FORSMAN ENGINEERING
30014 2nd Court South
Federal Way, WA 98003
(253) 815-9182

STRUCTURAL CALCULATIONS
for

Valentin Residence
At
4350 East Mercer Way
Mercer Island, WA 98040

Project #18062

Codes:

2015 International Building Code

Loads:

Roof	15 psf dead load	25 psf live load, snow
Walls	10 psf dead load	
Floor	25 psf dead load (1-1/2" Gypcrete)	40 psf live load
Deck	25 psf dead load	60 psf live load

Wind ASCE 7-10 Simple diaphragm, 110 mph wind speed, Exp "C", Risk category II, Kzt=1.0

Seismic ASCE 7-10 Importance factor 1.00, Site Category D, Sds=0.939 S1=0.540

3/11/19

Sheets 1-90

Foundation: Geotech Consultants, Inc. JN 17464

4" Pipe Pile 10 Ton capacity;
Walls 40 psf/ft active pressure
250 psf/ft passive pressure

The items designed herein represent the entire scope of structural investigation performed. No other portions of the structure have been reviewed. These calculations apply to the location specified above. The site was not investigated and no judgment on the suitability of the site was made.

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SCOPE OF WORK

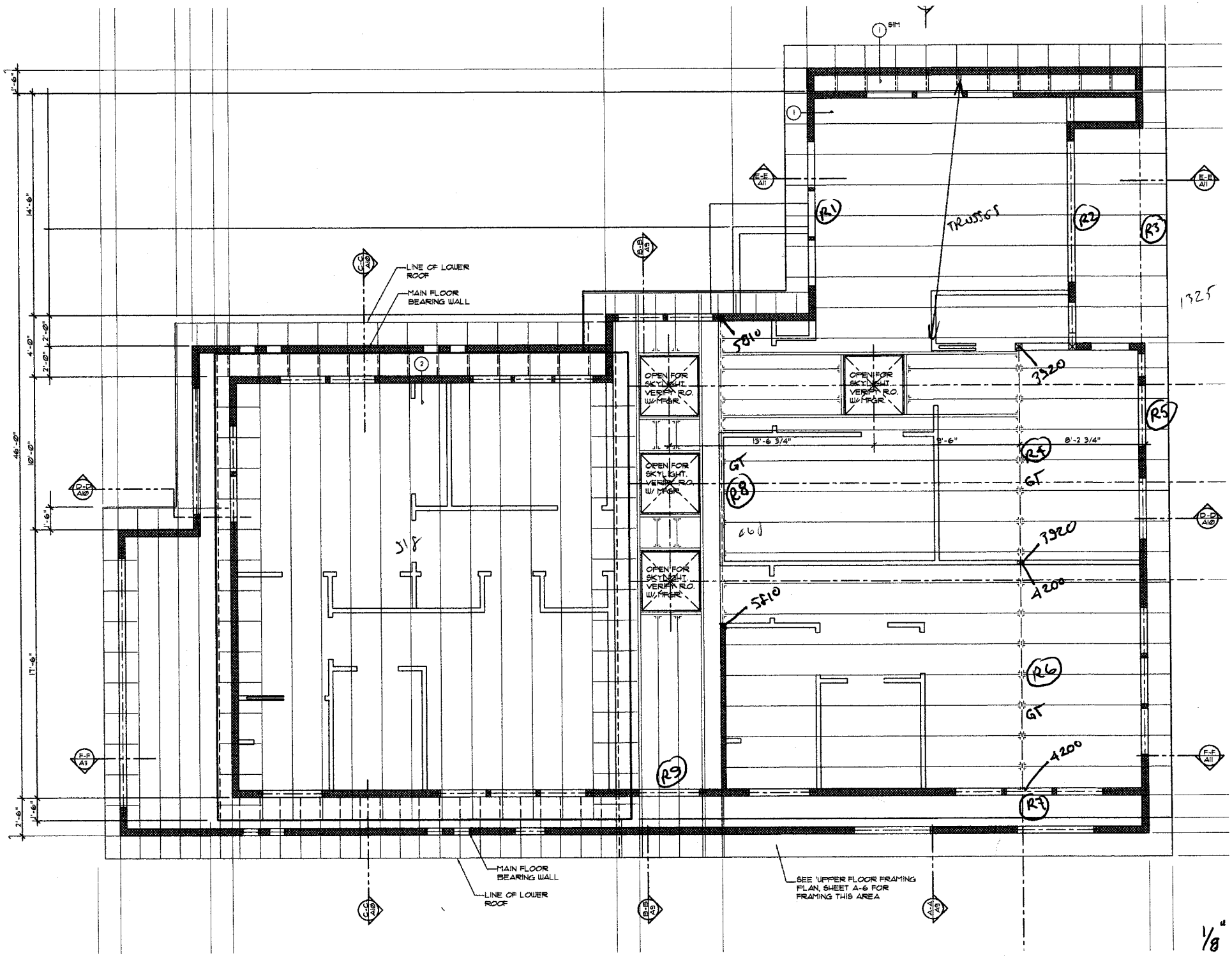
Forsman Engineering was asked to provide a lateral load analysis, shear wall design review of major framing members, and drawings review for a wood framed single family residential addition. The roof framing is primarily manufactured trusses, the floor framing is also primarily manufactured floor trusses, and the foundation is typical concrete grade beams supported by pipe piling per geotechnical report.

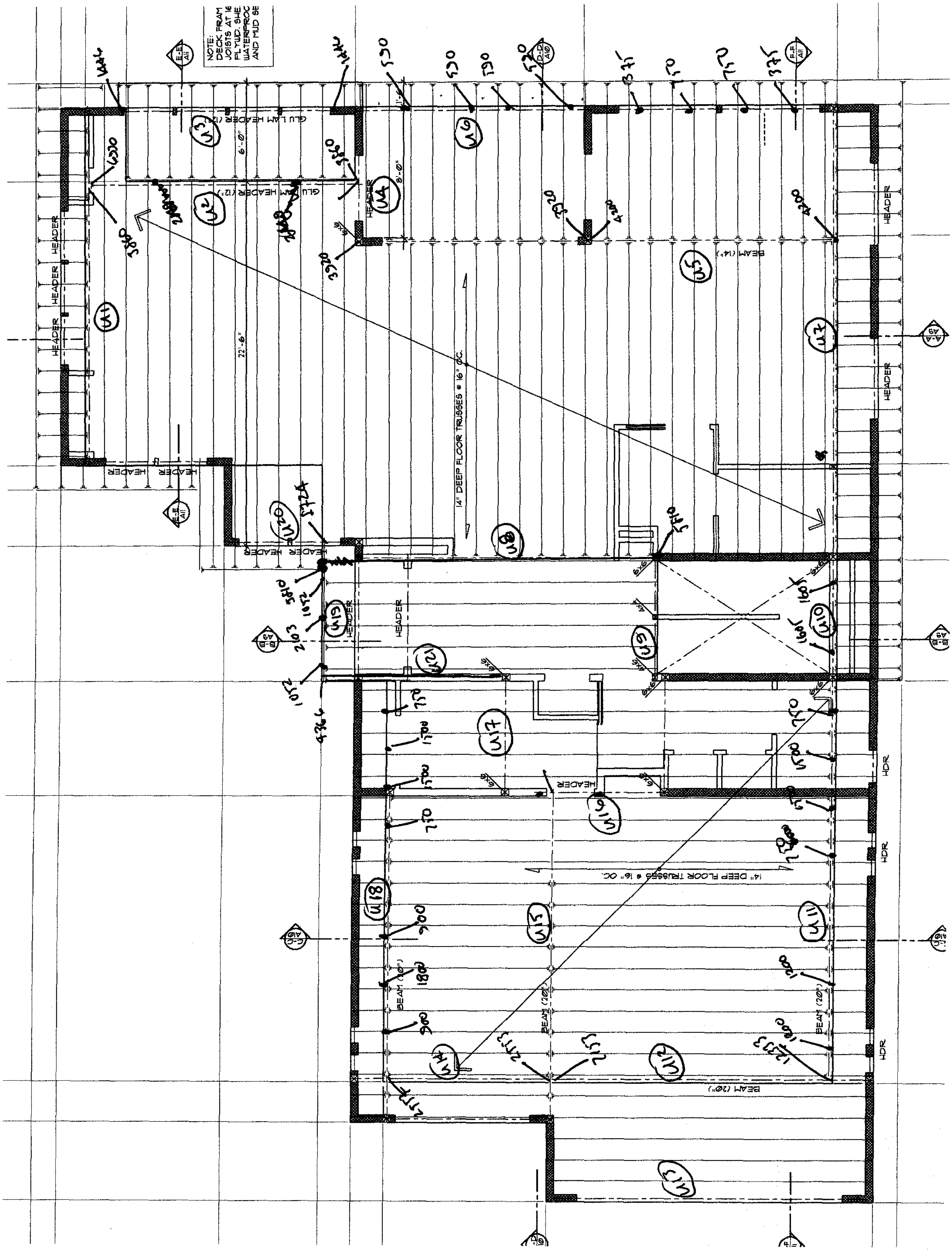
The attached calculations are to be used as a submittal for one potential building site. The cover sheet should have an original signature in blue ink over the seal.

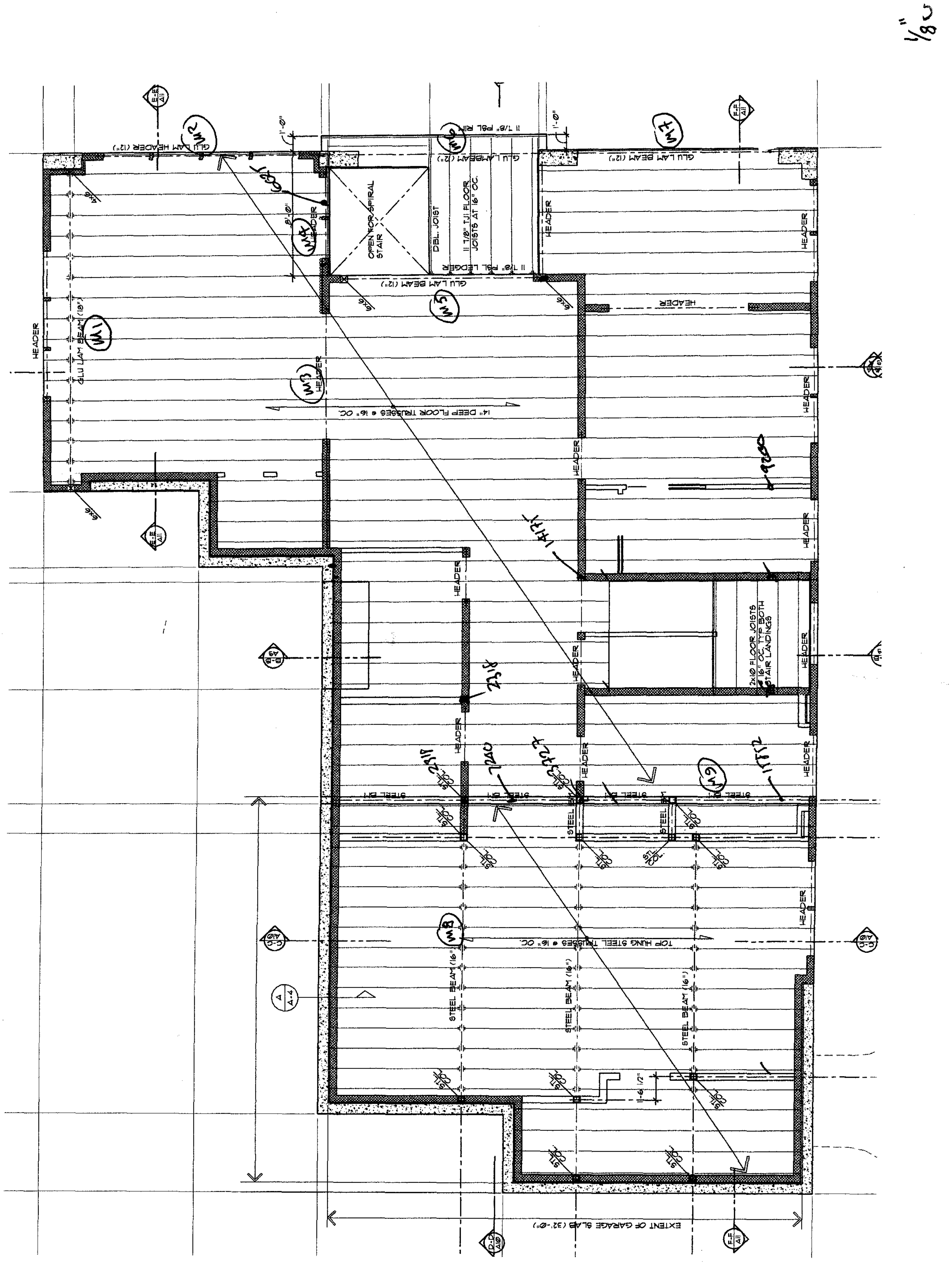
Forsman Engineering will use that degree of care and skill ordinarily exercised under similar circumstances by members of the engineering profession in this local. No other warranty, either expressed or implied is made in connection with our rending of professional services. For any dispute, claim, or action arising out of this design, Forsman Engineering shall have liability limited to the amount of the fee received by Forsman Engineering.

Questions regarding the attached should be addressed to Forsman Engineering.

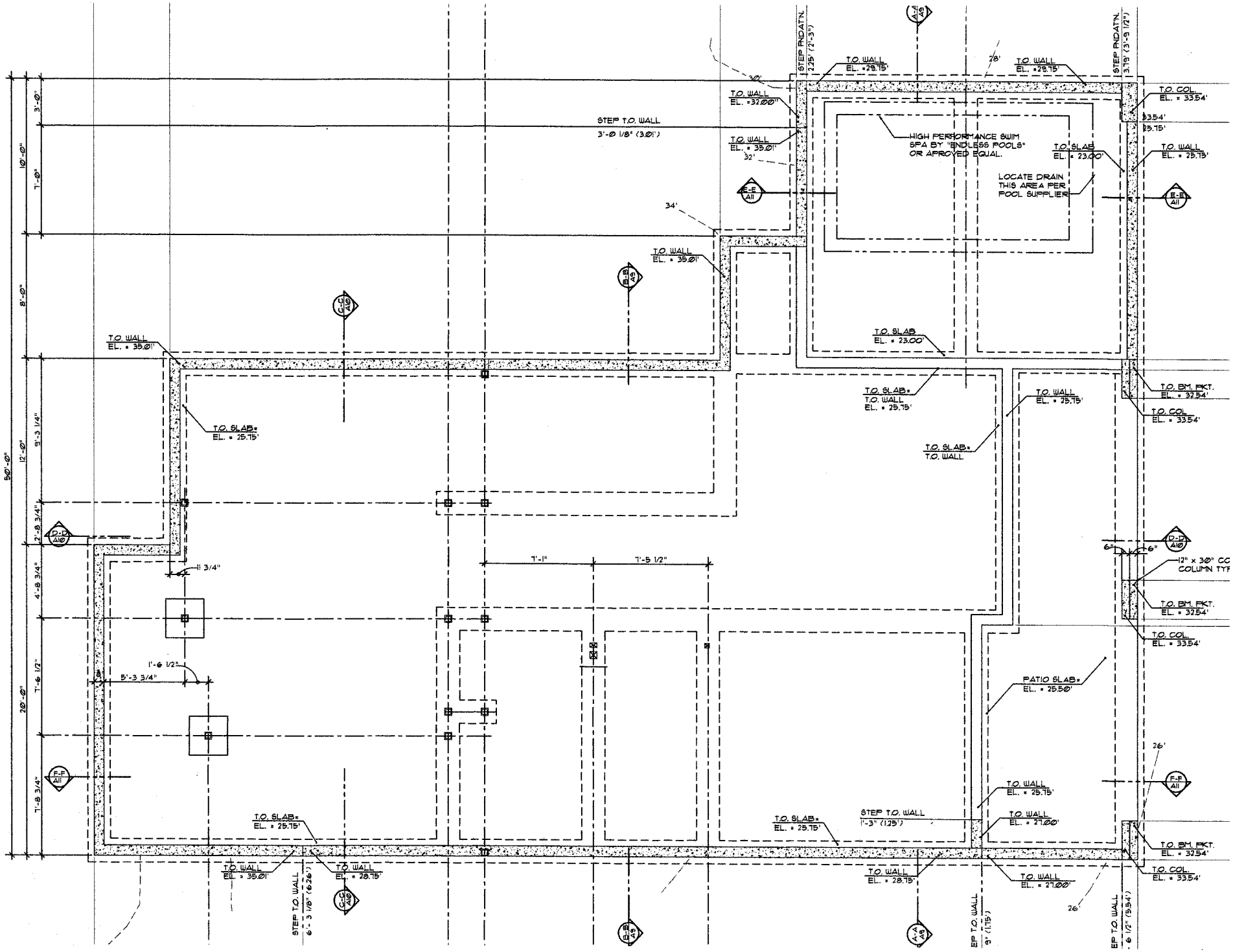
Arnold E. Forsman, P.E.
Forsman Engineering

