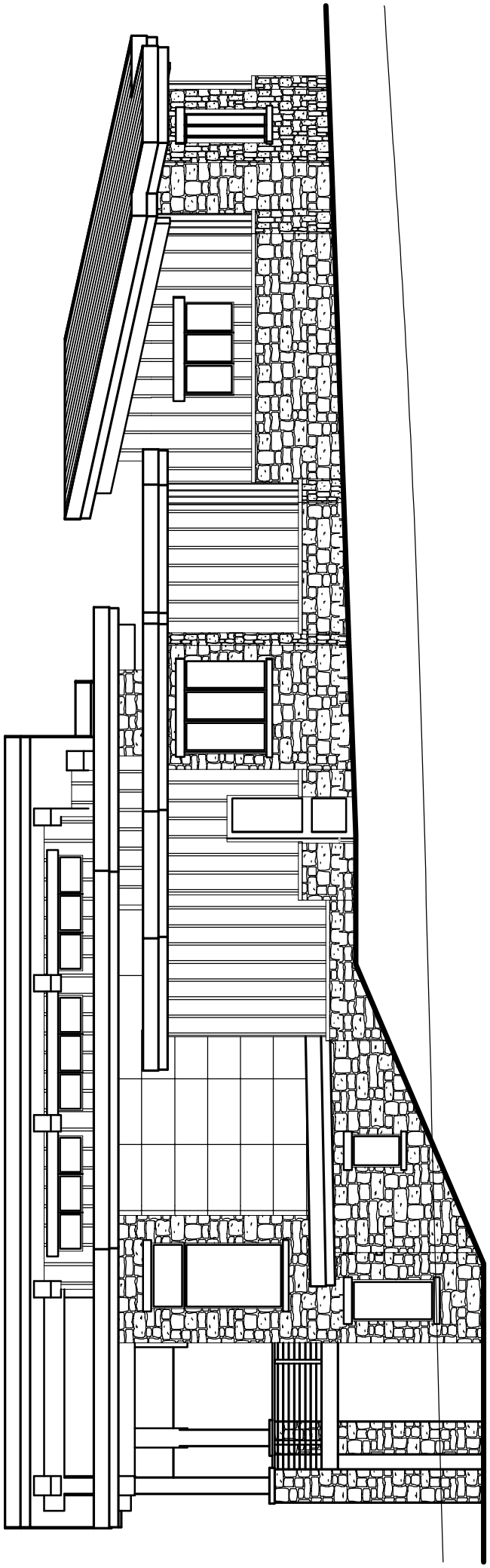
Stud to plates	toenail 4-8d or end nail 2-16d
Roof Blocking	toenail 5-8d nails or 1-A35
Double top plates	face nail 16"o.c. staggered 1-16d
Double top plates Lap Splice	face nail 8-16d nails.
Double studs	face nail 16d at 24"o.c.
Corner stud and angles	16d at 24"o.c.
Rim joist to sill	toenail 16d at 16"o.c.
Joist to sill or girders	2-10d nails
Sole plate to joist/blocking.	face nail 16d at 16"o.c.

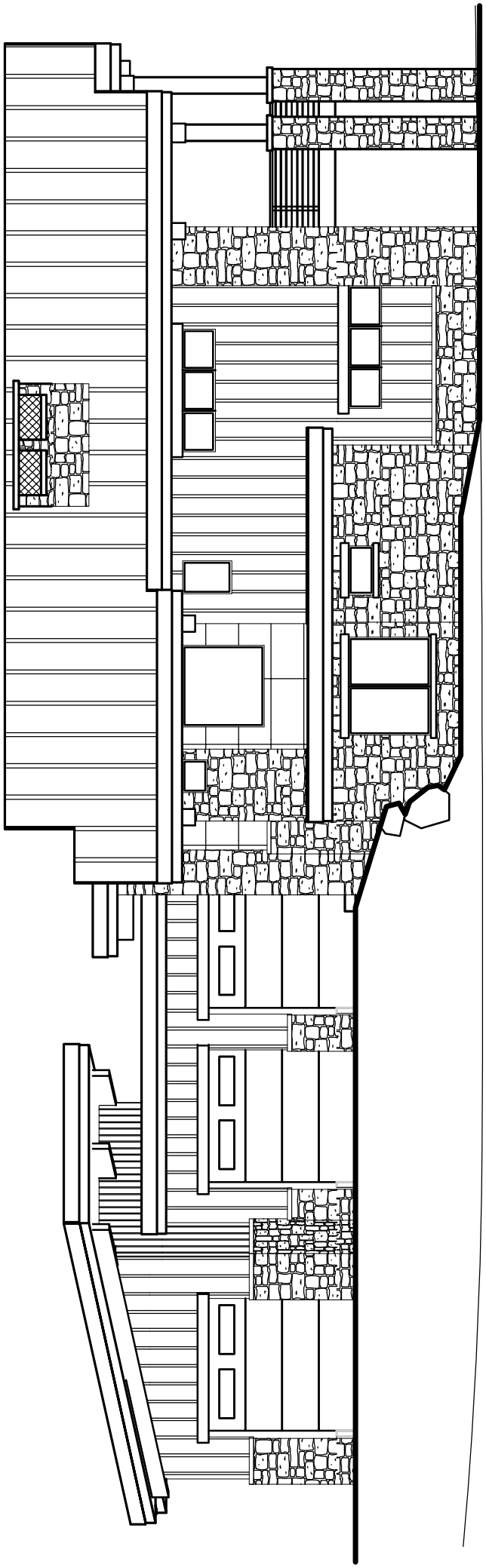
Plywood to roof joists, trusses or studs - see nailing schedule

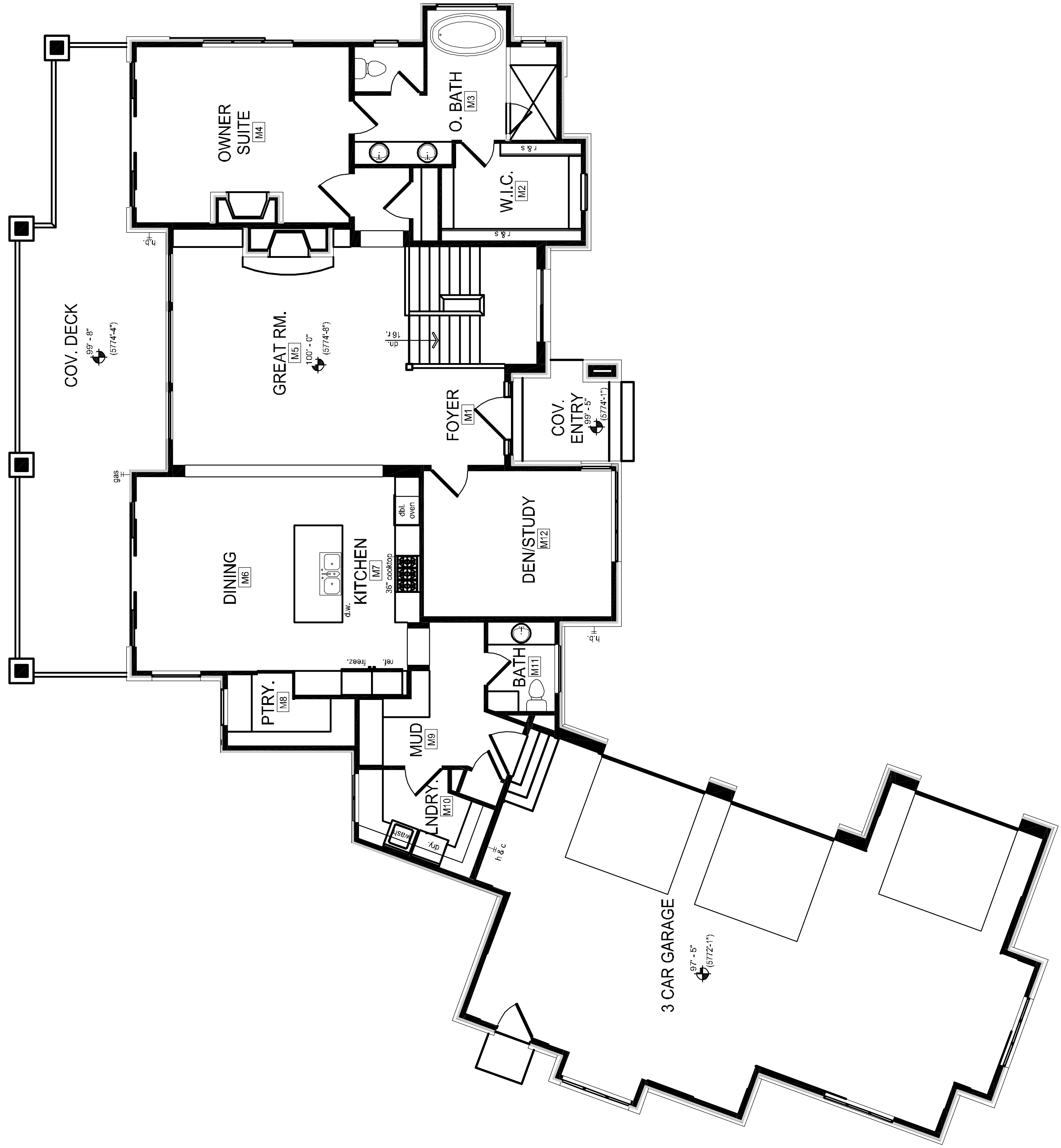
Fasteners, including nuts and washers, and connectors in contact with preservative-treated and fire-retardant-treated wood shall be in accordance with Sections 2304.10.5.1 through 2304.10.5.4. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153.