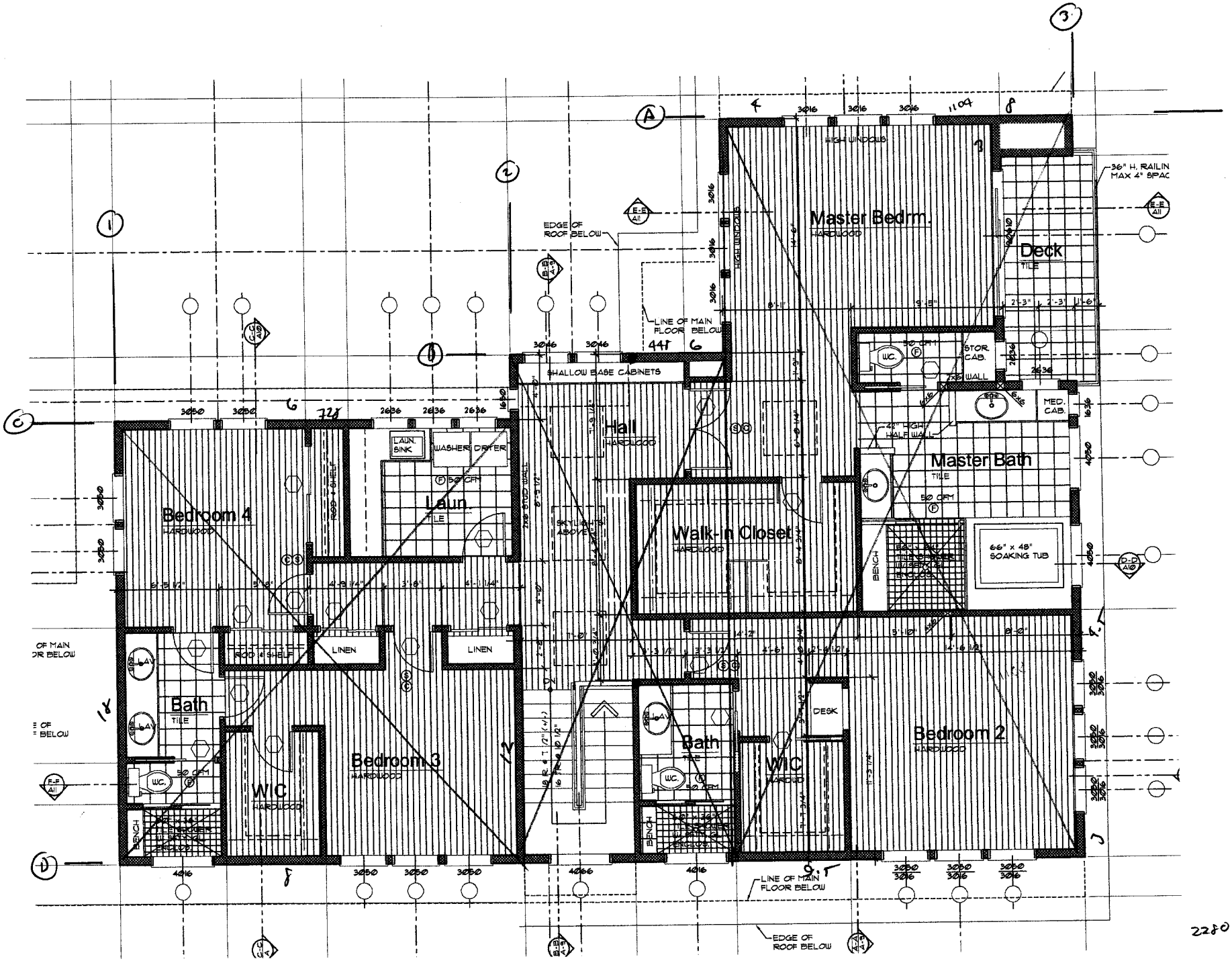

LINE OF LOWER ROOF
MAIN FLOOR BEARING WALL
OPEN FOR SKYLIGHT. VERIFY R.O. W/ MFGR.
OPEN FOR SKYLIGHT. VERIFY R.O. W/ MFGR.
OPEN FOR SKYLIGHT. VERIFY R.O. W/ MFGR.
TRUSSES
5810
3320
3920
4200
5810
4200
13'-6 3/4"
9'-6"
8'-2 3/4"
GT
GT
GT
R1
R2
R3
R4
R5
R6
R7
R8
R9
MAIN FLOOR BEARING WALL
LINE OF LOWER ROOF
SEE 'UPPER FLOOR FRAMING PLAN, SHEET A-6 FOR FRAMING THIS AREA
1325
1/8"


NOTE:
DECK FRAM
JOISTS AT 16
PLYWD. SHE
WATERPROC
AND MUD SE
GLU LAM HEADER (12")
6'-0"
8'-0"
22'-6"
HEADER
BEAM (14")
14" DEEP FLOOR TRUSSES @ 16" O.C.
6x6
HDR
BEAM (20")
14" DEEP FLOOR TRUSSES @ 16" OC.



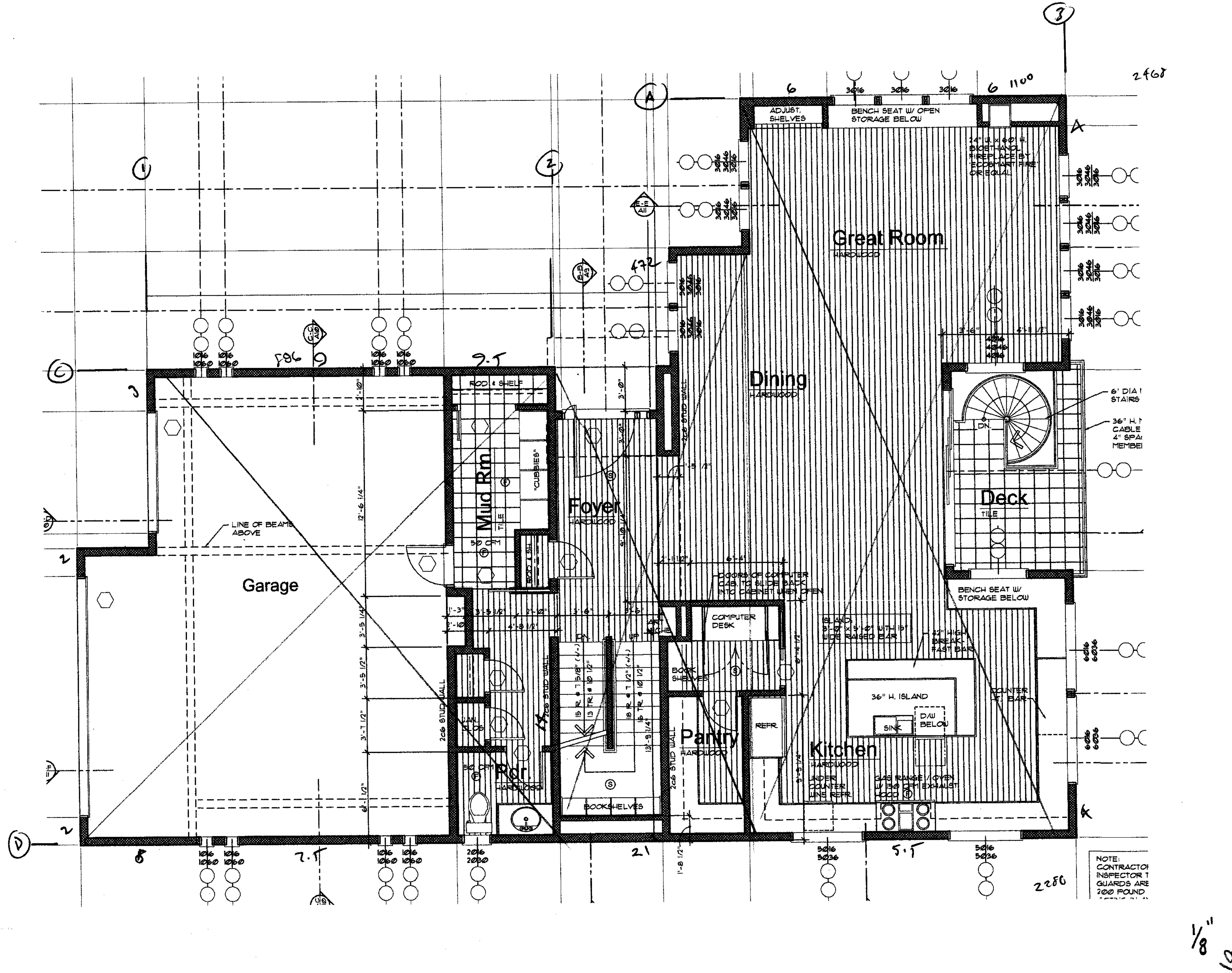
1/8"
GLU LAM HEADER (12")
GLU LAM BEAM (12")
GLU LAM BEAM (18")
11 7/8" PSL RIM
11 7/8" TJI FLOOR JOISTS AT 16" OC.
11 7/8" PSL LEDGER
DBL. JOIST
OPEN FOR SPIRAL STAIR
HEADER
14" DEEP FLOOR TRUSSES @ 16" OC.
2x10 FLOOR JOISTS @ 16" OC. TYP BOTH STAIR LANDINGS
STEEL BM
STEEL
STL. COL.
TOP HUNG STEEL TRUSSES @ 16" OC.
STEEL BEAM (16")
EXTENT OF GARAGE SLAB (32'-0")
11'-6 1/2"
1'-0"
8'-0"
6x6
W1
W2
W3
W4
W5
W6
W7
W8
W9


STEP T.O. WALL
3'-0 1/8" (3.01')
T.O. WALL
EL. = 32.00'
T.O. WALL
EL. = 35.01'
T.O. WALL
EL. = 29.75'
STEP R/DATN.
2.25' (2'-3")
STEP R/DATN.
3.75' (3'-9 1/2")
T.O. COL.
EL. = 33.54'
HIGH PERFORMANCE SWIM SPA BY "ENDLESS POOLS" OR APROVED EQUAL.
T.O. SLAB
EL. = 23.00'
LOCATE DRAIN THIS AREA PER POOL SUPPLIER
T.O. SLAB=
EL. = 25.75'
T.O. SLAB=
T.O. WALL
EL. = 25.75'
T.O. BM. PKT.
EL. = 32.54'
12" x 30" CC
COLUMN TYP
PATIO SLAB=
EL. = 25.50'
STEP T.O. WALL
1'-3" (1.25')
EP T.O. WALL
9" (.75')
EP T.O. WALL
6 1/2" (.54')
T.O. WALL
EL. = 27.00'
T.O. WALL
EL. = 28.75'
STEP T.O. WALL
6'-3 1/8" (6.26')
5'-3 3/4"
1'-6 1/2"
11 3/4"
7'-1"
7'-5 1/2"
50'-0"
26'-0"
12'-0"
10'-0"
8'-0"
3'-0"
T'-0"
9'-3 1/4"
2'-8 3/4"
4'-8 3/4"
T'-6 1/2"
1'-8 3/4"
34'
32'
30'
28'
26'

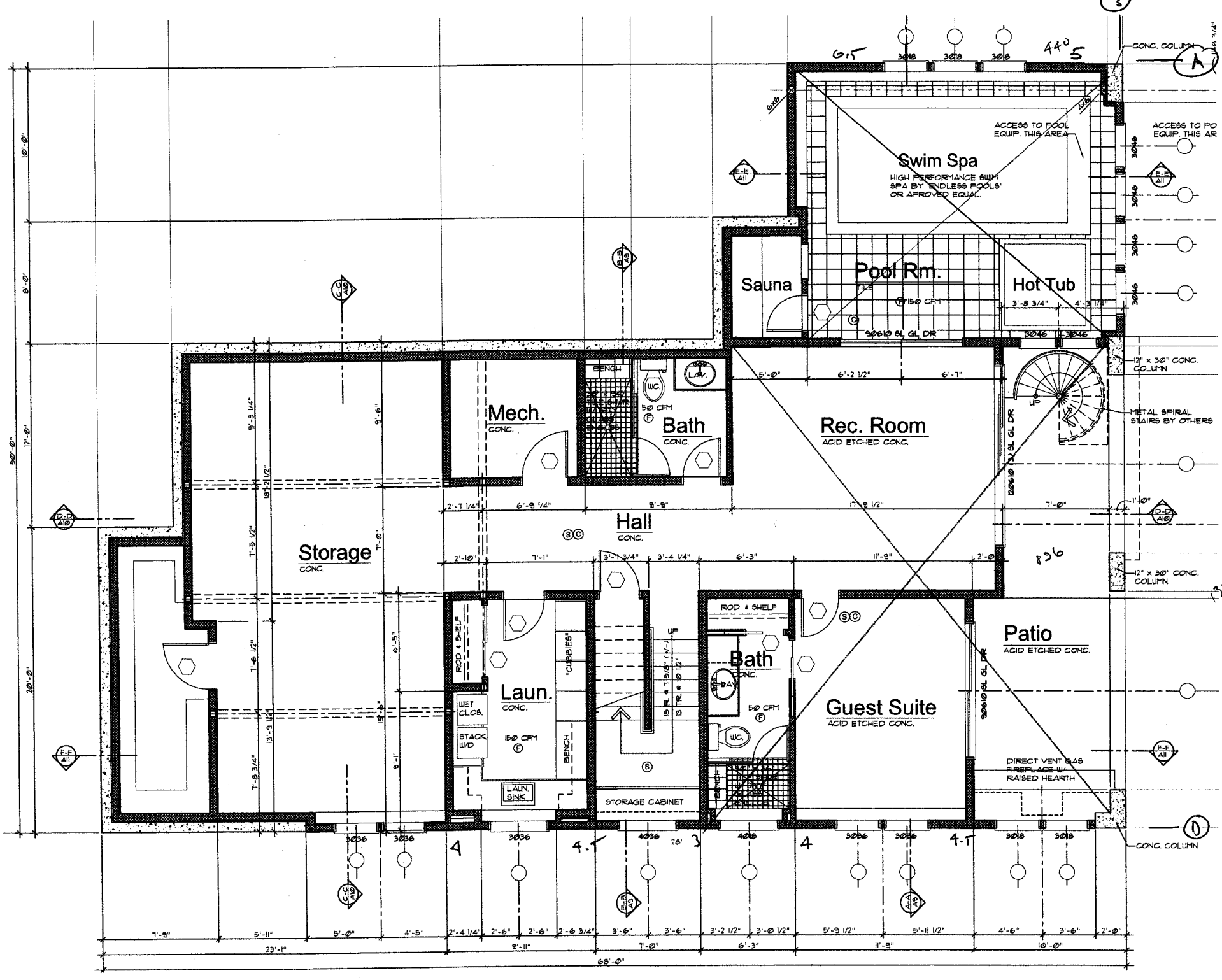

Master Bedrm.
HARDWOOD
Deck
TILE
HIGH WINDOWS
36" H. RAILIN
MAX 4" SPAC
EDGE OF
ROOF BELOW
LINE OF MAIN
FLOOR BELOW
SHALLOW BASE CABINETS
W.C.
50 CFM
STOR.
CAB.
2X6 WALL
MED.
CAB.
42" HIGH
HALF WALL
Hall
HARDWOOD
Master Bath
TILE
50 CFM
Bedroom 4
HARDWOOD
LAUN.
SINK
WASHER DRYER
Laun.
TILE
SKYLIGHT
ABOVE
Walk-in Closet
HARDWOOD
BENCH
66" x 48"
SOAKING TUB
ROD & SHELF
LINEN
LINEN
Bath
TILE
Bedroom 3
HARDWOOD
WIC
HARDWOOD
Bath
TILE
DESK
WIC
HARDWOOD
Bedroom 2
HARDWOOD
LINE OF MAIN
FLOOR BELOW
EDGE OF
ROOF BELOW

2280

1/8"



Great Room
HARDWOOD
ADJUST. SHELVES
BENCH SEAT W/ OPEN STORAGE BELOW
24" W. x 60" H. BIOETHANOL FIREPLACE BY "ECOSMART FIRE" OR EQUAL
Dining
HARDWOOD
Deck
TILE
6' DIA. STAIRS
BENCH SEAT W/ STORAGE BELOW
Kitchen
HARDWOOD
36" H. ISLAND
SINK
D/W BELOW
42" HIGH BREAK-FAST BAR
COUNTER BAR
UNDER COUNTER WINE REFR.
GAS RANGE / OVEN W/ 150 CFM EXHAUST HOOD
REFR
Pantry
HARDWOOD
COMPUTER DESK
DOORS OF COMPUTER CAB. TO SLIDE BACK INTO CABINET WHEN OPEN
BOOK SHELVES
BOOKSHELVES
2x6 STUD WALL
Foyer
HARDWOOD
Mud Rm
TILE
"CUBBIES"
ROD & SHELF
50 CFM
Pdr
HARDWOOD
JAN. CLOS.
Garage
LINE OF BEAMS ABOVE
NOTE: CONTRACTOR INSPECTOR GUARDS ARE 200 POUND


Swim Spa
HIGH PERFORMANCE SWIM SPA BY "ENDLESS POOLS" OR APPROVED EQUAL
ACCESS TO POOL EQUIP. THIS AREA
Pool Rm.
TILE
Sauna
Hot Tub
Mech.
CONC.
Bath
CONC.
Rec. Room
ACID ETCHED CONC.
Hall
CONC.
Storage
CONC.
Laun.
CONC.
Bath
CONC.
Guest Suite
ACID ETCHED CONC.
Patio
ACID ETCHED CONC.
CONC. COLUMN
12" x 30" CONC. COLUMN
METAL SPIRAL STAIRS BY OTHERS
ROD & SHELF
WET CLOS.
STACK W/D
LAUN. SINK
BENCH
STORAGE CABINET
DIRECT VENT GAS FIREPLACE W/ RAISED HEARTH
50 CFM
68'-0"
23'-1"
9'-11"
7'-0"
6'-3"
11'-9"
10'-0"

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JOB 18062
SHEET NO. 16 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Roof Framing

R1 L = 4'

$w_{DL} = 15 \cdot 20/2 = 150$ plf
$w_{LL} = 25 \cdot 20/2 = 250$ plf
⇒ 6x10 DF #2

R2 L = 17'

$w_{DL} = 15 \cdot 22/2 = 165$ plf
$w_{LL} = 25 \cdot 22/2 = 275$ plf
⇒ 5 1/8 x 12 GLB

R3 L = 14.5'

$w_{DL} = \frac{15}{(2)4.5}(4.5+2)^2 = 70$ plf
$w_{LL} = \frac{25}{(2)4.5}(4.5+2)^2 = 117$ plf
⇒ 6x10 DF #2

R4 L = 14'

$w_{DL} = 15 \cdot 28/2 = 210$ plf
$w_{LL} = 25 \cdot 28/2 = 350$ plf
⇒ GIRDER TRUSS

R5 L = 4.5

$w_{DL} = \frac{15}{(2)8}(8+2)^2 = 94$ plf
$w_{LL} = \frac{25}{2(8)}(8+2)^2 = 156$ plf
⇒ 6x10 DF #2

R6 L = 15'

$w_{DL} = 15 \cdot 28/2 = 210$ plf
$w_{LL} = 25 \cdot 28/2 = 350$ plf
⇒ GIRDER TRUSS

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JOB 18062
SHEET NO. 11 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

R7 L = 4'

$w_{DL} = 15 \cdot 4 = 60$ plf
$w_{LL} = 25 \cdot 4 = 100$ plf
P = 4200# @ 2' (RG)

⇒ 6x10 DF #2

R8 L = 20'

$w_{DL} = 15 \cdot 29/2 = 218$ plf
$w_{LL} = 25 \cdot 27/2 = 363$ plf

⇒ GIRDER TRUSS

R9 L = 4.5'

$w_{DL} = 15 \cdot 35/2 = 263$ plf
$w_{LL} = 25 \cdot 35/2 = 438$ plf

⇒ 6x10 DF #2

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 12, 2019 07:48:37	Valentin Residence BeamR1

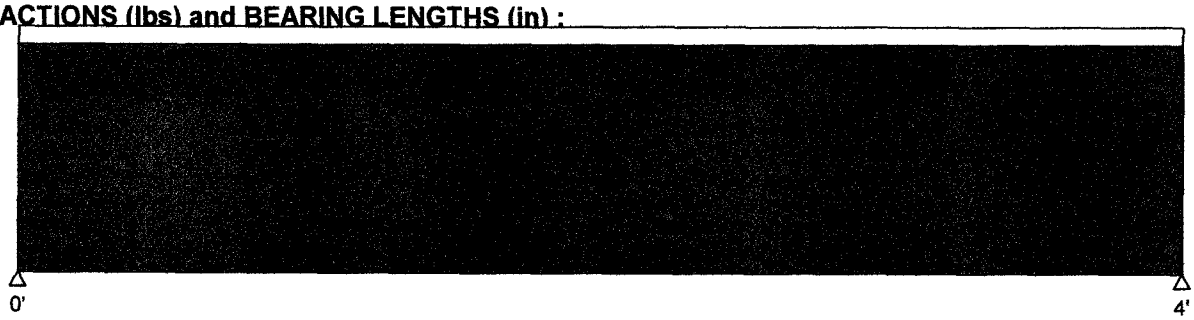
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	150.0				No
wll	Snow	Full UDL	250.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	325		325
Live	500		500
Total	825		825
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 14	Fv' = 195	fv/Fv' = 0.07
Bending(+)	fb = 120	Fb' = 1006	fb/Fb' = 0.12
Live Defl'n	0.00 = <L/999	0.13 = L/360	0.02
Total Defl'n	0.00 = <L/999	0.20 = L/240	0.02

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.15	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 825 lbs-ft
Shear : LC# 2 = D+S, V = 825, V design = 498 lbs
Deflection: LC# 2 = D+S EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	165.0				No
wll	Snow	Full UDL	275.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	1523		1523
Live	2338		2338
Total	3860		3860
Bearing:			
LC number	2		2
Length	1.2		1.2

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x12"

Self Weight of 14.16 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 83	Fv' = 276	fv/Fv' = 0.30
Bending(+)	fb = 1601	Fb' = 2760	fb/Fb' = 0.58
Live Defl'n	0.39 = L/524	0.57 = L/360	0.69
Total Defl'n	0.77 = L/265	0.85 = L/240	0.90

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.15	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+S, M = 16407 lbs-ft
Shear : LC# 2 = D+S, V = 3860, V design = 3406 lbs
Deflection: LC# 2 = D+S EI=1328.38e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 12, 2019 07:50:07	Valentin Residence BeamR3

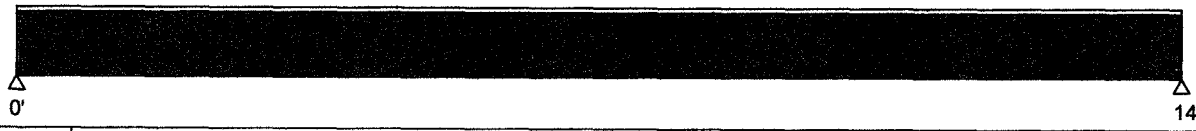
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	70.0				No
wll	Snow	Full UDL	117.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	597		597
Live	848		848
Total	1446		1446
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 37	Fv' = 195	fv/Fv' = 0.19
Bending(+)	fb = 760	Fb' = 1006	fb/Fb' = 0.76
Live Defl'n	0.23 = L/763	0.48 = L/360	0.47
Total Defl'n	0.39 = L/448	0.73 = L/240	0.54

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.15	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 5241 lbs-ft
Shear : LC# 2 = D+S, V = 1446, V design = 1288 lbs
Deflection: LC# 2 = D+S EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 12, 2019 07:50:46	Valentin Residence BeamR5

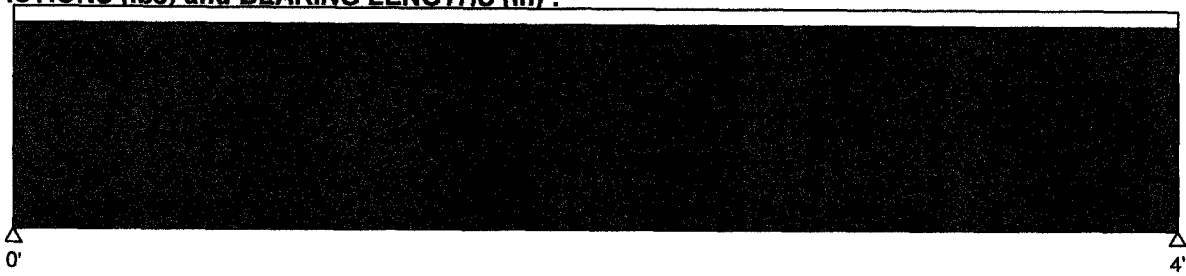
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	94.0				No
wll	Snow	Full UDL	156.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	239		239
Live	351		351
Total	590		590
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 11	Fv' = 195	fv/Fv' = 0.06
Bending(+)	fb = 96	Fb' = 1006	fb/Fb' = 0.10
Live Defl'n	0.00 = <L/999	0.15 = L/360	0.02
Total Defl'n	0.00 = <L/999	0.22 = L/240	0.02

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.15	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 664 lbs-ft
Shear : LC# 2 = D+S, V = 590, V design = 383 lbs
Deflection: LC# 2 = D+S EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

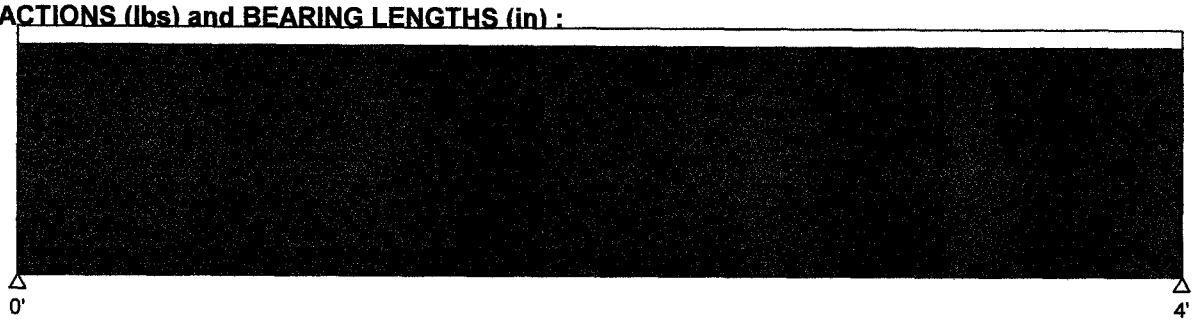
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	60.0				No
wll	Snow	Full UDL	100.0				No
p	Dead	Point	4200		2.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	2245		2245
Live	200		200
Total	2445		2445
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 63	Fv' = 153	fv/Fv' = 0.41
Bending(+)	fb = 630	Fb' = 787	fb/Fb' = 0.80
Live Defl'n	0.00 = <L/999	0.13 = L/360	0.01
Total Defl'n	0.02 = <L/999	0.20 = L/240	0.10

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	0.90	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	1
Fv'	170	0.90	1.00	1.00	-	-	-	-	1.00	1.00	1.00	1
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 1 = D only, M = 4345 lbs-ft
Shear : LC# 1 = D only, V = 2245, V design = 2187 lbs
Deflection: LC# 2 = D+S EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 12, 2019 07:53:52	Valentin Residence BeamR9

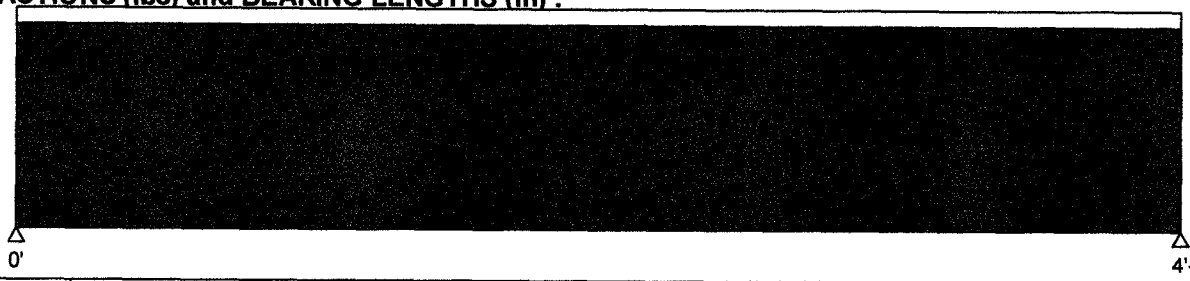
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	263.0				No
wll	Snow	Full UDL	438.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	620		620
Live	985		985
Total	1605		1605
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 30	Fv' = 195	fv/Fv' = 0.15
Bending(+)	fb = 262	Fb' = 1006	fb/Fb' = 0.26
Live Defl'n	0.01 = <L/999	0.15 = L/360	0.05
Total Defl'n	0.01 = <L/999	0.22 = L/240	0.06

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.15	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+S, M = 1806 lbs-ft
Shear : LC# 2 = D+S, V = 1605, V design = 1040 lbs
Deflection: LC# 2 = D+S EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

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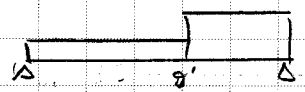
Upper Floor Framing

u1 L = 21.5'

$w_{DL} = 15 \cdot 4 + 80 + 25 \cdot 2 = 190$ plf
$w_{LL} = 25 \cdot 4 + 40 \cdot 2 = 180$ plf
$P = 3860 + 6930$ @ 17' ⇒ 5 1/8 x 19 1/2 GLB
(R2) (u2)

u2 L = 17'



$w_{1DL} = 25 \cdot 22/2 = 275$ plf
$w_{1LL} = 40 \cdot 18/2 + 60 \cdot 4/2 = 480$ plf
$w_{2DL} = 25 \cdot 27/2 = 338$ plf
$w_{2LL} = 40 \cdot 23/2 + 60 \cdot 4/2 = 580$ plf
⇒ 8 3/4 x 12 GLB

u3 L = 12.5'

$w_{DL} = \frac{25}{(4)^2}(4+2)^2 = 113$ plf
$w_{LL} = \frac{60}{(4)^2}(4+2)^2 = 270$ plf
⇒ 5 1/8 x 9 GLB

u4 L = 4'

$w_{DL} = 25 \cdot 2 = 50$ plf
$w_{LL} = 40 \cdot 2 = 80$ plf
$P = 3860 + 7620 = 11480$ @ 2' ⇒ 5 1/8 x 10 1/2 GLB
(R2) + (u2)

u5 L = 15'

$w_{DL} = 25 \cdot 28/2 = 350$ plf
$w_{LL} = 40 \cdot 21/2 = 560$ plf
⇒ 5 1/8 x 13 1/2 GLB

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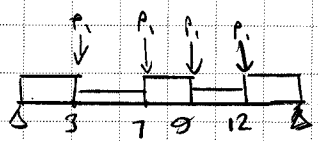
U6 L = 14'



$w_{1DL} = 15 \cdot 12/2 + 80 + 25 \cdot 10/2 = 295$ plf
$w_{1LL} = 25 \cdot 12/2 + 40 \cdot 10/2 = 350$ plf
$w_{2DL} = 25 \cdot 10/2 = 125$ plf
$w_{2LL} = 40 \cdot 10/2 = 200$ plf
$P_1 = 590^{\#}$ (RJ)

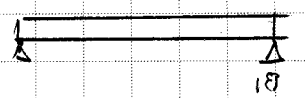
⇒ 5 1/8 x 12 GLB

U7 L = 22'

$w_{DL} = 15 \cdot 4 + 80 + 25 \cdot 3 = 215$ plf
$w_{LL} = 25 \cdot 4 + 40 \cdot 3 = 220$ plf
$P = 4200^{\#}$ (RJ) $+ 6944$ (U5) $= 11144$ @ 14'

⇒ 6 3/4 x 21 GLB

U8 L = 18'



$w_{DL} = 25 \cdot 28/2 = 350$ plf
$w_{LL} = 40 \cdot 28/2 = 560$ plf

⇒ 5 1/8 x 16 1/2 GLB

U9 L = 8'

$w_{DL} = 25 \cdot 20/2 = 250$ plf
$w_{LL} = 40 \cdot 20/2 = 400$ plf

⇒ 3 1/8 x 9" GLB

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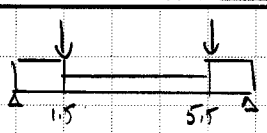
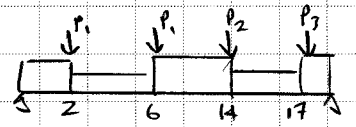
U10 L = 8'



$w_{1DL} = 15 \cdot 3\frac{1}{2}/2 + 80 + 25 \cdot 2 = 385$ plf
$w_{1LL} = 25 \cdot 3\frac{1}{2}/2 + 40 \cdot 2 = 505$ plf
$w_{2DL} = 25 \cdot 2 = 50$ plf
$w_{2LL} = 40 \cdot 2 = 80$ plf
$P_1 = P_2 = 1605$ #
(R9)

⇒ $5\frac{1}{8} \times 9$ GLB

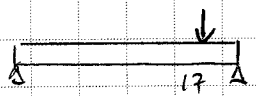
U11 L = 18'



$w_{1DL} = 15 \cdot 3\frac{1}{2}/2 + 80 + 25 \cdot 2\frac{0}{2} = 585$ plf
$w_{1LL} = 25 \cdot 3\frac{1}{2}/2 + 40 \cdot 2\frac{0}{2} = 825$ plf
$w_{2DL} = 25 \cdot 2\frac{0}{2} = 250$ plf
$w_{2LL} = 40 \cdot 2\frac{0}{2} = 400$ plf
$P_1 = 1200$ #
$P_2 = 750$ #
$P_3 = 1500$ #

⇒ $5\frac{1}{8} \times 19\frac{1}{2}$ GLB

U12 L = 20'



$w_{DL} = 15 \cdot 4 + 80 + 25 \cdot 4 = 240$ plf
$w_{LL} = 25 \cdot 4 + 40 \cdot 4 = 260$ plf
$P = 12333$ @ 17'
(U11)

⇒ $6\frac{3}{4} \times 19\frac{1}{2}$ GLB

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U13 L = 16.5'

$w_{DL} = 15.4 = 60$ plf
$w_{LL} = 25.4 = 100$ plf
⇒ 6x12 DF #2

U14 L = 10'

$w_{DL} = 15.4 + 80 + 25.4 = 240$ plf
$w_{LL} = 25.4 + 40.4 = 260$ plf
⇒ 5 1/8 x 9 GLB

U15 L = 20'

$w_{DL} = 25 \cdot 27/2 = 338$ plf
$w_{LL} = 40 \cdot 27/2 = 540$ plf
$P = 7153$ (U12) $+ 2553$ (U14) $= 9706$ @ 3'
⇒ 6 3/4 x 19 1/2 GLB

U16 L = 3'

$w_{DL} = 25.2 = 50$ plf
$w_{LL} = 40.2 = 80$ plf
$P = 10539$ @ 2' (U17)
⇒ 5 1/8 x 10 1/2 GLB

U17 L = 7'

$w_{DL} = 25 \cdot 20/2 = 250$ plf
$w_{LL} = 40 \cdot 20/2 = 400$ plf
⇒ 6x10 DF #2

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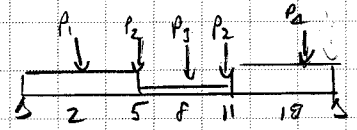
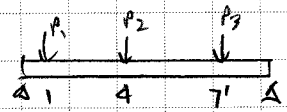
U18 L=20'



$W_{10L} = 15 \cdot 24/2 + 80 + 25 \cdot 12/2 = 485$ plf
$W_{1LL} = 25 \cdot 34/2 + 40 \cdot 12/2 = 665$ plf
$W_{20L} = 25 \cdot 12/2 = 150$ plf
$W_{2LL} = 40 \cdot 12/2 = 240$ plf
$P_1 = 2553^{\#}$ (U4)
$P_2 = 900^{\#}$
$P_3 = 1800^{\#}$
$P_4 = 750^{\#}$

⇒ 5 1/8 x 19 1/2 GLB

U19 L=8'



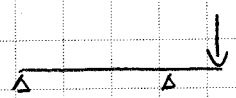
$W_{DL} = 15 \cdot 4 + 80 + 25 \cdot 2 = 190$ plf
$W_{LL} = 25 \cdot 4 + 40 \cdot 2 = 180$ plf
$P_1 = 1052^{\#}$
$P_2 = 2107^{\#}$
$P_3 = 5810 + 1052 = 6862^{\#}$ ⇒ 5 1/8 x 12 GLB

U20 L= 6.5'

$W_{DL} = 25 \cdot 24/2 = 300$ plf
$W_{LL} = 40 \cdot 24/2 = 480$ plf
$P = 8724$ @ 1'
(U19)

⇒ 5 1/8 x 12 GLB

U21 L= 2' cant
3' Back span



$P = 4366^{\#}$ ⇒ 3 1/2 x 14 PSL
OR FLOOR TRUSS

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:12:38	Valentin Residence BeamU1

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	190.0				No
wll	Live	Full UDL	180.0				No
p	Live	Point	10790		17.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	2290		2290
Live	4193		10467
Total	6483		12756
Bearing:			
LC number	2		2
Length	1.9		3.8