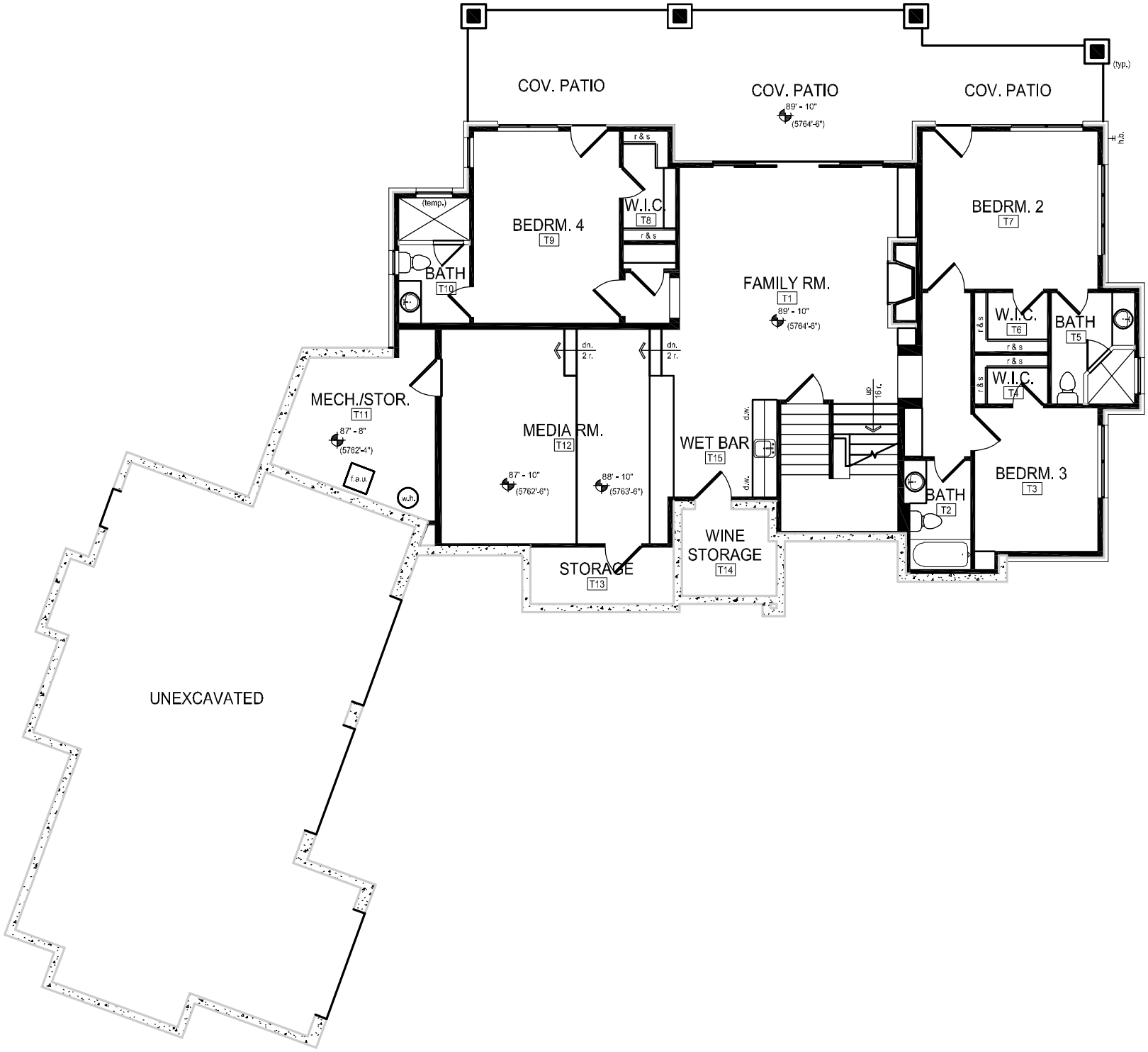

12"
2 1/2"