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x19-1/2"

Self Weight of 23.01 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 182	Fv' = 240	fv/Fv' = 0.76
Bending(+)	fb = 1974	Fb' = 2281	fb/Fb' = 0.87
Live Defl'n	0.55 = L/467	0.72 = L/360	0.77
Total Defl'n	0.82 = L/313	1.08 = L/240	0.76

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	0.950	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 53441 lbs-ft
Shear : LC# 2 = D+L, V = 12756, V design = 12118 lbs
Deflection: LC# 2 = D+L EI=5700.09e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:11:19	Valentin Residence BeamU2

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1d1	Dead	Partial UDL	275.0	275.0	0.00	9.00	No
w1l1	Live	Partial UDL	480.0	480.0	0.00	9.00	No
w2d1	Dead	Partial UDL	338.0	338.0	9.00	17.00	No
w2l1	Live	Partial UDL	580.0	580.0	9.00	17.00	No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	2662		2928
Live	4268		4692
Total	6930		7620
Bearing:			
LC number	2		2
Length	1.2		1.3

Glulam-Bal., West Species, 24F-1.8E WS, 8-3/4x12"

Self Weight of 24.17 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 95	Fv' = 240	fv/Fv' = 0.40
Bending(+)	fb = 1761	Fb' = 2324	fb/Fb' = 0.76
Live Defl'n	0.44 = L/468	0.57 = L/360	0.77
Total Defl'n	0.84 = L/242	0.85 = L/240	0.99

ADDITIONAL DATA:

FACTORS: F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+ 2400	1.00	1.00	1.00	1.000	0.968	1.00	1.00	1.00	1.00	-	2
Fv' 240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp' 650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E' 1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 30811 lbs-ft
Shear : LC# 2 = D+L, V = 7620, V design = 6683 lbs
Deflection: LC# 2 = D+L EI=2267.96e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

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COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:14:14	Valentin Residence BeamU3

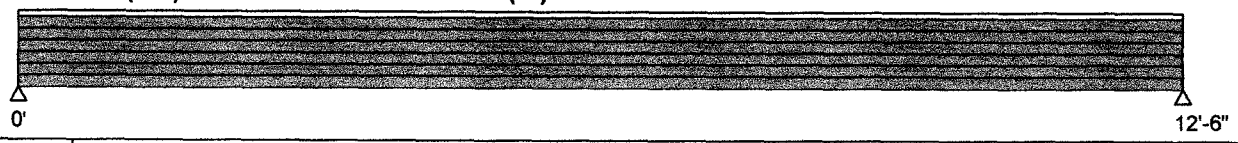
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	113.0				No
wll	Live	Full UDL	270.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	773		773
Live	1688		1688
Total	2460		2460
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 70	Fv' = 240	fv/Fv' = 0.29
Bending(+)	fb = 1333	Fb' = 2400	fb/Fb' = 0.56
Live Defl'n	0.26 = L/566	0.42 = L/360	0.64
Total Defl'n	0.45 = L/336	0.63 = L/240	0.71

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8	million	1.00	1.00	-	-	-	-	1.00	-	-	2

```
Bending(+): LC# 2 = D+L, M =   7688 lbs-ft
Shear     : LC# 2 = D+L, V =   2460, V design =   2165 lbs
Deflection: LC# 2 = D+L   EI= 560.41e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
  (D=dead  L=live  S=snow  W=wind  I=impact  C=construction  CLd=concentrated)
  (All LC's are listed in the Analysis output)
```

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:16:56	Valentin Residence BeamU4

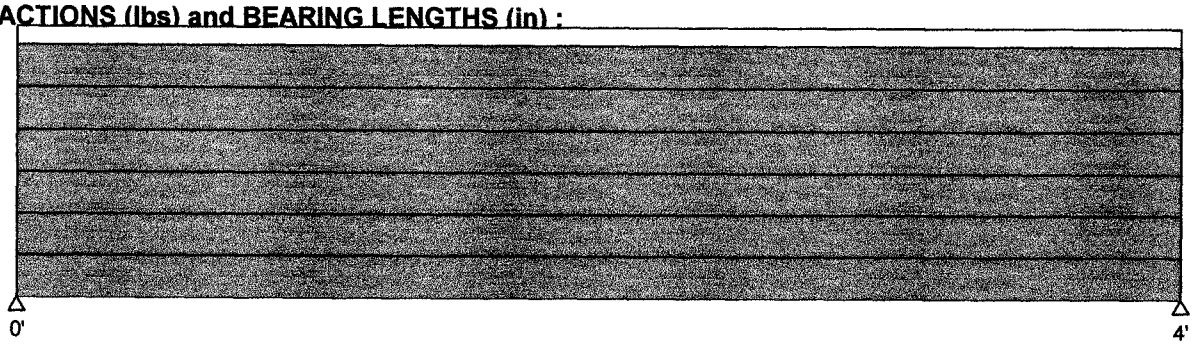
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	50.0				No
wll	Live	Full UDL	80.0				No
p	Live	Point	11480		2.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	125		125
Live	5900		5900
Total	6025		6025
Bearing:			
LC number	2		2
Length	1.8		1.8

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x10-1/2"

Self Weight of 12.39 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 164	Fv' = 240	fv/Fv' = 0.69
Bending(+)	fb = 1499	Fb' = 2400	fb/Fb' = 0.62
Live Defl'n	0.03 = <L/999	0.13 = L/360	0.23
Total Defl'n	0.03 = <L/999	0.20 = L/240	0.15

ADDITIONAL DATA:

FACTORS: F		CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

```
Bending(+): LC# 2 = D+L, M =  11765 lbs-ft
Shear     : LC# 2 = D+L, V =   6025, V design =   5900 lbs
Deflection: LC# 2 = D+L   EI= 889.91e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
  (D=dead  L=live  S=snow  W=wind  I=impact  C=construction  CLd=concentrated)
  (All LC's are listed in the Analysis output)
```

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:18:01	Valentin Residence BeamU5

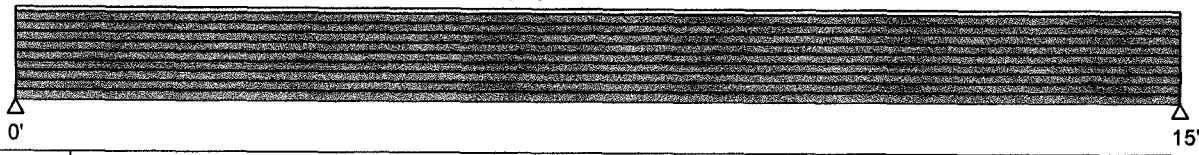
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	350.0				No
wll	Live	Full UDL	560.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



	0'	15'
Dead	2744	2744
Live	4200	4200
Total	6944	6944
Bearing:		
LC number	2	2
Length	2.1	2.1

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x13-1/2"

Self Weight of 15.93 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 128	Fv' = 240	fv/Fv' = 0.53
Bending(+)	fb = 2007	Fb' = 2400	fb/Fb' = 0.84
Live Defl'n	0.34 = L/533	0.50 = L/360	0.67
Total Defl'n	0.56 = L/322	0.75 = L/240	0.74

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8	million	1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 26042 lbs-ft
Shear : LC# 2 = D+L, V = 6944, V design = 5903 lbs
Deflection: LC# 2 = D+L EI=1891.38e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	295.0	295.0	0.00	3.00	No
w1ll	Live	Partial UDL	350.0	350.0	0.00	3.00	No
w2dl	Dead	Partial UDL	125.0	125.0	3.00	7.00	No
w2ll	Live	Partial UDL	200.0	200.0	3.00	7.00	No
w3dl	Dead	Partial UDL	295.0	295.0	7.00	9.00	No
w3ll	Live	Partial UDL	350.0	350.0	7.00	9.00	No
w4dl	Dead	Partial UDL	125.0	125.0	9.00	12.00	No
w4ll	Live	Partial UDL	200.0	200.0	9.00	12.00	No
w5dl	Dead	Partial UDL	295.0	295.0	12.00	14.00	No
w5ll	Live	Partial UDL	350.0	350.0	12.00	14.00	No
p1	Live	Point	590		3.00		No
p2	Live	Point	590		7.00		No
p3	Live	Point	590		9.00		No
p4	Live	Point	590		12.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

	0'	14'
Dead	1599	1539
Live	3005	3205
Total	4605	4743
Bearing:		
LC number	2	2
Length	1.4	1.4

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x12"

Self Weight of 14.16 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 100	Fv' = 240	fv/Fv' = 0.42
Bending(+)	fb = 1589	Fb' = 2400	fb/Fb' = 0.66
Live Defl'n	0.29 = L/570	0.47 = L/360	0.63
Total Defl'n	0.43 = L/393	0.70 = L/240	0.61

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 16290 lbs-ft
Shear : LC# 2 = D+L, V = 4743, V design = 4084 lbs
Deflection: LC# 2 = D+L EI=1328.38e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:25:38	Valentin Residence BeamU7

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	215.0				No
wll	Live	Full UDL	220.0				No
p	Live	Point	11144		14.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

	0'	22'
Dead	2724	2724
Live	6472	9512
Total	9196	12236
Bearing:		
LC number	2	2
Length	2.1	2.8

Glulam-Bal., West Species, 24F-1.8E WS, 6-3/4x21"

Self Weight of 32.64 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 121	Fv' = 240	fv/Fv' = 0.50
Bending(+)	fb = 2005	Fb' = 2197	fb/Fb' = 0.91
Live Defl'n	0.53 = L/495	0.73 = L/360	0.73
Total Defl'n	0.67 = L/392	1.10 = L/240	0.61

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	0.916	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 82908 lbs-ft
Shear : LC# 2 = D+L, V = 12236, V design = 11417 lbs
Deflection: LC# 2 = D+L EI=9376.61e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	350.0				No
wll	Live	Full UDL	560.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	3325		3325
Live	5040		5040
Total	8365		8365
Bearing:			
LC number	2		2
Length	2.5		2.5

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x16-1/2"

Self Weight of 19.47 plf automatically included in loads;
Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 126	Fv' = 240	fv/Fv' = 0.52
Bending(+)	fb = 1942	Fb' = 2361	fb/Fb' = 0.82
Live Defl'n	0.38 = L/563	0.60 = L/360	0.64
Total Defl'n	0.64 = L/339	0.90 = L/240	0.71

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	0.984	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	1.00	1.00		-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 37643 lbs-ft
Shear : LC# 2 = D+L, V = 8365, V design = 7087 lbs
Deflection: LC# 2 = D+L EI=3453.27e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

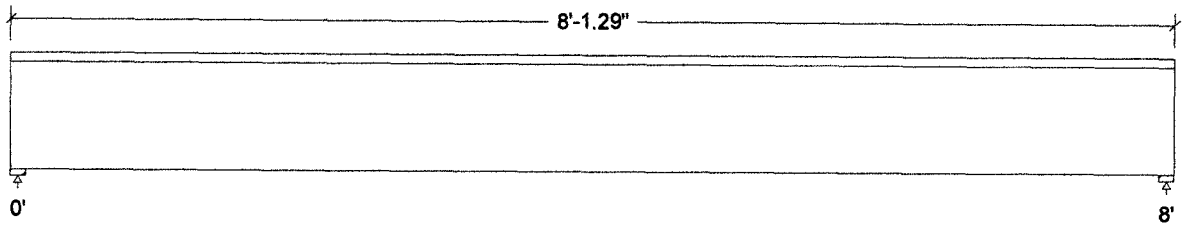
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
wdl	Dead	Full UDL				250.0		plf
wll	Live	Full UDL				400.0		plf
Self-weight	Dead	Full UDL				6.5		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	1026		1026
Live	1600		1600
Factored:			
Total	2626		2626
Bearing:			
Capacity			
Beam	2626		2626
Des ratio			
Beam	1.00		1.00
Load comb	#2		#2
Length	1.29		1.29
Min req'd	1.29		1.29
Cb	1.00		1.00
Cb min	1.00		1.00

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/8"x9"
6 laminations, 3-1/8" maximum width,
Supports: All - Non-wood
Total length: 8'-1.29"; Clear span: 7'-10.71"; volume = 1.6 cu.ft.
Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 112	Fv' = 265	psi	fv/Fv' = 0.42
Bending(+)	fb = 1494	Fb' = 2400	psi	fb/Fb' = 0.62
Live Defl'n	0.11 = L/889	0.27 = L/360	in	0.40
Total Defl'n	0.21 = L/453	0.40 = L/240	in	0.53

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:
Shear : LC #2 = D+L, V max = 2626, V design = 2098 lbs
Bending(+): LC #2 = D+L, M = 5252 lbs-ft
Deflection: LC #2 = D+L (live)
LC #2 = D+L (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ICC-IBC

CALCULATIONS:
Deflection: EI = 342e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow...)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2015 and manufactured in accordance with ANSI A190.1-2012
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:33:44	Valentin Residence BeamU10

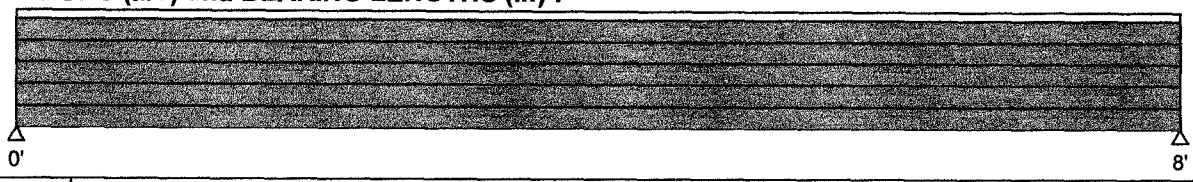
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	385.0	385.0	0.00	1.50	No
w1ll	Live	Partial UDL	505.0	505.0	0.00	1.50	No
w2dl	Dead	Partial UDL	50.0	50.0	1.50	5.50	No
w2ll	Live	Partial UDL	80.0	80.0	1.50	5.50	No
w3dl	Dead	Partial UDL	385.0	385.0	5.50	8.00	No
w3ll	Live	Partial UDL	505.0	505.0	5.50	8.00	No
p1	Live	Point	1605		1.50		No
p2	Live	Point	1605		5.50		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	829		996
Live	2869		2681
Total	3698		3677
Bearing:			
LC number	2		2
Length	1.1		1.1

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 98	Fv' = 240	fv/Fv' = 0.41
Bending(+)	fb = 1106	Fb' = 2400	fb/Fb' = 0.46
Live Defl'n	0.11 = L/909	0.27 = L/360	0.40
Total Defl'n	0.13 = L/726	0.40 = L/240	0.33

ADDITIONAL DATA:

FACTORS: F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+ 2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv' 240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp' 650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E' 1.8 million	1.00	1.00		-	-	-	-	1.00	-	-	2

```
Bending(+): LC# 2 = D+L, M =   6377 lbs-ft
Shear     : LC# 2 = D+L, V =   3698, V design =   3023 lbs
Deflection: LC# 2 = D+L   EI= 560.41e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
  (D=dead  L=live  S=snow  W=wind  I=impact  C=construction  CLd=concentrated)
  (All LC's are listed in the Analysis output)
```

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:38:29	Valentin Residence BeamU11

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	585.0	585.0	0.00	2.00	No
w1ll	Live	Partial UDL	825.0	825.0	0.00	2.00	No
w2dl	Dead	Partial UDL	250.0	250.0	2.00	6.00	No
w2ll	Live	Partial UDL	400.0	400.0	2.00	6.00	No
w3dl	Dead	Partial UDL	585.0	585.0	6.00	14.00	No
w3ll	Live	Partial UDL	825.0	825.0	6.00	14.00	No
w4dl	Dead	Partial UDL	250.0	250.0	14.00	17.00	No
w4ll	Live	Partial UDL	400.0	400.0	14.00	17.00	No
w5dl	Dead	Partial UDL	585.0	585.0	17.00	18.00	No
w5ll	Live	Partial UDL	825.0	825.0	17.00	18.00	No
p1	Live	Point	1200		2.00		No
p2	Live	Point	1200		6.00		No
p3	Live	Point	750		14.00		No
p4	Live	Point	1500		17.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	4290		4309
Live	8042		8483
Total	12333		12792
Bearing:			
LC number	2		2
Length	3.7		3.8

Glulam-Bal., West Species, 24F-1.8E WS, 5-1/8x19-1/2"

Self Weight of 23.01 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv* = 155	Fv' = 240	fv*/Fv' = 0.65
Bending(+)	fb = 2004	Fb' = 2322	fb/Fb' = 0.86
Live Defl'n	0.36 = L/594	0.60 = L/360	0.61
Total Defl'n	0.57 = L/378	0.90 = L/240	0.63

*The effect of point loads within a distance d of the support has been included as per NDS 3.4.3.1

ADDITIONAL DATA:

FACTORS: F		CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	0.967	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	1.00	1.00		-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 54239 lbs-ft
Shear : LC# 2 = D+L, V = 12792, V design* = 10358 lbs
Deflection: LC# 2 = D+L EI=5700.09e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:40:46	Valentin Residence BeamU12

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Full UDL	240.0				No
w1ll	Dead	Full UDL	260.0				No
p	Dead	Point	12333		17.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

	0'	20'
Dead	7153	15786
Live		
Total	7153	15786
Bearing:		
LC number	1	1
Length	1.6	3.6

Glulam-Bal., West Species, 24F-1.8E WS, 6-3/4x19-1/2"

Self Weight of 30.3 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 170	Fv' = 216	fv/Fv' = 0.79
Bending(+)	fb = 1353	Fb' = 2011	fb/Fb' = 0.67
Live Defl'n	negligible		
Total Defl'n	0.46 = L/520	1.00 = L/240	0.46

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	0.90	1.00	1.00	1.000	0.931	1.00	1.00	1.00	1.00	-	1
Fv'	240	0.90	1.00	1.00	-	-	-	-	1.00	1.00	1.00	1
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	1

Bending(+): LC# 1 = D only, M = 48222 lbs-ft
Shear : LC# 1 = D only, V = 15786, V design = 14924 lbs
Deflection: LC# 1 = D only EI=7507.44e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 18062 Jan. 22, 2019 13:42:50	Valentin Residence BeamU13	3C

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	60.0				No
wll	Live	Full UDL	100.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	619		619
Live	825		825
Total	1444		1444
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x12"