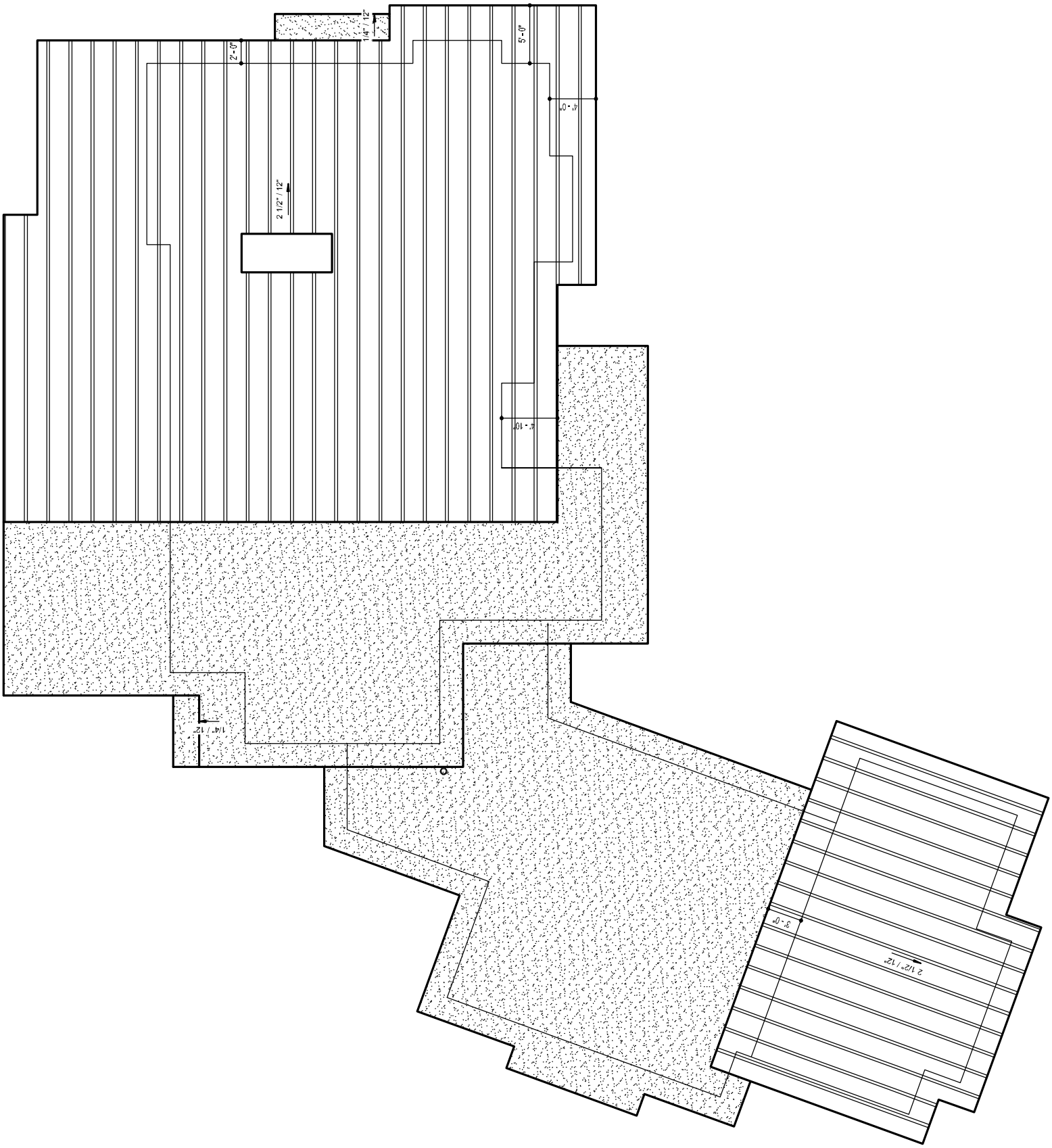

12"
2 1/2"

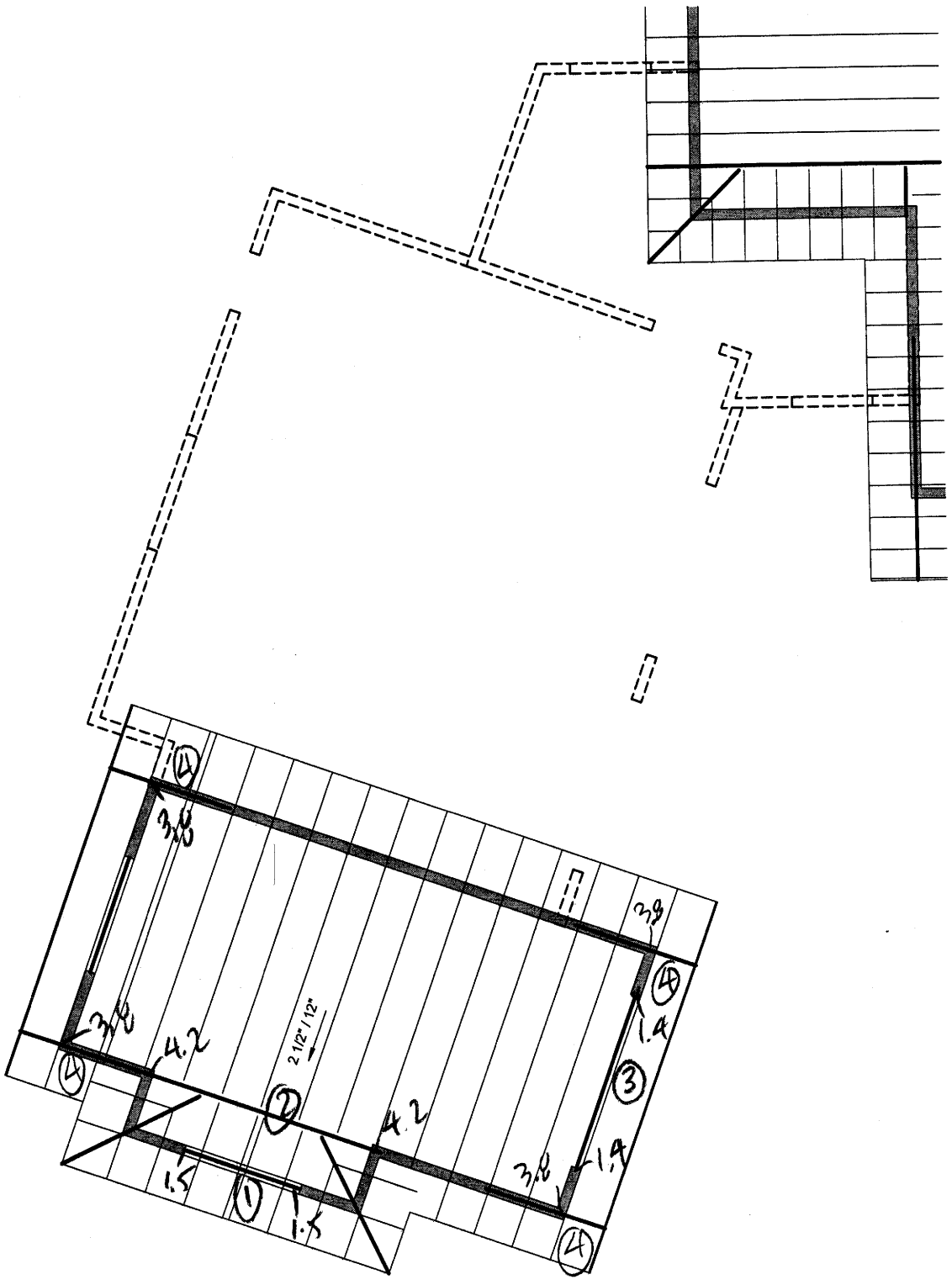


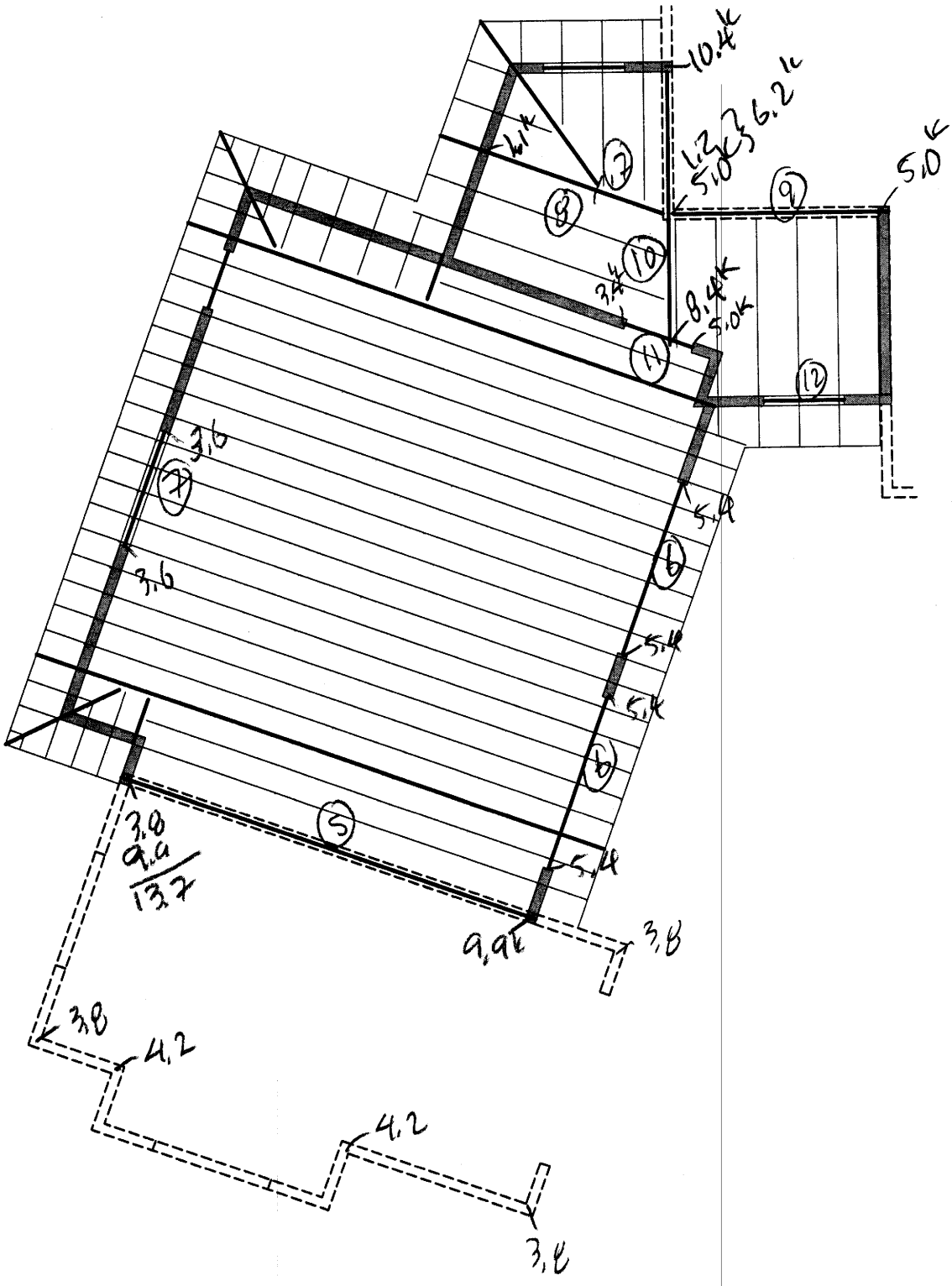



OWNER SUITE
M4
O. BATH
M3
W.I.C.
M2
r & s
r & s
h.b.
COV. DECK
99' - 8"
(5774'-4")
GREAT RM.
M5
100' - 0"
(5774'-8")
16 r.
dn.
FOYER
M1
COV. ENTRY
99' - 5"
(5774'-1")
gas
DINING
M6
KITCHEN
M7
36" cooktop
dbl. oven
d.w.
freez.
ref.
DEN/STUDY
M12
h.b.
BATH
M11
PTRY.
M8
MUD
M9
LNDRY.
M10
wash
dry.
h & c
3 CAR GARAGE
97' - 5"
(5772'-1")

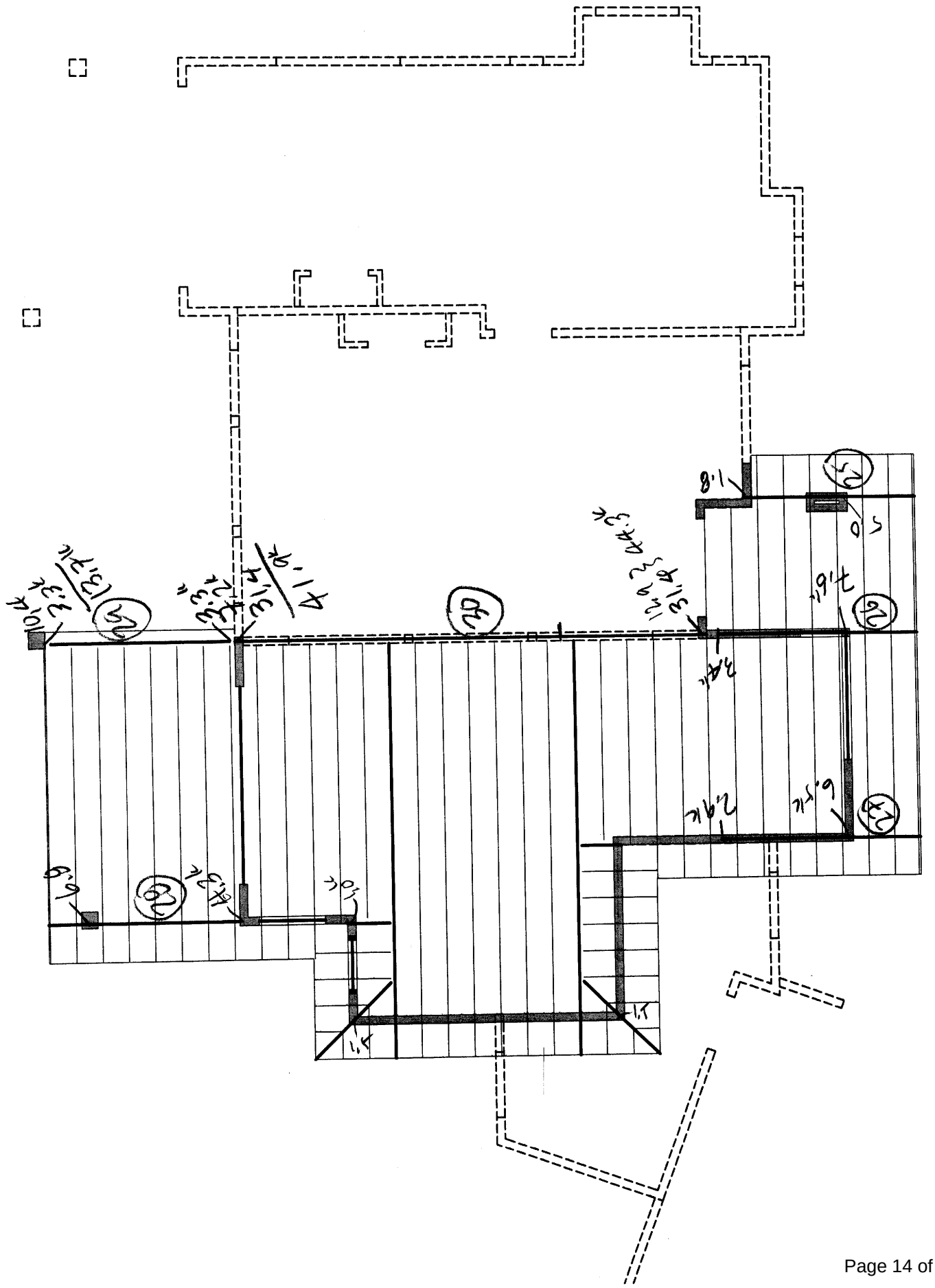

COV. PATIO
COV. PATIO
89' - 10"
(5764'-6")
COV. PATIO
(typ.)
h.s.
r & s
(temp.)
W.I.C.
T8
r & s
BEDRM. 4
T9
BATH
T10
FAMILY RM.
T1
89' - 10"
(5764'-6")
BEDRM. 2
T7
W.I.C.
T6
r & s
r & s
W.I.C.
T4
BATH
T5
dn.
2 r.
dn.
2 r.
MECH./STOR.
T11
87' - 8"
(5762'-4")
r.a.u.
w.h.
MEDIA RM.
T12
87' - 10"
(5762'-6")
88' - 10"
(5763'-6")
WET BAR
T15
d.w.
d.w.
up
16 r.
BATH
T2
BEDRM. 3
T3
WINE
STORAGE
T14
STORAGE
T13
UNEXCAVATED


1/4" / 12"
2' - 0"
5' - 0"
4' - 0"
2 1/2" / 12"
4' - 10"
1/4" / 12"
3' - 0"
2 1/2" / 12"


3.8
4.2
2 1/2" / 12"
4.2
1.5
1.5
3.8
1.4
1.4
3.8


10.4
6.2
5.0
5.0
3.6
3.6
5.4
5.4
5.4
3.8
9.9
13.7
9.9
3.8
3.8
4.2
4.2
3.8

2 1/2" / 12"



(5) 46"

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Beams-1

(1) span 6'-0" w = 500 plf
R = 1.5k
V = 1.2k
M = 2.25
S = 27.3 in³
(2) 2x12s

(2) span 12'-0" w = 700 plf
R = 4.2k
V = 3.5k
M = 12.6 k-ft
S = 58.2 in³
I = 430 in⁴
(2) 14" LVL