Self Weight of 15.02 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 30	Fv' = 170	fv/Fv' = 0.18
Bending(+)	fb = 590	Fb' = 875	fb/Fb' = 0.67
Live Defl'n	0.18 = <L/999	0.55 = L/360	0.33
Total Defl'n	0.32 = L/614	0.83 = L/240	0.39

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 5956 lbs-ft
Shear : LC# 2 = D+L, V = 1444, V design = 1276 lbs
Deflection: LC# 2 = D+L EI= 906.17e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:43:54	Valentin Residence BeamU14

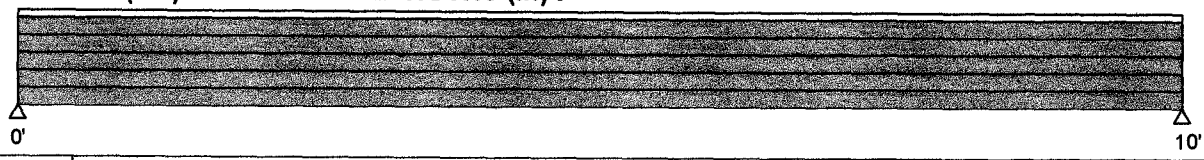
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wd1	Dead	Full UDL	240.0				No
wl1	Live	Full UDL	260.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	1253		1253
Live	1300		1300
Total	2553		2553
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 plf automatically included in loads;
Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 71	Fv' = 240	fv/Fv' = 0.29
Bending(+)	fb = 1107	Fb' = 2400	fb/Fb' = 0.46
Live Defl'n	0.10 = <L/999	0.33 = L/360	0.31
Total Defl'n	0.21 = L/585	0.50 = L/240	0.41

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8	million	1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 6383 lbs-ft
Shear : LC# 2 = D+L, V = 2553, V design = 2170 lbs
Deflection: LC# 2 = D+L EI= 560.41e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 18062 Jan. 22, 2019 13:45:44	Valentin Residence BeamU15	38

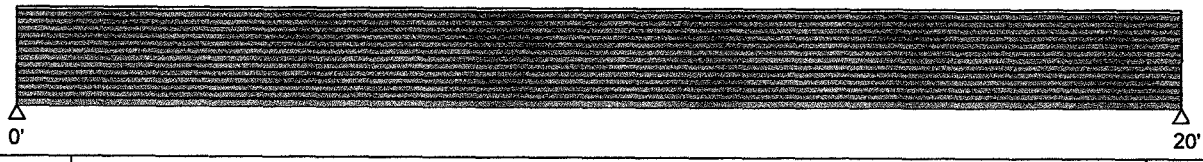
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	338.0				No
wll	Live	Full UDL	540.0				No
p	Live	Point	9706		3.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	3683		3683
Live	13650		6856
Total	17333		10539
Bearing:			
LC number	2		2
Length	4.0		2.4

Glulam-Unbal., West Species, 24F-1.8E WS, 6-3/4x19-1/2"

Self Weight of 30.3 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 181	Fv' = 240	fv/Fv' = 0.75
Bending(+)	fb = 1715	Fb' = 2235	fb/Fb' = 0.77
Live Defl'n	0.42 = L/569	0.67 = L/360	0.63
Total Defl'n	0.60 = L/401	1.00 = L/240	0.60

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	0.931	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 61139 lbs-ft
Shear : LC# 2 = D+L, V = 17333, V design = 15857 lbs
Deflection: LC# 2 = D+L EI=7507.44e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:50:09	Valentin Residence BeamU16

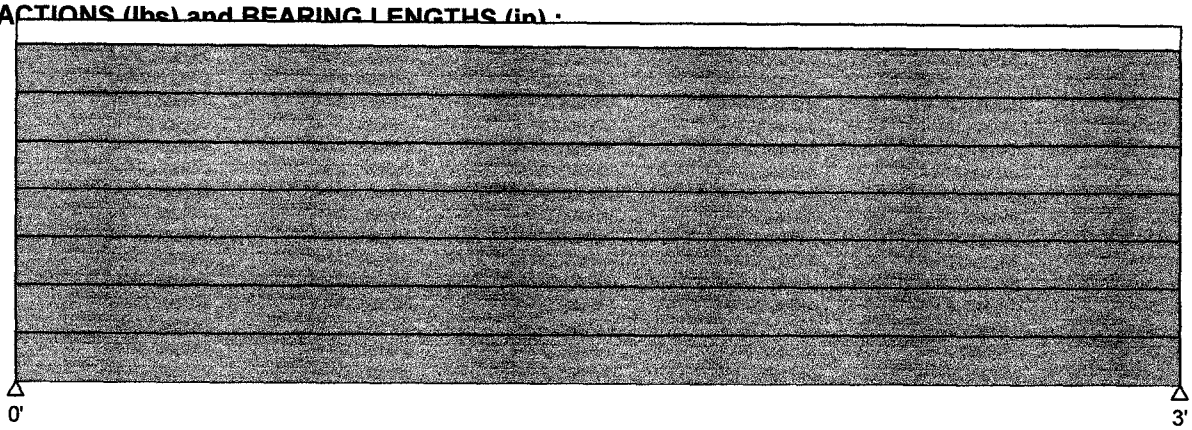
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	50.0				No
wll	Live	Full UDL	80.0				No
Load4	Live	Point	10539		2.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	94		94
Live	3633		7146
Total	3727		7240
Bearing:			
LC number	2		2
Length	1.1		2.2

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x10-1/2"

Self Weight of 12.39 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 198	Fv' = 240	fv/Fv' = 0.83
Bending(+)	fb = 913	Fb' = 2400	fb/Fb' = 0.38
Live Defl'n	0.01 = <L/999	0.10 = L/360	0.10
Total Defl'n	0.01 = <L/999	0.15 = L/240	0.07

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 7168 lbs-ft
Shear : LC# 2 = D+L, V = 7240, V design = 7115 lbs
Deflection: LC# 2 = D+L EI= 889.91e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 18062 Jan. 22, 2019 13:49:13	Valentin Residence BeamU17	45

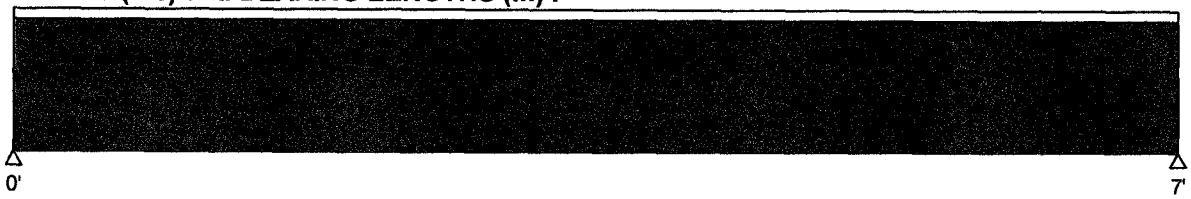
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	250.0				No
wll	Live	Full UDL	400.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	918		918
Live	1400		1400
Total	2318		2318
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 52	Fv' = 170	fv/Fv' = 0.30
Bending(+)	fb = 589	Fb' = 875	fb/Fb' = 0.67
Live Defl'n	0.04 = <L/999	0.23 = L/360	0.18
Total Defl'n	0.07 = <L/999	0.35 = L/240	0.20

ADDITIONAL DATA:

FACTORS: F		CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million	1.00	1.00		-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 4057 lbs-ft
Shear : LC# 2 = D+L, V = 2318, V design = 1794 lbs
Deflection: LC# 2 = D+L EI= 510.84e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT	
Forsman Engineering 18062 Jan. 22, 2019 13:54:59	Valentin Residence BeamU18	41

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
w1dl	Dead	Partial UDL	485.0	485.0	0.00	5.00	No
w1ll	Live	Partial UDL	665.0	665.0	0.00	5.00	No
w2dl	Dead	Partial UDL	150.0	150.0	5.00	11.00	No
w2ll	Live	Partial UDL	240.0	240.0	5.00	11.00	No
w3dl	Dead	Partial UDL	485.0	485.0	11.00	20.00	No
w3ll	Live	Partial UDL	665.0	665.0	11.00	20.00	No
p1	Live	Point	2553		2.00		No
p2	Live	Point	900		5.00		No
p3	Live	Point	1800		8.00		No
p4	Live	Point	900		11.00		No
p5	Live	Point	750		18.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	3874		4276
Live	9653		8000
Total	13527		12276
Bearing:			
LC number	2		2
Length	4.1		3.7

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x19-1/2"

Self Weight of 23.01 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 174	Fv' = 240	fv/Fv' = 0.73
Bending(+)	fb = 2133	Fb' = 2297	fb/Fb' = 0.93
Live Defl'n	0.51 = L/466	0.67 = L/360	0.77
Total Defl'n	0.74 = L/323	1.00 = L/240	0.74

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	0.957	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 57728 lbs-ft
Shear : LC# 2 = D+L, V = 13527, V design = 11621 lbs
Deflection: LC# 2 = D+L EI=5700.09e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:57:09	Valentin Residence BeamU19

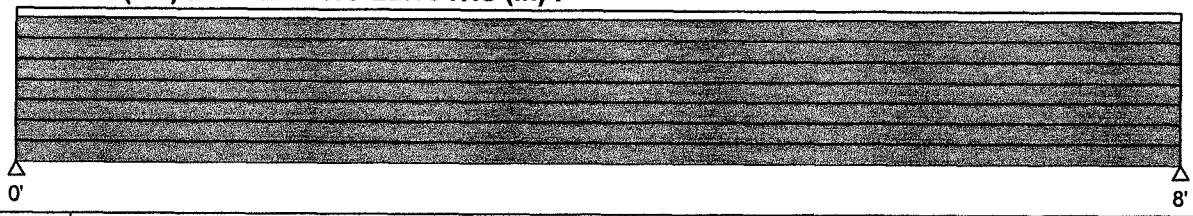
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	190.0				No
wll	Live	Full UDL	180.0				No
p1	Live	Point	1052		1.00		No
p2	Live	Point	2103		4.00		No
p3	Live	Point	6862		7.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	817		817
Live	3550		7907
Total	4366		8724
Bearing:			
LC number	2		2
Length	1.3		2.6

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x12"

Self Weight of 14.16 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv* = 203	Fv' = 240	fv*/Fv' = 0.85
Bending(+)	fb = 1096	Fb' = 2400	fb/Fb' = 0.46
Live Defl'n	0.08 = <L/999	0.27 = L/360	0.31
Total Defl'n	0.10 = L/998	0.40 = L/240	0.24

*The effect of point loads within a distance d of the support has been included as per NDS 3.4.3.1

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 11236 lbs-ft
Shear : LC# 2 = D+L, V = 8724, V design* = 8340 lbs
Deflection: LC# 2 = D+L EI=1328.38e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 22, 2019 13:59:22	Valentin Residence BeamU20

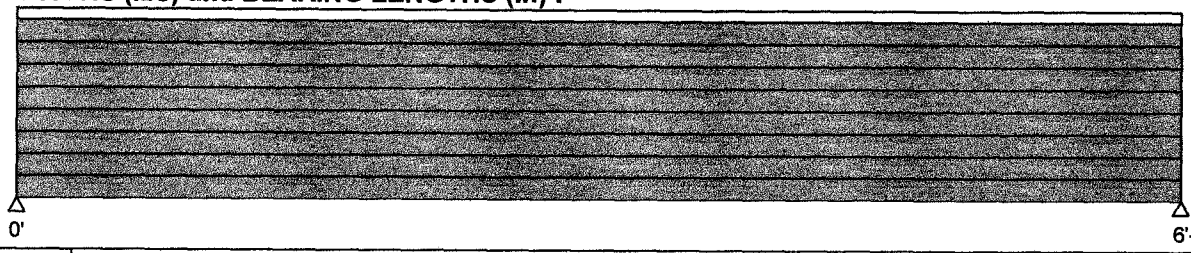
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	300.0				No
wll	Live	Full UDL	480.0				No
p	Live	Point	8724		1.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	1021		1021
Live	8942		2902
Total	9963		3923
Bearing:			
LC number	2		2
Length	3.0		1.2

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x12"

Self Weight of 14.16 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 224	Fv' = 240	fv/Fv' = 0.93
Bending(+)	fb = 945	Fb' = 2400	fb/Fb' = 0.39
Live Defl'n	0.04 = <L/999	0.22 = L/360	0.20
Total Defl'n	0.05 = <L/999	0.32 = L/240	0.16

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	1.00	1.00		-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 9690 lbs-ft
Shear : LC# 2 = D+L, V = 9963, V design = 9169 lbs
Deflection: LC# 2 = D+L EI=1328.38e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

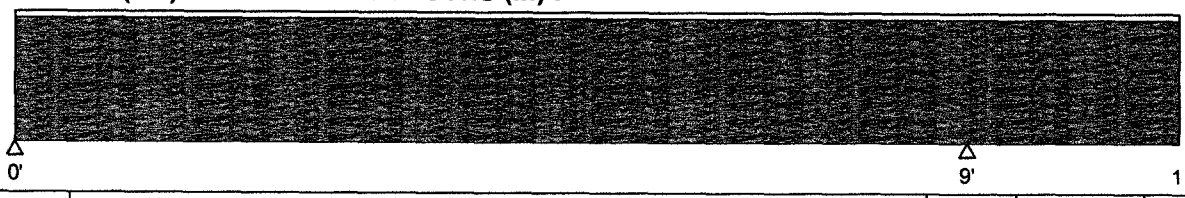
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
p	Dead	Point	4366		11.00		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead			5439		
Live					
Uplift	905				
Total			5439		
Bearing:					
LC number	1		1		1
Length	0.0		1.7		0.0
Cb	0.00		1.22		0.00

PSL, 2.0E, 2900Fb, 3-1/2x14"

Self Weight of 15.31 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (lbs, lbs-ft, or in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 134	Fv' = 256	fv/Fv' = 0.52
Bending(+)	fb = 15	Fb' = 2566	fb/Fb' = 0.01
Bending(-)	fb = 920	Fb' = 2502	fb/Fb' = 0.37
Deflection:			
Interior Live	negligible		
Total	0.05 = <L/999	0.45 = L/240	0.10
Cantil. Live	negligible		
Total	0.07 = L/351	0.20 = L/120	0.34

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	2900	0.90	-	1.00	1.000	0.98	-	1.00	1.00	-	-	1
Fb'-	2900	0.90	-	1.00	0.959	1.00	-	1.00	1.00	-	-	1
Fv'	285	0.90	-	1.00	-	-	-	-	1.00	-	1.00	1
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-	-
E'	2.0	million	-	1.00	-	-	-	-	1.00	-	-	1

```
Bending(+): LC# 1 = D only, M =    140 lbs-ft
Bending(-): LC# 1 = D only, M =   8763 lbs-ft
Shear     : LC# 1 = D only, V =   4397, V design =   4379 lbs
Deflection: LC# 1 = D only   EI=1600.64e06 lb-in2
Total Deflection = 1.00(Dead Load Deflection) + Live Load Deflection.
  (D=dead  L=live  S=snow  W=wind  I=impact  C=construction  CLd=concentrated)
  (All LC's are listed in the Analysis output)
```

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. SCL-BEAMS (Structural Composite Lumber): the attached SCL selection is for preliminary design only. For final member design contact your local SCL manufacturer.
3. Size factors vary from one manufacturer to another for SCL materials. They can be changed in the database editor.
4. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

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JOB 18062
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SCALE

Main Floor Framing

M1 L = 21'

$w_{DL} = 25 \cdot 18/2 = 225$ plf
$w_{LL} = 40 \cdot 18/2 = 360$ plf
⇒ 5 1/8 x 10 1/2 GLB

M2 L = 12.5'

$w_{DL} = 25 \cdot 2 = 50$ plf
$w_{LL} = 40 \cdot 2 = 80$ plf
⇒ 6x10 DF #2

M3 L = 8.5'

$w_{DL} = 25 \cdot 33/2 = 413$ plf
$w_{LL} = 40 \cdot 33/2 = 660$ plf
⇒ 5 1/8 x 9 GLB

M4 L = 5.5'

$w_{DL} = 25 \cdot 17/2 + 100 = 313$ plf
$w_{LL} = 40 \cdot 13/2 = 260$ plf
P = 6025 @ 3.5'
(ea)
⇒ 5 1/8 x 9 GLB

M5 L = 13'

$w_{DL} = 25 \cdot 10/2 = 125$ plf
$w_{LL} = 60 \cdot 10/2 = 300$ plf
⇒ 5 1/8 x 10 1/2 GLB

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JOB 18062
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SCALE

M6 L = 19'

$w_{DL} = \frac{25}{2(8)}(8+1)^2 = 127$ plf

$w_{LL} = \frac{60}{2(8)}(8+1)^2 = 304$ plf

⇒ $5\frac{1}{8} \times 10\frac{1}{2}$ GLB

M7 L = 13'

$w_{DL} = 100 + 25.2 = 150$ plf

$w_{LL} = 40.2 = 80$ plf

⇒ $5\frac{1}{8} \times 9$ GLB

M8 L = 17'

$w_{DL} = (75)\,16/2 = 600$ plf

$w_{LL} = (50)\,16/2 = 400$ plf

$M_1 = (1.000)\,17^2/8 = 36.1$ k-ft ← controls

$M_2 = (.3)\,17/4 + (.6)\,17^2/8 = 34.4$ k-ft

$S_{x\,req'd} = \frac{(36.1)(12)\,1.67}{50} = 14.51\ in^3$

$l/480 = \frac{17 \cdot 12}{480} = 0.425$

$I_{x\,req'd} = \frac{(5)\left(\frac{1000}{12}\right)204^4}{384\,(29\times10^6)(.425)} = 152.5\ in^4$

$W_{12\times26}$ $S_x = 33.4$ $I_x = 204$ ⇒ W12×26

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JOB 18062
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M9 L = 9'

w_{DL} = 15.4 + 100 + 25.4 + 160 + 75.2 = 510 plf

w_{LL} = 25.4 + 40.40 + 50.4 = 460 plf

P = 15852 @ 2.5'

$$M = (510+460)9^2/8 + \frac{(15852)(2.5)(6.5)}{9} = 38.4^{k\text{-}ft}$$

W12x26 S_x = 33.4 I_x = 204

$(33.4)\,50/1.67 = 1000^{k\text{-}in}/12 = 83.3^{k\text{-}ft}$ ✓

A = 7.65 $(7.65)(50)/2 = 191^{k}$

$V = (510+460)9/2 + 15852 = 20.2^{k}$ ✓

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 27, 2019 13:11:00	Valentin Residence BeamM1