(3) span 9'-0" w = 300 plf
R = 1.35k
V = 1.05k
M = 3.0 k-ft
S = 36.8 in³
(3) 2x10s

(4) span 6'-0" 850 plf
2' 3.8k 4' 1.3k
V = 4.0k
M = 1.2 k-ft
A = 15.8 in²
S = 20.6 in²
(3) 2x10s

(5) span 22'-0" w = 900 plf
R = 9.9k
V = 8.3k
M = 54.5 k-ft
A = 65.7 in² A = 43.2 in²
S = 272 in³ S = 251 in³
I = 2833 in⁴ I = 2550 in⁴
(3) 18" LVL

(6) span 9'-0" w = 1200 plf
R = 5.4k
V = 4.5k
M = 12.2 k-ft
A = 23.7 in²
S = 56.1 in³
I = 311 in⁴
(3) 9 1/2 LVL

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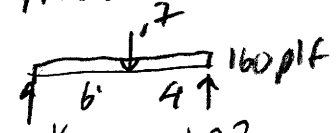
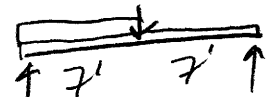
Beams 2

(7) span 6'-0" $w = 1.2$ klf
$R = 3.6^k$
$V = 2.7^k$
$M = 5.4^{k\text{-}ft}$
$A = 37.1 in^2$
$S = 56.9 in^3$
(3) 2x10s

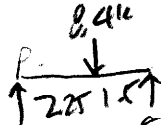
(8) span 10'-0"


1.0k 1.22
$M = 3.6^{k\text{-}ft}$
$S = 16.6 in^2$
(1) 14" LVL

(9) span 11'-0" $w = 900$ plf
$R = 5.0^k$
$V = 4.1^k$
$M = 13.6^{k\text{-}ft}$
$A = 27.6 in^2$
$S = 62.8 in^3$
$I = 425 in^4$
(2) 14" LVL

(10) span 14'-0"


10.4k $V = 9.2^k$ 8.4k
$M = 43.8^{k\text{-}ft}$
$A = 48.4 in^2$
$S = 181 in^3$
$I = 1600 in^4$
7" x 14" Parallam

(11) span 3'6"


3.4k 5.0k
$M = 7.6^{k\text{-}ft}$
$A = 26.51 in^2$
$S = 34.9 in^3$
(3) 9 1/2 LVL

(12) span 4'-0" $w = 700$ plf
$R = 1.4^k$
$V = 1.2^k$
$M = 1.4^{k\text{-}ft}$
$A = 19.3 in^2$
$S = 17.0 in^3$
(2) 2x10

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Beams 3

(13) span 5'-0" $w = 400$ plf
$R = 1.0^k$
$V = .7^k$ $S = 15.2 in^3$
$M = 1.25^{k-ft}$
(2) 2x10's

(14) span 18'-0"
1150 plf 800 plf
4' 4.5' 3.0' 7.5' 3.0'
9.2^k 15^k 3.0^k
$M = 9.2^{k-ft}$ $M = 5.6^{k-ft}$
$S = 46 in^3$
$I = 471 in^4$
4 5½x9

(15) span 6'-0"
650 plf
750 plf
2' 4'
4.7^k 2.4^k
$V = 2.1^k$
$M = 2.8^{k-ft}$
$A = 33.2 in^2$
$S = 33.9 in^3$
(3) 2x10's

(16) span 15'-0"
1150 plf
5' 10'
12.9^k 4.3^k
$V = 4.6^k$
$M = 14.4^{k-ft}$
$A = 36.3 in^2$
$S = 72.0 in^3$
$I = 920 in^4$
4L 5½x12

(17) span 7'-6" $w = 1150$ plf
$R = 4.3^k$
$V = 3.5^k$
$M = 8.1^{k-ft}$
$A = 18.2 in^2$
$S = 37.3 in^3$
$I = 172 in^4$
(3) 9½ LVL

(18) span 15'-0"
1150 plf
2' 12'
10.4^k 7.2^k
$M = 22.5^{k-ft}$
$A = 48.0 in^2$
$S = 112 in^3$
$I = 562 in^4$
4L 5½x12

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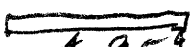
Beams 4

(19) span 12'-0"



10.6k 6.7k

V = 5.5k

M = 15.8k-ft

A = 43.4in²
S = 79.0in³
I = 300in⁴

4L5½x16½

(20) span 9'-0"

5.3k 2.1k

V = 2.1k

M = 4.5k-ft

A = 33.6in²
S = 54.4in³

(3)2x10

(21) span 7'-6"

w = 850plf

R = 3.2k

V = 2.6k

M = 6.0k-ft

A = 13.4in²
S = 27.6in³
I = 127in⁴

(2)9½LL

(22) span 4'-0"

w = 1400plf

R = 2.8k

V = 2.5k

M = 2.8k-ft

A = 38.7in²
S = 33.9in³

(3)2x10

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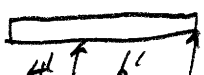
Beams-5

(25) span 10'-0"



V= 2.0k
M= 4.8 k-ft
A=
S= 24.0 in³

L4L5"x4"

(26) span 12'-0"

V= 2.7k
M= 6.7 k-ft
S= 33.6 in³

L4L5"x4"

(27) span 12'-0"

V=
M= 5.8 k-ft
S= 28.8 in³

L4L5"x4"

(28) span 12'-0"

M= 10.2 k-ft
S= 50.8 in³
I= 290 in⁴

L4L5"x4"

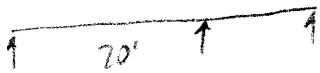
(29) span 9'-6"

w= 700plf
R= 3.3k
V= 2.6k
M= 7.9 k-ft
S= 35.5 in³

L3"x3"x13"

(30) span 20'-6"

w= 2200plf
R= 31.4 k-ft
M= 223 k-ft
I= 1200 in⁴



W18x86

SP

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Beams 6

(31) span 12'-6"

M = 4.0 k-ft S = 10.5 in³ (1) 14" LVL

(32) span 6'-0" w = 700 plf

R = 2.1k A = 24.9 in²
V = 1.6k S = 38.2 in³
M = 3.15 k-ft (2) 2x10

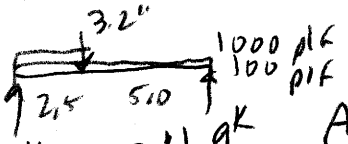
(33) span 13'-0" w = 350 plf

R = 2.3k S = 34.1 in³
V = 1.9k I = 273 in⁴
M = 7.4 k-ft (1) 14" LVL

(34) span 10'-0" w = 1100 plf

R = 5.5k A = 23.2 in²
V = 4.4k S = 63.5 in³
M = 13.8 k-ft I = 391 in⁴ (2) 14" LVL

(35) span 7'-6"



V = 3.8 / 1.9k A = 19.8 in²
M = 8.0 k-ft S = 37.1 in³
I = 171 in⁴ (3) 9 1/2" LVL

(36) span 16'-0" w = 700 plf

R = 5.6k
M = 22 k-ft
I = 66.7 in⁴ W12x35

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Beams-7

(37) span 14'-6" $w = 1.0$ K/L

$R = 7.3^k$ $A = 31.1 in^2$

$V = 5.9^k$ $S = 121. in^3$

$M = 26.3^{k-ft}$ $I = 1053 in^4$

(3) 16" LVL

(38) span 6'-0" $w = 1.0^{kif}$

$R = 3.0^k$ $A = 35.5. in^2$

$V = 2.25$ $S = 54.5 in^3$

$M = 4.5^{k-ft}$

(3) 2X10's

(39) span 6'-0" $w = 1.0^{K/L}$

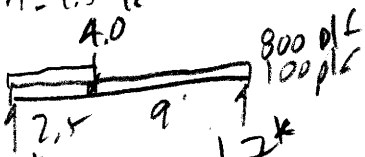
$R = 3.0^k$ $S = 20.9 in^3$

$V = 2.0^k$

$M = 4.5^{k-ft}$

(2) 14" LVL

(40) span 11'-6"