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	225.0				No
wll	Live	Full UDL	360.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	2567		2567
Live	3780		3780
Total	6347		6347
Bearing:			
LC number	2		2
Length	1.9		1.9

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x16-1/2"

Self Weight of 19.47 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 98	Fv' = 240	fv/Fv' = 0.41
Bending(+)	fb = 1719	Fb' = 2325	fb/Fb' = 0.74
Live Defl'n	0.46 = L/552	0.70 = L/360	0.65
Total Defl'n	0.92 = L/273	1.05 = L/240	0.88

ADDITIONAL DATA:

FACTORS: F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+ 2400	1.00	1.00	1.00	1.000	0.969	1.00	1.00	1.00	1.00	-	2
Fv' 240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp' 650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E' 1.8 million	1.00	1.00	-	-	-	-	1.00	-	-	2	

Bending(+): LC# 2 = D+L, M = 33321 lbs-ft
Shear : LC# 2 = D+L, V = 6347, V design = 5516 lbs
Deflection: LC# 2 = D+L EI=3453.27e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 27, 2019 13:12:26	Valentin Residence BeamM2

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	50.0				No
wll	Live	Full UDL	80.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	390		390
Live	500		500
Total	890		890
Bearing:			
LC number	2		2
Length	1.0		1.0

Timber-soft, D.Fir-L, No.2, 6x10"

Self Weight of 12.41 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 22	Fv' = 170	fv/Fv' = 0.13
Bending(+)	fb = 403	Fb' = 875	fb/Fb' = 0.46
Live Defl'n	0.09 = <L/999	0.42 = L/360	0.21
Total Defl'n	0.19 = L/803	0.63 = L/240	0.30

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fb'+	875	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	170	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	-	2

Bending(+): LC# 2 = D+L, M = 2781 lbs-ft
Shear : LC# 2 = D+L, V = 890, V design = 777 lbs
Deflection: LC# 2 = D+L EI= 510.84e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 27, 2019 13:14:23	Valentin Residence BeamM3

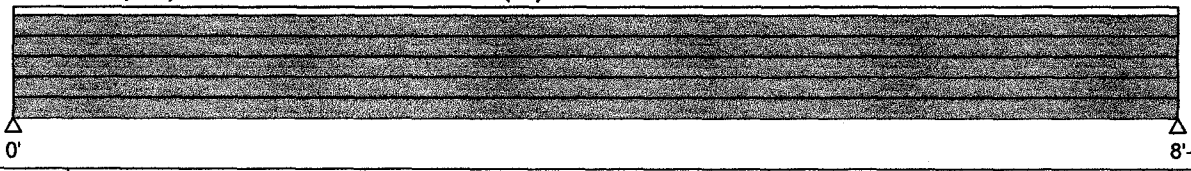
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	413.0				No
wll	Live	Full UDL	660.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	1800		1800
Live	2805		2805
Total	4605		4605
Bearing:			
LC number	2		2
Length	1.4		1.4

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 123	Fv' = 240	fv/Fv' = 0.51
Bending(+)	fb = 1697	Fb' = 2400	fb/Fb' = 0.71
Live Defl'n	0.14 = L/737	0.28 = L/360	0.49
Total Defl'n	0.27 = L/375	0.43 = L/240	0.64

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million	1.00	1.00		-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 9786 lbs-ft
Shear : LC# 2 = D+L, V = 4605, V design = 3793 lbs
Deflection: LC# 2 = D+L EI= 560.41e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

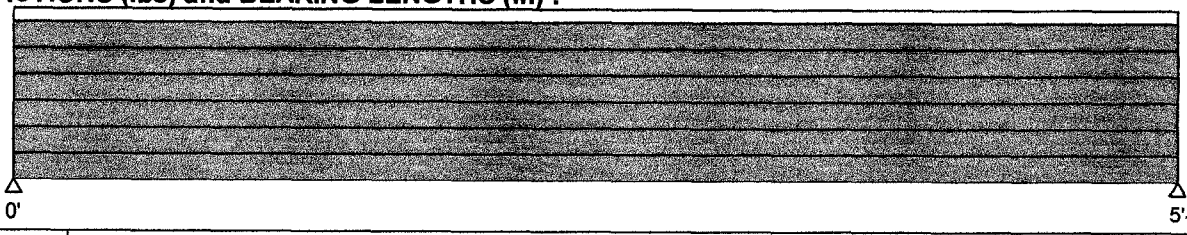
Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	313.0				No
wll	Live	Full UDL	260.0				No
p	Live	Point	6025		3.50		No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :



Dead	890		890
Live	2906		4549
Total	3796		5439
Bearing:			
LC number	2		2
Length	1.1		1.6

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 163	Fv' = 240	fv/Fv' = 0.68
Bending(+)	fb = 1684	Fb' = 2400	fb/Fb' = 0.70
Live Defl'n	0.07 = L/979	0.18 = L/360	0.37
Total Defl'n	0.09 = L/774	0.28 = L/240	0.31

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 9711 lbs-ft
Shear : LC# 2 = D+L, V = 5439, V design = 5001 lbs
Deflection: LC# 2 = D+L EI= 560.41e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 27, 2019 13:17:52	Valentin Residence BeamM5

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	125.0				No
wll	Live	Full UDL	300.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	893		893
Live	1950		1950
Total	2843		2843
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x10-1/2"

Self Weight of 12.39 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 69	Fv' = 240	fv/Fv' = 0.29
Bending(+)	fb = 1177	Fb' = 2400	fb/Fb' = 0.49
Live Defl'n	0.22 = L/720	0.43 = L/360	0.50
Total Defl'n	0.37 = L/426	0.65 = L/240	0.56

ADDITIONAL DATA:

FACTORS: F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+ 2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv' 240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp' 650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E' 1.8 million	1.00	1.00	-	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 9240 lbs-ft
Shear : LC# 2 = D+L, V = 2843, V design = 2460 lbs
Deflection: LC# 2 = D+L EI= 889.91e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 27, 2019 13:18:51	Valentin Residence BeamM6

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	127.0				No
wll	Live	Full UDL	304.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

	0'		14'
Dead	976		976
Live	2128		2128
Total	3104		3104
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x10-1/2"

Self Weight of 12.39 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 76	Fv' = 240	fv/Fv' = 0.32
Bending(+)	fb = 1384	Fb' = 2400	fb/Fb' = 0.58
Live Defl'n	0.30 = L/568	0.47 = L/360	0.63
Total Defl'n	0.50 = L/337	0.70 = L/240	0.71

ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 10863 lbs-ft
Shear : LC# 2 = D+L, V = 3104, V design = 2716 lbs
Deflection: LC# 2 = D+L EI= 889.91e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
Forsman Engineering 18062 Jan. 27, 2019 13:19:46	Valentin Residence BeamM7

Design Check Calculation Sheet

Sizer 2004

LOADS: (lbs, psf, or plf)

Load	Type	Distribution	Magnitude Start	Magnitude End	Location [ft] Start	Location [ft] End	Pattern Load?
wdl	Dead	Full UDL	150.0				No
wll	Live	Full UDL	80.0				No

MAXIMUM REACTIONS (lbs) and BEARING LENGTHS (in) :

Dead	1044		1044
Live	520		520
Total	1564		1564
Bearing:			
LC number	2		2
Length	1.0		1.0

Glulam-Unbal., West Species, 24F-1.8E WS, 5-1/8x9"

Self Weight of 10.62 plf automatically included in loads;

Lateral support: top= full, bottom= at supports; Load combinations: ICC-IBC;

SECTION vs. DESIGN CODE NDS-2001: (stress=psi, and in)

Criterion	Analysis Value	Design Value	Analysis/Design
Shear	fv = 45	Fv' = 240	fv/Fv' = 0.19
Bending(+)	fb = 882	Fb' = 2400	fb/Fb' = 0.37
Live Defl'n	0.09 = <L/999	0.43 = L/360	0.21
Total Defl'n	0.37 = L/423	0.65 = L/240	0.57

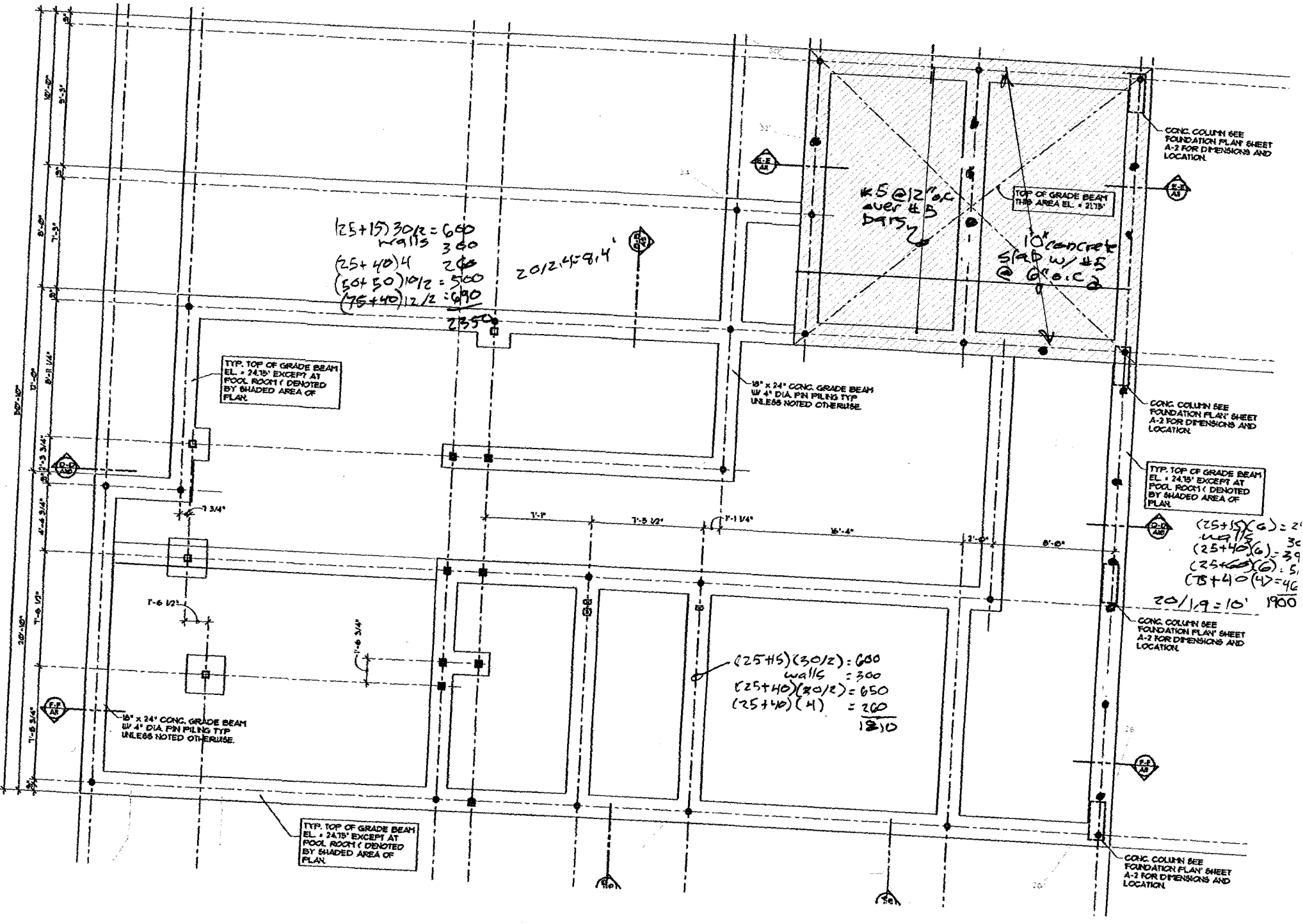
ADDITIONAL DATA:

FACTORS:	F	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn	LC#
Fb'+	2400	1.00	1.00	1.00	1.000	1.000	1.00	1.00	1.00	1.00	-	2
Fv'	240	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2

Bending(+): LC# 2 = D+L, M = 5083 lbs-ft
Shear : LC# 2 = D+L, V = 1564, V design = 1384 lbs
Deflection: LC# 2 = D+L EI= 560.41e06 lb-in2
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.
(D=dead L=live S=snow W=wind I=impact C=construction CLd=concentrated)
(All LC's are listed in the Analysis output)

DESIGN NOTES:

1. Please verify that the default deflection limits are appropriate for your application.
2. Glulam design values are for materials conforming to AITC 117-2001 and manufactured in accordance with ANSI/AITC A190.1-1992
3. GLULAM: bxd = actual breadth x actual depth.
4. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
5. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).


(25+15) 30/2 = 600
walls 300
(25+40) 4 260
(50+50) 10/2 = 500
(75+40) 12/2 = 690
2350
2012.45 9.4'
#5 @ 12" o.c. over #5 bars
10" concrete slab w/ #5 @ 6" o.c.
TOP OF GRADE BEAM EL. = 21.75'
CONC. COLUMN SEE FOUNDATION PLAN SHEET A-2 FOR DIMENSIONS AND LOCATION.
TYP. TOP OF GRADE BEAM EL. = 24.15' EXCEPT AT POOL ROOM (DENOTED BY SHADED AREA OF PLAN.
18" x 24" CONC. GRADE BEAM W/ 4" DIA. PIN PILING TYP UNLESS NOTED OTHERWISE.
(25+15)(30/2) = 600
walls = 300
(25+40)(20/2) = 650
(25+40)(4) = 260
1810
20/1.9 = 10' 1900
Calcs for

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JOB _____
SHEET NO. 56 OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Foundation, Spa only

Spa grade beam load. –

95
350
445 psf

445 x 21/2 = 4673 plf

From Geo-technical report 4"ϕ 7in pile capacity is 10 tons - or 20k

So req'd spacing - 20/4.7 = 4.3' o.c.

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JOB
SHEET NO. 57 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

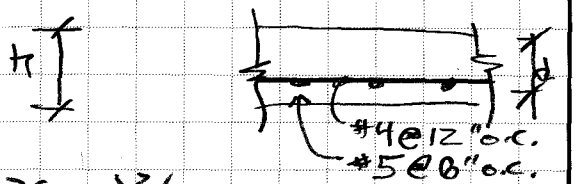
Spa structural slab
- one way

$\ell = 10,5'$

W_{SDL}: 20 + 6/12(150) = 95psf
W_{LL} = 50psf + 300psf = 350psf

$W_{D\,ult} = 1,4 \times 95 = 133$ psf
$W_{L\,ult} = 1,7 \times 350 = 595$psf
728

$W_{TL\,ult} = 728$plf



$M_{ULT} = (728)(10,5)^2/8$
$= 10,033^{\#'} = 10,0^{K'}$

check w/ (8/12)150 + 20 = 120psf
$1,4 \times 120 = 168$plf

$M_{ult} = (168 + 595)(10,5)^2/8$
$= 10,515^{\#'} = 10,5^{K'}$

8" concrete w/ #5 @ 6" o.c.
see next sheet

$\phi M_n = 15,6^{K'}$ o.k.

Check w/ 3" cover, 10" thick.
$w_{ult} = 1,4(10/12)150 + 20 = 195$
$M_{ult} = (195 + 595)(10,5)^2/8$
$= 10,9^{K'} < 15,6^{K'}$
∴ Use 10" conc. slab w/ #5 @ 6" o.c.