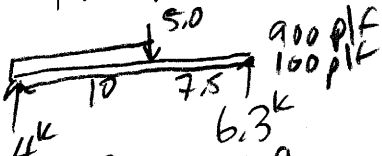
$V = 4.6^k$ $A = 24.2. in^2$

$M = 10.9^{k-ft}$ $S = 50.3 in^3$

$I = 357. in^4$

3½X14 Parallam

(41) span 17'-6"

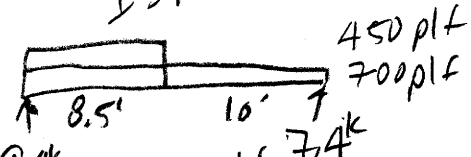


$M = 44.6^{k-ft}$

$I = 144$

W12X26

(42) span 18'-6"



$M = 38.6^{k-ft}$

$I = 133 in^4$

W12X26

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Beams-8

(43) span 6'-0" w = 200 plf
R = .6k
M = 1.9 k-ft
S = 4.21 in³
(1) 1¾ LVL

(44) span 15'-0" w = 300 plf
R = 2.25k
V = 2.0k
M = 8.4 k-ft
A = 15.8 in²
S = 42.2 in³
I = 380 in⁴
GL 5½ x 12

(45) span 17'-0" w = 400 plf
R = 3.4k
V = 3.0k
M = 14.5 k-ft
A = 23.7 in²
S = 72.3 in³
I = 737 in⁴
GL 5½ x 12

(46) span 20'-0" w = 550 plf
R = 5.5k
V = 4.8k
M = 27.5 k-ft
A = 37.6 in²
S = 138 in³
I = 1650 in⁴
GL 5½ x 16½

(47) span 9'-0"
2.3k
2.5 | 6.5
1.7k | .6k
M = 4.2 k-ft
S = 20.8 in³
I = 112 in⁴
GL 3½ x 12

(48) span 12'-0"
3.4k
2.5 | 9.5 | 4
2.7k | .7k
M = 6.7 k-ft
S = 33.6 in³
I = 242 in⁴
GL 3½ x 12

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Seismic

House1

Roof = (25+10)(20.75) = 72.6^k
Walls = 10(14/2)(120) = 8.4
81.0

Floor = (25)(1220) = 30.5
Walls = (10)(22/2)(80) = 8.8
39.3

V_T = .076(81.0+39.3) = 9.1^k
V_T = .140( ) = 16.8^k

h	w	wh	ΣV	ΣV
24	81.0	1944	7.6	14.0
10	39.3	393	1.5	2.8
		2337	9.1	16.8

House2

Roof = (25+10)(14.20) = 49.7^k
Walls = (10)(12/2)(120) = 7.2
56.9

Floor = (25)(9.10) = 22.8^k
Walls = (10)(20/2)(80) = 8.0^k
30.8^k

V_T = .076(56.9+30.8) = 6.7
V_T = .140( ) = 12.3^k

h	w	wh	ΣV	ΣV
22	56.9	1252	5.4^k	9.9^k
10	30.8	308	1.3	2.4^k
		1560	6.7^k	12.3^k

Garage

Roof = (25+10)(14.60) = 51.1^k
Walls = (10)(11/2)(90) = 5.0^k
56.1^k

V_T = .076(56.1) = 4.3^k
V_T = .140(56.1) = 7.9^k

BearGhost Inc.

Shear Walls - House 1

Front $P = \frac{7.6}{2} = 3.8^k$

$V = \frac{3.8}{7.5+7.5} = 253 plf$

$T = 253(12) = 3.0^k$

Edge 4" o.c. RJ

Right $P = \frac{7.6}{4} = 1.9^k$

$V = \frac{1.9}{6+10} = 119 plf$

$T = 0$

Not bld

Middle $P = \frac{7.6}{2} = 3.8^k$

$V = \frac{3.8}{15} = 253 plf$

$T = 0$

No Hold

Center $P = \frac{7.6}{4} + \frac{5.4}{2} = 4.6^k$

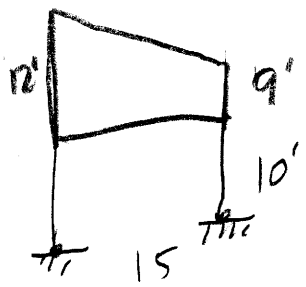
$V = \frac{4.6}{6+5} = 418 plf$

$T = 419(10) = 4.2^k$

Edge 3" o.c. MST RT

Rear $P = \frac{14}{2} = 7.0^k$

$P = \frac{2.8}{2} = 1.4^k$



W12x35

BearGhost Inc.

ShearWalls2 House1

Right $P = \frac{9.1}{4} = 2.3^{k}$

$V = \frac{2.3}{3+3+5} = 209 plf$

$T = 209(9) = 1.9^{k}$ HDU2

Middle $P = \frac{9.1}{2} = 4.55^{k}$

$V = \frac{4.55}{11} = 414 plf$

$T = 414(9) = 1.110^{k} \approx 2.6^{k}$ Pdo3"o.c. HDU2

Center $P = \frac{9.1}{4} + \frac{6.7}{2} = 5.63^{k}$

$V = \frac{5.63}{11+6} = 331 plf$

$T = 331(9) = 3.0^{k}$ Pdo4"o.c. HDU2

BearGhost Inc.

ShearWalls - 3 House2

Front $P = \frac{5.4}{2} = 2.7^{k}$

$V = \frac{2.7}{5+5} = 270 plf$

$T = 270(10) = 2.7^{k}$

Col 4" o.c.

R5

Rear $P = \frac{5.4}{2} = 2.7^{k}$

$V = \frac{2.7}{5} = 540 plf$

$T = 540(a) = 4.9^{k}$

Side 2½" MST

Left $P = \frac{5.4}{2} = 2.7^{k}$

$V = \frac{2.7}{9+8} = 169 plf$

$T = 0$

No Hold

BearGhost Inc.

Shear Walls-4 House2

Rear $P = \frac{6.7}{2} = 3.35^{k}$

$V = \frac{3.35}{8.5} = 394\,plf$

$T = 394(a) = 3.5^{k}$

Side 24" o.c. Hdr5

Left $P = \frac{6.7}{2} = 3.35^{k}$

$V = \frac{3.35}{10+9} = 176\,plf$

$T = 0$

No Hold

BearGhost Inc.