Forsman Engineering

Job # _____
Des _____

REINFORCED CONCRETE BEAM (ACI 318)

Beam Section

b	12.000	in
h	10.000	in
cover	3.000	in
d	6.188	in
Bar #	5	
No. Bars	2	
As	0.62	in^2
As min	0.25	in^2
As max	1.19	in^2
Tie #	4	
No. Bars	0	
Spa	4.000	in
Spa max	3.094	in
Av	0.00	in^2
Av min	0.04	in^2

Material

f'c	3,000	psi
Wc	155	pcf
Ec	3,488	ksi
fy	60,000	psi
Es	29,000	ksi

Analysis

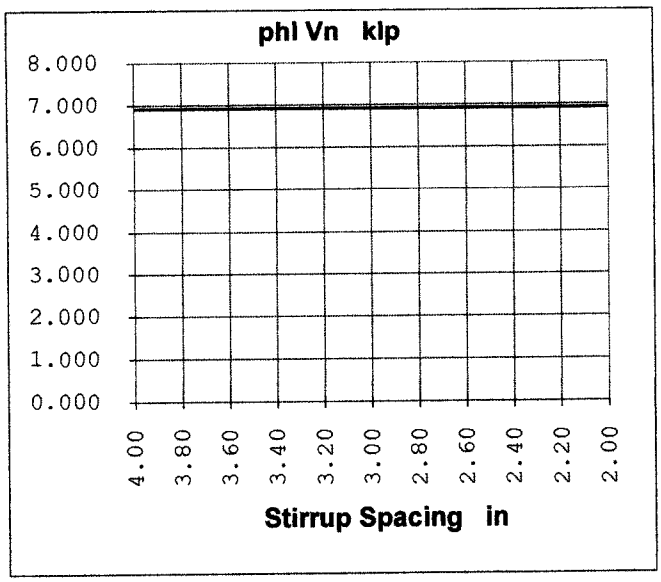
phi shear	0.85	
phi flex	0.90	
Beta 1	0.85	
n	8.000	
rho	0.008	
k	0.305	
j	0.898	
Ag	74	in^2
Ig	237	in^4

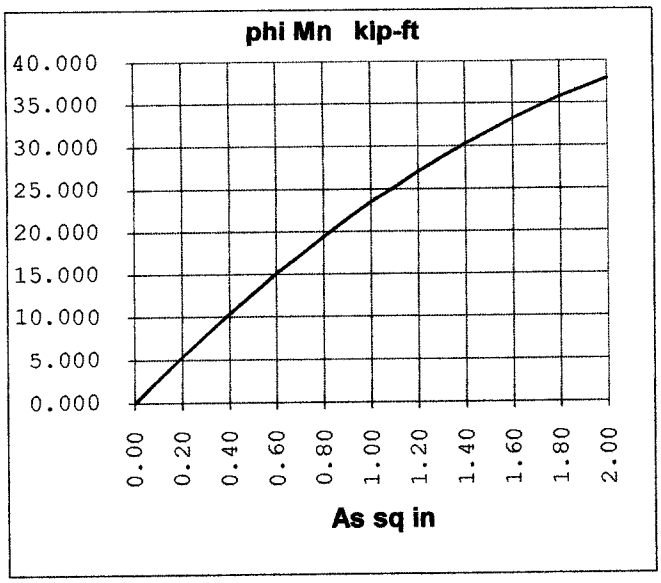
Capacity

phi Vc	6.914	k
phi Vs	0.000	k
phi Vn	6.914	k
phi Mn	15.562	k-ft

Serviceability

M min	1.900	k-ft
fc min	362	psi
fs min	6,615	psi
M max	6.130	k-ft
fc max	1,170	psi
fs max	21,343	psi
fr	14,728	psi
fr allow	19,057	psi
Mcr	6.847	k-ft
dc	2.000	in
A	24.000	in^2
Z	77.566	k/in





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JOB _____
SHEET NO. 59 OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Foundation

Typical basement slab

Calculate maximum span for 6" ws # 5 @ 12" o.c.

from Spread sheet $\phi M_n = 4^{k'}$

$M_{ult} = wl^2/8$ x

$w = (9/12)(150)1.4 + (40)1.7 = 173 plf$

$l = \sqrt{\frac{4^{k'} \times 8}{(.173)}}$ 208

$= 13.6'$ max 8" thick 13.5'

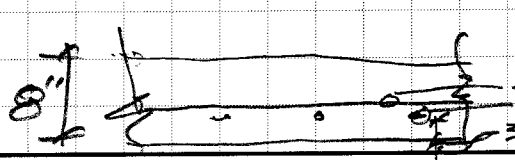
try 16' span

$M_{ULT} = (.173)(16)^2/8$
$= 5.5^{k'}$

#5@6" o.c. w/ 1½" cover

Check min slab depth - l/24
16/24 = .667
= 8"

use 8" slab for deflection.
w/ #5 @ 8" o.c., 3" cover
from bottom G.F. 7.8k' ✓



REINFORCED CONCRETE BEAM (ACI 318)

Beam Section

b	12.000	in
h	8.000	in
cover	3.000	in
d	4.188	in
Bar #	5	
No. Bars	1.5	
As	0.47	in^2
As min	0.17	in^2
As max	0.81	in^2
Tie #	4	
No. Bars	0	
Spa	4.000	in
Spa max	2.094	in
Av	0.00	in^2
Av min	0.04	in^2

Material

f'c	3,000	psi
Wc	155	pcf
Ec	3,488	ksi
fy	60,000	psi
Es	29,000	ksi

Analysis

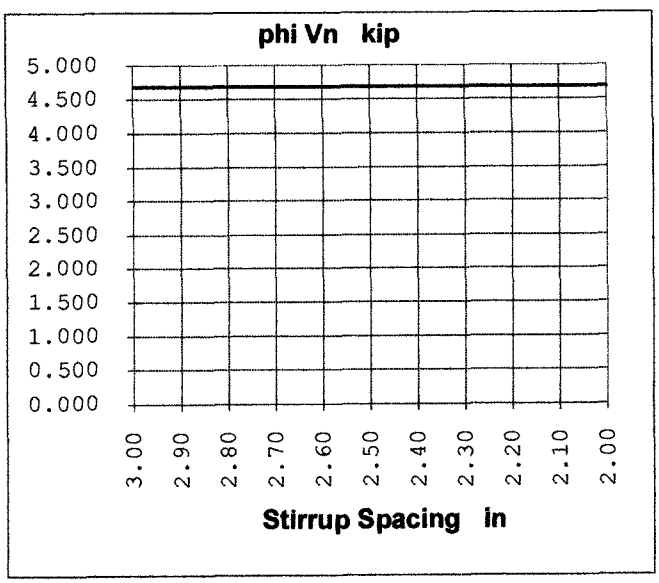
phi shear	0.85	
phi flex	0.90	
Beta 1	0.85	
n	8.000	
rho	0.009	
k	0.318	
j	0.894	
Ag	50	in^2
Ig	73	in^4

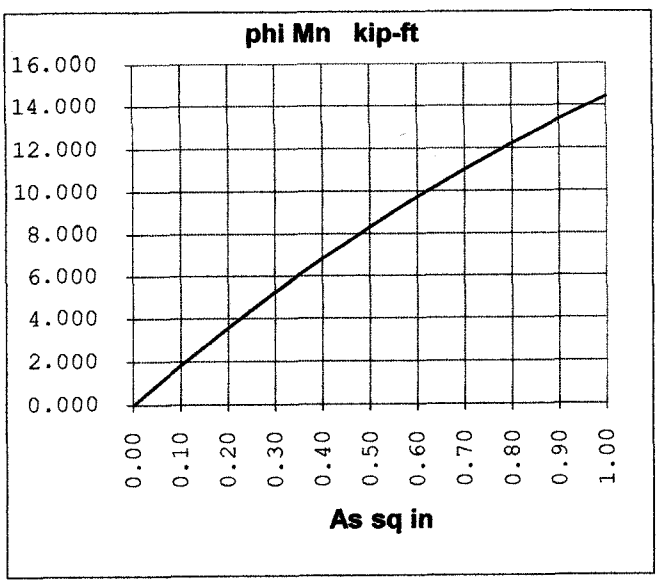
Capacity

phi Vc	4.679	k
phi Vs	0.000	k
phi Vn	4.679	k
phi Mn	7.806	k-ft

Serviceability

M min	1.900	k-ft
fc min	763	psi
fs min	13,097	psi
M max	6.130	k-ft
fc max	2,461	psi
fs max	42,254	psi
fr	29,157	psi
fr allow	16,918	psi
Mcr	4.382	k-ft
dc	2.000	in
A	32.000	in^2
Z	169.015	k/in





REINFORCED CONCRETE BEAM (ACI 318)

Beam Section

b	12.000	in
h	8.000	in
cover	3.625	in
d	3.563	in
Bar #	5	
No. Bars	1.0	
As	0.31	in^2
As min	0.14	in^2
As max	0.69	in^2
Tie #	4	
No. Bars	0	
Spa	4.000	in
Spa max	1.781	in
Av	0.00	in^2
Av min	0.04	in^2

Material

f'c	3,000	psi
Wc	155	pcf
Ec	3,488	ksi
fy	60,000	psi
Es	29,000	ksi

Analysis

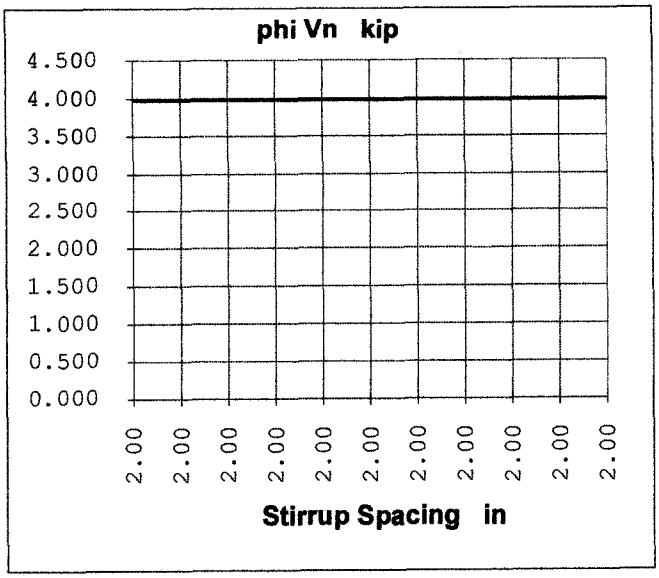
phi shear	0.85	
phi flex	0.90	
Beta 1	0.85	
n	8.000	
rho	0.007	
k	0.288	
j	0.904	
Ag	43	in^2
Ig	45	in^4

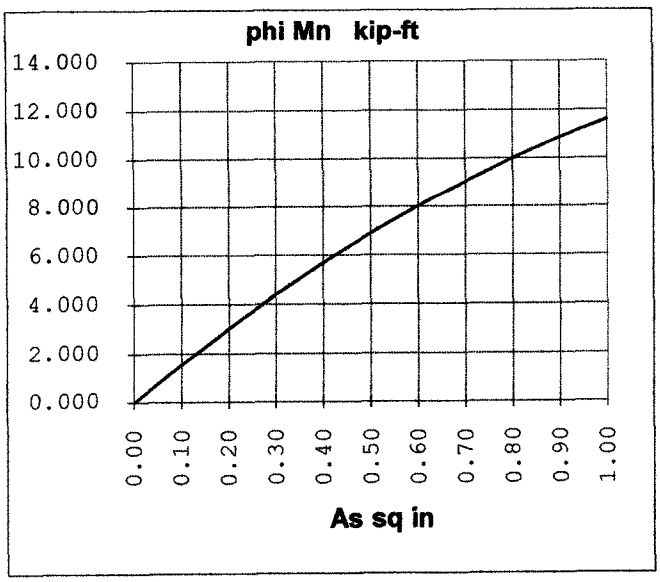
Capacity

phi Vc	3.981	k
phi Vs	0.000	k
phi Vn	3.981	k
phi Mn	4.544	k-ft

Serviceability

M min	1.900	k-ft
fc min	1,152	psi
fs min	22,833	psi
M max	6.130	k-ft
fc max	3,716	psi
fs max	73,668	psi
fr	50,835	psi
fr allow	13,705	psi
Mcr	4.382	k-ft
dc	2.000	in
A	48.000	in^2
Z	337.315	k/in





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JOB
SHEET NO. 62 OF
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SCALE

4"Ø Pipe pile spacing

See calc on calc sheet for pipe pile plan
Max uniform load from truss is 2350 plf
for 18" wide x 24" deep grade beam is 450 plf
2800 plf

10^T = 20^k

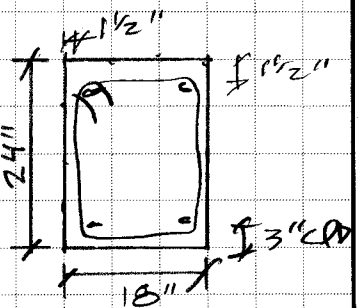
20^k / 2.8 klf = 7.1' max.

Grade beam design
Span max = l_{max} = 7.1'

w_{ult} = 1.4(15.30/2 + 300 + 25.4 + 50.19/2 + 75.12/2)
+ 1.7(25.30/2 + 40.19 + 50.10/2 + 40.12/2)
= 1855 + 1.4(201.5 lbs) + 1743
= 4249 plf

M_{ult} = [(4249)(7.1)²/8] / 1000
= 26.8^{k'}

From Spread sheet ϕM_n = 55.4^{k'}



(4) #5 Bars

REINFORCED CONCRETE BEAM (ACI 318)

Beam Section

b	18.000	in
h	24.000	in
cover	3.000	in
d	20.313	in
Bar #	5	
No. Bars	2	
As	0.62	in^2
As min	1.22	in^2
As max	5.86	in^2
Tie #	3	
No. Bars	2	
Spa	10.000	in
Spa max	10.156	in
Av	0.22	in^2
Av min	0.15	in^2

Material

f'c	3,000	psi
Wc	155	pcf
Ec	3,488	ksi
fy	60,000	psi
Es	29,000	ksi

Analysis

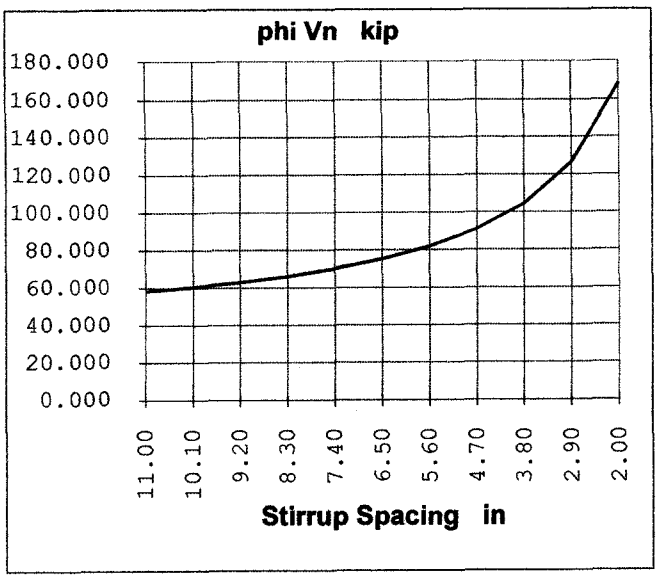
phi shear	0.85	
phi flex	0.90	
Beta 1	0.85	
n	8.000	
rho	0.002	
k	0.152	
j	0.949	
Ag	366	in^2
Ig	12,571	in^4

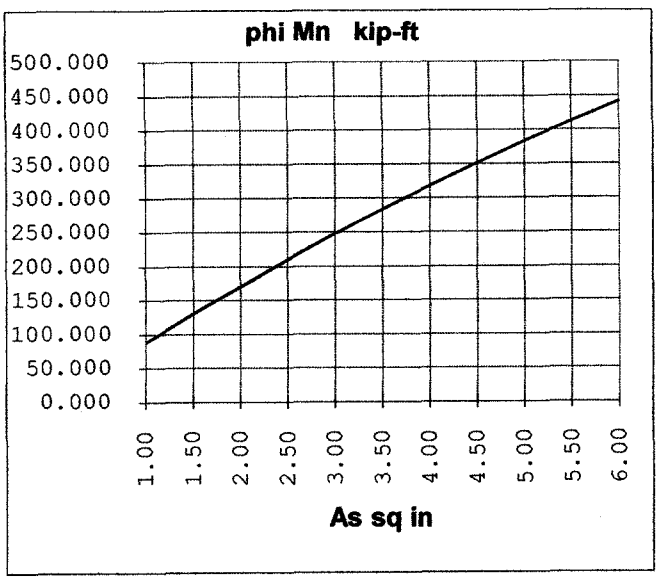
Capacity

phi Vc	34.044	k
phi Vs	26.813	k
phi Vn	60.857	k
phi Mn	55.538	k-ft

Serviceability

M min	1.900	k-ft
fc min	43	psi
fs min	1,907	psi
M max	6.130	k-ft
fc max	138	psi
fs max	6,152	psi
fr	4,245	psi
fr allow	20,611	psi
Mcr	59.154	k-ft
dc	2.000	in
A	36.000	in^2
Z	25.594	k/in





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JOB _____

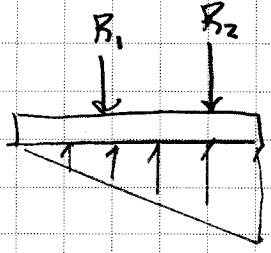
SHEET NO. 64 OF _____

CALCULATED BY _____ DATE _____

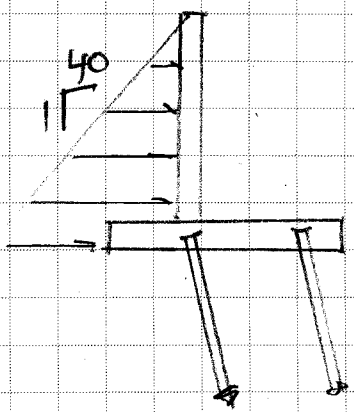
CHECKED BY _____ DATE _____

SCALE _____

Cantilever retaining walls

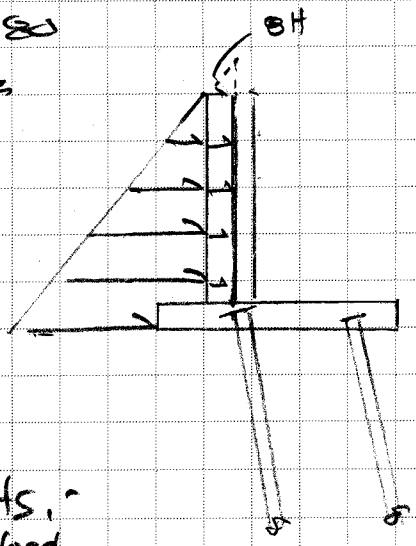


Check w/ F.S. = 1.5



- OR -

Seismic ** 8H 8x10 = 80
80/40 = 2 o/t



See spread sheets.
R2 is a higher load.

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JOB ______
SHEET NO. 65 ______ OF ______
CALCULATED BY ______ DATE ______
CHECKED BY ______ DATE ______
SCALE ______

For 12' wall

$[(3916+87)\,1/2 \times 2.6 \times 2/3] = 3.5^K$

F.S.

$19.7/3.5\ (1.3/1.5)(3.7/4.4) = 3.8'$

space paired piles at 3'-6" o.c.

For 10' wall

$[(1761-207)\,1/2 \times 4.67 \times 2/3] + (207 \times 4.67/2) = 3044^{\#}$

$(19.7^K/3.0)(2.0/1.5)(3.7/4.2) = 6.9'$

space piles 6'-6" o.c.