ShearWalls-5 Garage

Front $P = \frac{4.4}{2} = 2.2^k$

$V = \frac{2.2}{4+9+7} = 110 plf$ — No HDU

$T = 0$

Rear Common $P = \frac{4.4}{2} = 2.2^k$

$V = \frac{2.2}{20} = 110 plf$ — No HDU

$T = 0$

Left $P = \frac{4.4}{2} = 2.2^k$

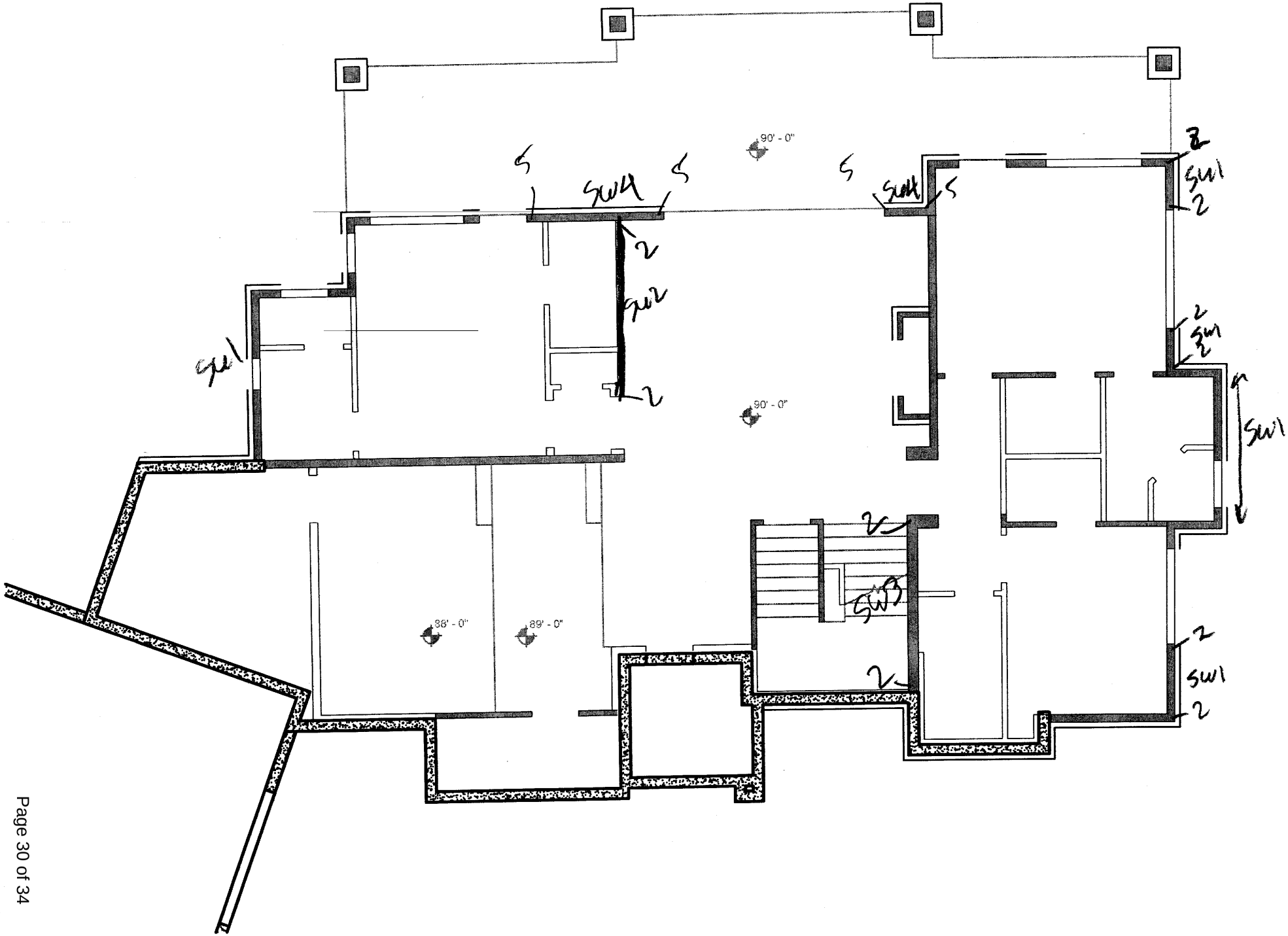
$V = \frac{2.2}{3+21+10} = 65 plf$ — No HDU

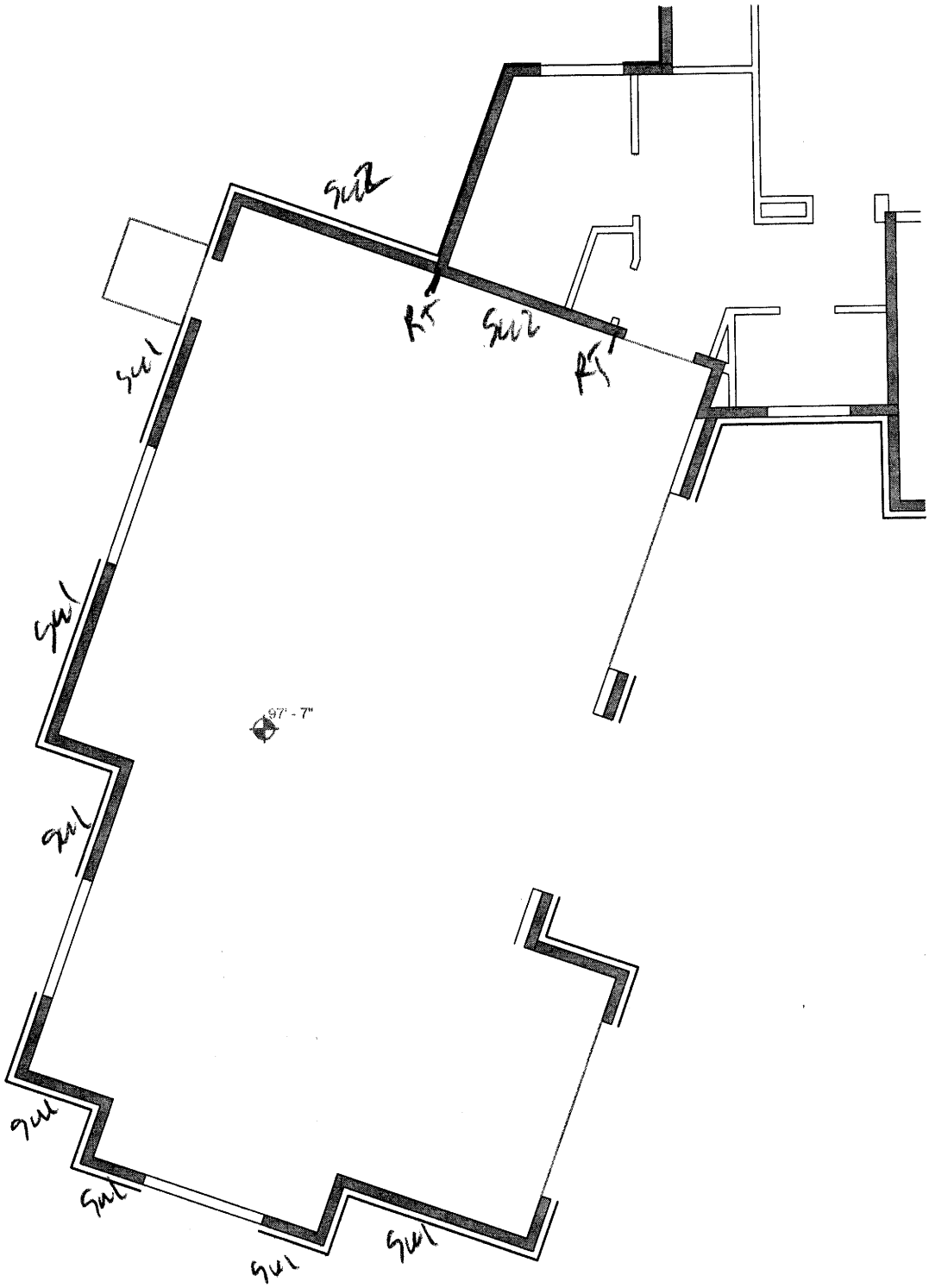
$T = 0$

Right $P = \frac{4.4}{2} = 2.2^k$

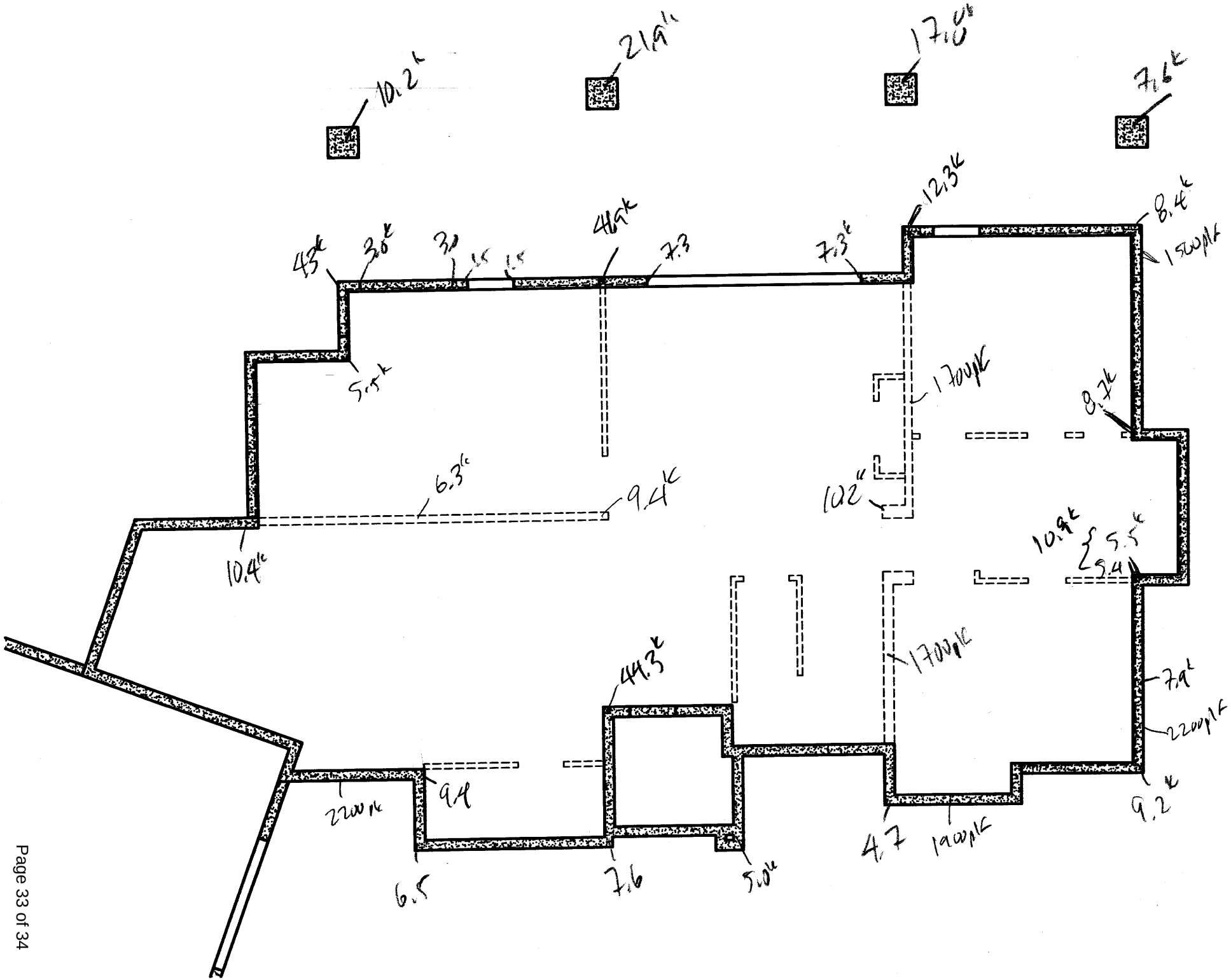
$V = \frac{2.2}{4+2.5+1.5+2.5+25} = \frac{157}{.57} = 276 plf$ — @ c 3" o.c. HDU2

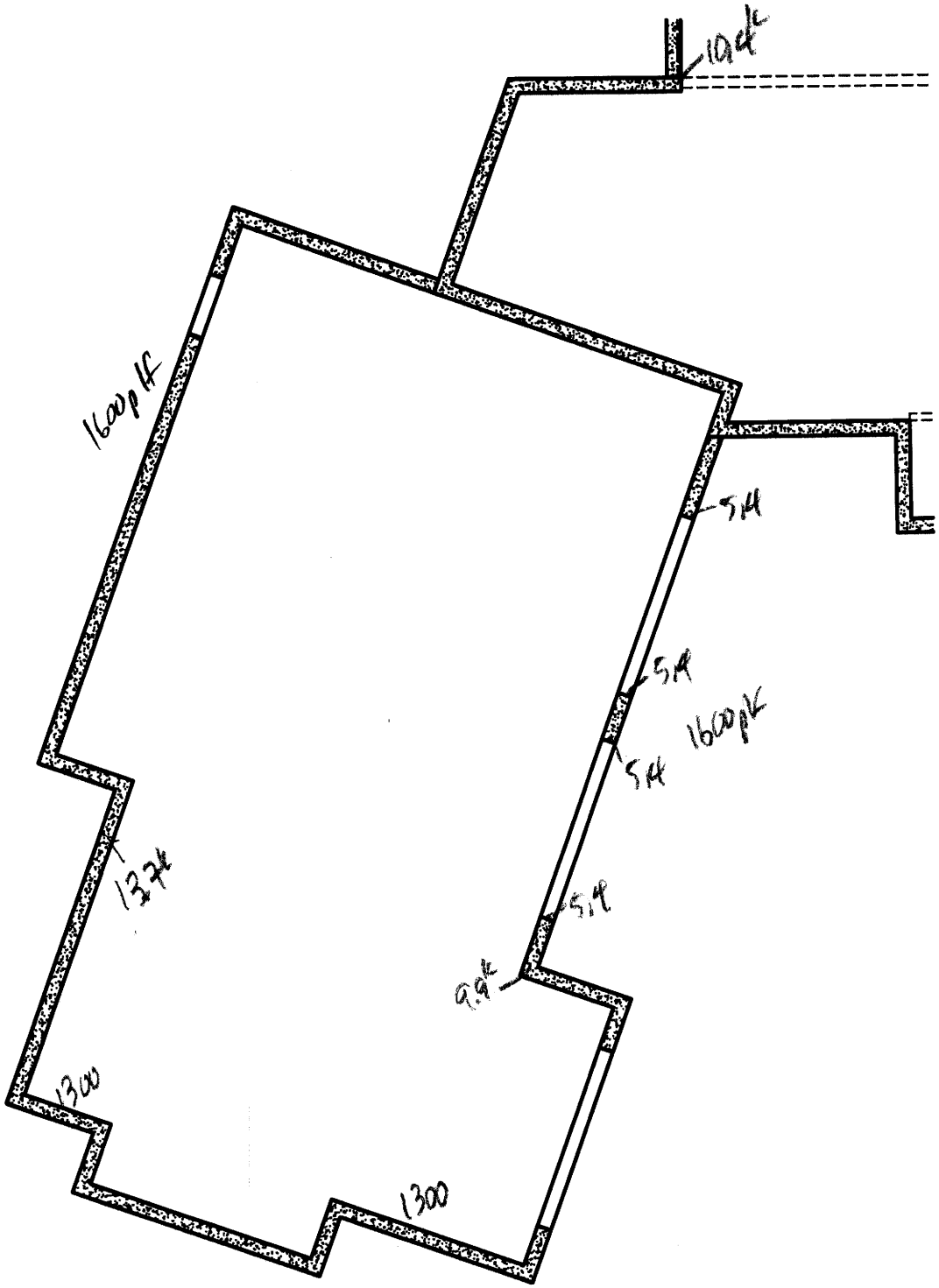
$T = 157(11) = 1.6^k$


90' - 0"
90' - 0"
88' - 0"
89' - 0"
SW1
SW2
SW3
SW4
2


97' - 7"

99' - 8"
100' - 0"
99' - 5"


10.2
21.9
17.6
7.6
12.3
8.4
4.5
3.0
3.0
1.5
1.5
4.9
7.3
7.3
5.5
1700 PC
8.7
6.3
9.4
10.2"
10.4
10.9
5.5
9.4
1700 PC
44.3
7.9
2200 PC
9.4
2200 PC
9.2
4.7
1900 PC
6.5
7.6
5.0


19ft
160ft
5ft
5ft
5ft
160ft
137ft
5ft
9.9ft
130ft
130ft