For 8' wall

$(917 \times 4.67/2) = 2141^{\#}$

$(19.7/2.14) = 9.2$

space piles 9'-0" max

from earlier space piles
7'-6" max for gravity

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318-

Wall:

Hgt wall	13.000	ft
Hgt soil heel	12.500	ft
Hgt soil toe	1.000	ft
Toe	3.000	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	12.000	in
Thick Key	0.000	in
Depth Key	0.000	ft
Width ftg	4.667	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.040	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	3.000	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	1.600	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	5.058	kip
X resultant	0.862	ft
Sum F resist	2.451	kip
Sum F horiz	3.125	kip
F.S. sliding	0.784	
Sum M resist	17.442	k-ft
Sum M O.T.	13.021	k-ft
F.S. O.T.	1.340	

Eccentricity:

M ecc	7.440	k-ft
X ecc	1.471	ft
X zero	2.587	ft
compression	55.446	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.460	ksf
ph ftg base	0.500	ksf
ph key base	0.500	ksf
pv toe	3.910	ksf
pv wall toe	0.498	ksf
pv wall heel	-0.087	ksf
pv heel	0.000	ksf

Wall Reinforcing :

bar	6	#
spacing	6.000	in
As	0.880	sq-in
cover	1.500	in
d	6.125	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.245	sq-in
As max	1.179	sq-in
Mu	17.237	k-ft
Phi Mn	20.828	k-ft
Vu	4.692	kip
Phi Vc	6.844	kip

Toe Reinforcing :

bar	6	#
spacing	6.000	in
As	0.880	sq-in
cover	3.000	in
d	8.625	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.345	sq-in
As max	1.660	sq-in
Mu	12.511	k-ft
Phi Mn	30.728	k-ft
Vu	11.241	kip
Phi Vc	9.637	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	9.750	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.390	sq-in
As max	1.876	sq-in
Mu	1.155	k-ft
Phi Mn	8.598	k-ft
Vu	2.310	kip
Phi Vc	10.894	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318

Wall:

Hgt wall	11.000	ft
Hgt soil heel	10.500	ft
Hgt soil toe	1.000	ft
Toe	3.000	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	12.000	in
Thick Key	0.000	in
Depth Key	0.000	ft
Width ftg	4.667	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.040	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	3.000	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	1.600	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	4.592	kip
X resultant	1.719	ft
Sum F resist	2.241	kip
Sum F horiz	2.205	kip
F.S. sliding	1.016	
Sum M resist	15.670	k-ft
Sum M O.T.	7.718	k-ft
F.S. O.T.	2.030	

Eccentricity:

M ecc	2.820	k-ft
X ecc	0.614	ft
X zero	4.667	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.380	ksf
ph ftg base	0.420	ksf
ph key base	0.420	ksf
pv toe	1.761	ksf
pv wall toe	0.762	ksf
pv wall heel	0.540	ksf
pv heel	0.207	ksf

Wall Reinforcing :

bar	5	#
spacing	8.000	in
As	0.465	sq-in
cover	1.500	in
d	6.188	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.248	sq-in
As max	1.191	sq-in
Mu	9.717	k-ft
Phi Mn	11.991	k-ft
Vu	3.230	kip
Phi Vc	6.914	kip

Toe Reinforcing :

bar	5	#
spacing	8.000	in
As	0.465	sq-in
cover	3.000	in
d	8.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.348	sq-in
As max	1.672	sq-in
Mu	8.376	k-ft
Phi Mn	17.222	k-ft
Vu	6.433	kip
Phi Vc	9.707	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	9.750	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.390	sq-in
As max	1.876	sq-in
Mu	0.973	k-ft
Phi Mn	8.598	k-ft
Vu	1.946	kip
Phi Vc	10.894	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318

Wall:

Hgt wall	9.000	ft
Hgt soil heel	8.500	ft
Hgt soil toe	1.000	ft
Toe	3.000	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	12.000	in
Thick Key	0.000	in
Depth Key	0.000	ft
Width ftg	4.667	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.040	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	3.000	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	1.600	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	4.125	kip
X resultant	2.362	ft
Sum F resist	2.031	kip
Sum F horiz	1.445	kip
F.S. sliding	1.406	
Sum M resist	13.898	k-ft
Sum M O.T.	4.094	k-ft
F.S. O.T.	3.394	

Eccentricity:

M ecc	-0.120	k-ft
X ecc	-0.029	ft
X zero	4.667	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.300	ksf
ph ftg base	0.340	ksf
ph key base	0.340	ksf
pv toe	0.851	ksf
pv wall toe	0.893	ksf
pv wall heel	0.903	ksf
pv heel	0.917	ksf

Wall Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	1.500	in
d	6.188	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.248	sq-in
As max	1.191	sq-in
Mu	4.781	k-ft
Phi Mn	8.206	k-ft
Vu	2.040	kip
Phi Vc	6.914	kip

Toe Reinforcing :

bar	5	#
spacing	12.000	in
As	0.310	sq-in
cover	3.000	in
d	8.688	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.348	sq-in
As max	1.672	sq-in
Mu	6.726	k-ft
Phi Mn	11.694	k-ft
Vu	4.448	kip
Phi Vc	9.707	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	9.750	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.390	sq-in
As max	1.876	sq-in
Mu	0.791	k-ft
Phi Mn	8.598	k-ft
Vu	1.582	kip
Phi Vc	10.894	kip

REINFORCED CONCRETE CANTILEVER RETAINING WALL (ACI 318

Wall:

Hgt wall	7.000	ft
Hgt soil heel	6.500	ft
Hgt soil toe	1.000	ft
Toe	2.333	ft
Heel	1.000	ft
Thick wall	8.000	in
Thick ftg	12.000	in
Thick Key	0.000	in
Depth Key	0.000	ft
Width ftg	4.000	ft

Soil:

Wgt soil	0.130	kcf
EFP active	0.040	ksf/ft
EFP passive	0.350	ksf/ft
Friction	0.450	

Concrete:

Wgt conc	0.155	kcf
f'c	3.000	ksi
fy	60.000	ksi
Beta 1	0.850	

Load (@ CL of wall):

P vert	1.600	kip
P horiz	0.000	kip
Moment	0.000	k-ft

Phi Factors:

Phi Flexure	0.90
Phi Shear	0.85

Load Factors:

DeadLoad	1.400
LiveLoad	1.700

Stability:

Sum F vert	3.555	kip
X resultant	2.203	ft
Sum F resist	1.775	kip
Sum F horiz	0.845	kip
F.S. sliding	2.100	
Sum M resist	9.720	k-ft
Sum M O.T.	1.831	k-ft
F.S. O.T.	5.309	

Eccentricity:

M ecc	-0.721	k-ft
X ecc	-0.203	ft
X zero	4.000	ft
compression	100.000	%

Soil Pressure:

ph wall top	0.000	ksf
ph wall bot	0.220	ksf
ph ftg base	0.260	ksf
ph key base	0.260	ksf
pv toe	0.618	ksf
pv wall toe	0.934	ksf
pv wall heel	1.024	ksf
pv heel	1.159	ksf

Wall Reinforcing :

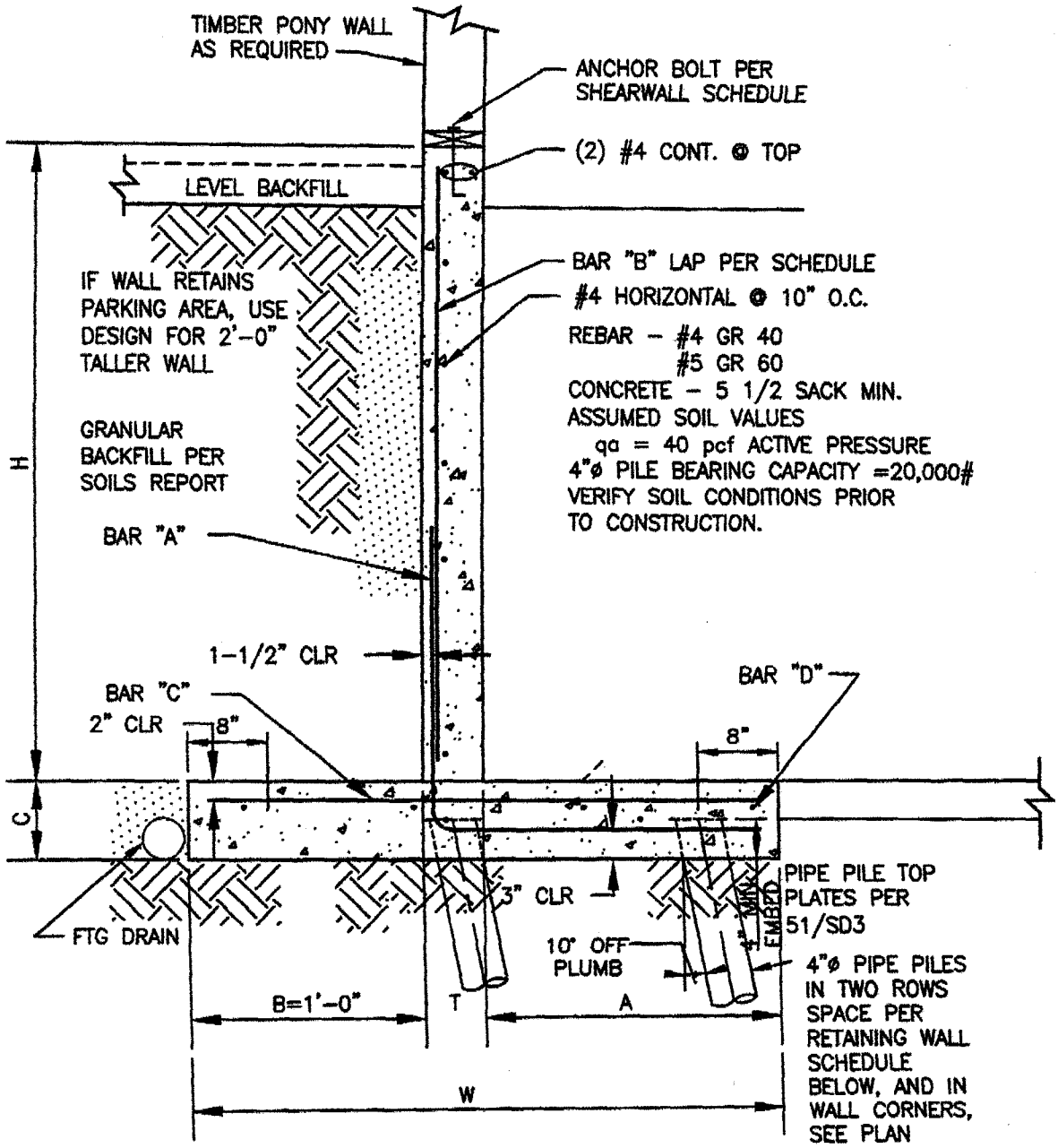
bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	1.500	in
d	6.250	in
0.0020 Ag	0.192	sq-in
0.0025 Ag	0.240	sq-in
As min	0.250	sq-in
As max	1.203	sq-in
Mu	1.886	k-ft
Phi Mn	5.448	k-ft
Vu	1.122	kip
Phi Vc	6.983	kip

Toe Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	3.000	in
d	8.750	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.350	sq-in
As max	1.684	sq-in
Mu	3.834	k-ft
Phi Mn	7.698	k-ft
Vu	3.078	kip
Phi Vc	9.777	kip

Heel Reinforcing :

bar	4	#
spacing	12.000	in
As	0.200	sq-in
cover	2.000	in
d	9.750	in
0.0018 Ag	0.259	sq-in
0.0020 Ag	0.288	sq-in
As min	0.390	sq-in
As max	1.876	sq-in
Mu	0.609	k-ft
Phi Mn	8.598	k-ft
Vu	1.218	kip
Phi Vc	10.894	kip

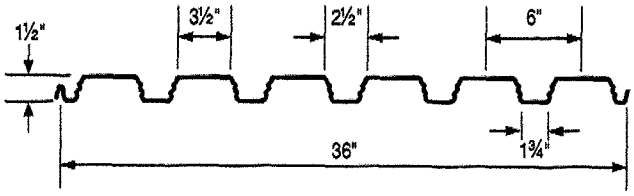
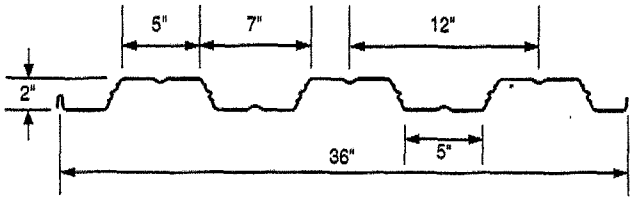
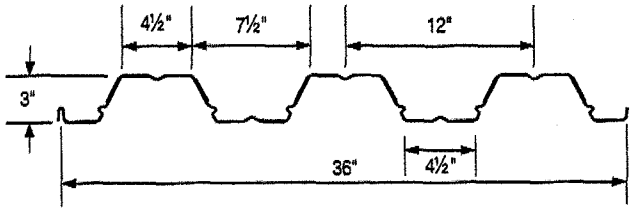
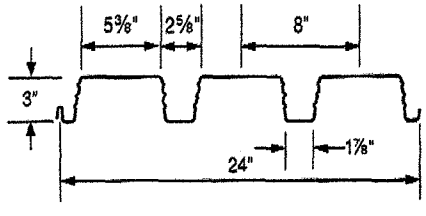


RETAINING WALL SCHEDULE										
H	T	A	B	C	W	BAR "A"	BAR "B"	BAR "C"	BAR "D"	PILE SPC
4'-0"	8"	10"	1'-0"	8"	2'-6"	#4 @ 16"	------	------	(2) #4	7'-6"
6'-0"	8"	2'-4"	1'-0"	10"	4'-0"	#4 @ 12"	#4 @ 12" LAP 24"	#4 @ 12"	(4) #4	7'-6"
8'-0"	8"	3'-0"	1'-0"	1'-0"	4'-8"	#5 @ 12"	#4 @ 12" LAP 36"	#4 @ 12"	(6) #4	7'-6"
10'-0"	8"	3'-0"	1'-0"	1'-0"	4'-8"	#5 @ 8"	#4 @ 8" LAP 36"	#4 @ 12"	(6) #4	6'-6"
12'-0"	8"	3'-0"	1'-0"	1'-0"	4'-8"	#6 @ 6"	#4 @ 6" LAP 36"	#4 @ 12"	(6) #4	3'-6"

TYPICAL RETAINING WALL DETAIL (30/SD3)

3/4" = 1'-0"

Pan Deck at Garage

Gage	Weight Galv psf N/m²	Weight Phos/ Painted psf N/m²	Section Properties per ft (m) of width I in.⁴ mm⁴	+ S in.³ mm³	− S in.³ mm³	Profile (dimensions in inches)	Type
22	1.9 91.0	1.8 86.2	0.175 238,978	0.187 10,054	0.198 10,645		
20	2.3 110.1	2.2 105.3	0.216 294,967	0.235 12,634	0.248 13,333		
18	2.9 138.9	2.8 134.1	0.302 412,408	0.322 17,312	0.335 18,011		
16	3.5 167.6	3.4 162.8	0.377 514,827	0.411 22,097	0.417 22,419		B FORMLOK™
22	1.8 86.2	1.7 81.4	0.340 464,300	0.283 15,215	0.287 15,430		
21	2.0 95.8	1.9 91.0	0.382 521,655	0.321 17,258	0.328 17,634		
20	2.1 100.5	2.0 95.8	0.423 577,644	0.361 19,408	0.370 19,892		
19	2.4 114.9	2.3 110.1	0.508 693,719	0.442 23,763	0.453 24,355		
18	2.7 129.3	2.5 119.7	0.555 757,901	0.510 27,419	0.511 27,473		
16	3.3 158.0	3.1 148.4	0.694 947,718	0.639 34,355	0.639 34,355		W2 FORMLOK™
22	1.9 91.0	1.8 86.2	0.718 980,492	0.418 22,473	0.444 23,871		
21	2.1 100.5	2.0 95.8	0.837 1,142,997	0.495 26,613	0.531 28,548		
20	2.3 110.1	2.2 105.3	0.896 1,223,567	0.534 28,709	0.564 30,322		
19	2.7 129.3	2.6 124.5	1.075 1,468,007	0.674 36,236	0.683 36,720		
18	2.9 138.9	2.7 129.3	1.203 1,642,802	0.767 41,236	0.767 41,236		W3 FORMLOK™
16	3.5 167.6	3.3 158.0	1.509 2,060,672	0.960 51,612	0.960 51,612		
22	2.2 105.3	2.1 100.5	0.613 837,105	0.361 19,408	0.446 23,978		
20	2.6 124.5	2.5 119.7	0.780 1,065,159	0.466 25,054	0.548 29,462		
18	3.5 167.6	3.4 162.8	1.146 1,564,964	0.664 35,699	0.737 39,623		
16	4.2 201.1	4.1 196.3	1.542 2,105,737	0.851 45,752	0.914 49,139		N FORMLOK™

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JOB

SHEET NO. 72 OF

CALCULATED BY DATE

CHECKED BY DATE

SCALE

Concrete composite deck

Live load = 50 psf or 3000# point load (wheel)

Max span = 9'-0' - 4 spans

Check point load with 1 span.

For Verco W3-6½ Formlock, 19 ga.

allowable superimposed = 353 psf >> 50 psf
Shoring not required

Check 3000# vehicle load
check over 1 span
$M = Pl/4 = (3000\#)(9')/4$
$= 6750\#' / 1'$ linear

Allowable superimposed $= (353 \times 1')(9)^2/8$
$= 3574\#'$

$6750\#'/3574\#' = 1.89$ req'd to distribute

determine effective width for tire load (4.5" x 4.5")

from SDI Floor deck manual
$b_m = b_2 + 2t_c + 2t_2$
$t_1 = 6.5"$ $t_c = 3"$ $t_2 = \phi$
$b_m = 4.5 + 2(3) + \phi = 10.5"$

For moment & defl., dist steel, put point load at midspan

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JOB _____
SHEET NO. 73 OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

$b_e = b_{on} + 2(1 - \frac{x}{z})x$ @ mid-span $x = L/2$

so $b_e = 10\frac{1}{2}" + 2(1 - \frac{L/2}{L})L/2$

$= 10\frac{1}{2}" + \frac{2L}{2} - \frac{2L \cdot x}{2x \cdot 2}$

$= 10\frac{1}{2}" + L - \frac{L}{2}$

$= 10\frac{1}{2}" + L/2 \quad = 10\frac{1}{2} + \left(\frac{9 \times 12}{2}\right)$

$b_e \quad = 64.5"$

$b_{e\,max} = 8.9\left(\frac{t_c}{h}\right) = 8.9\left(\frac{3}{6.5}\right)12 = 49"$

so $b_e = 49" = 4.1' > 1.89$ o.k.

check vertical shear, pt x at a distance "h" from support

$b_{ve} = b_w + (1 + h/L)x = 10\frac{1}{2}" + (1 + 6.5/108)6.5 = 17.4" \leq 49"$

∴ For M_{max} use $b_e = 49"$; shear use 17.4"

$w_{pv} = 3000(17.4/12) = 4350$ plf

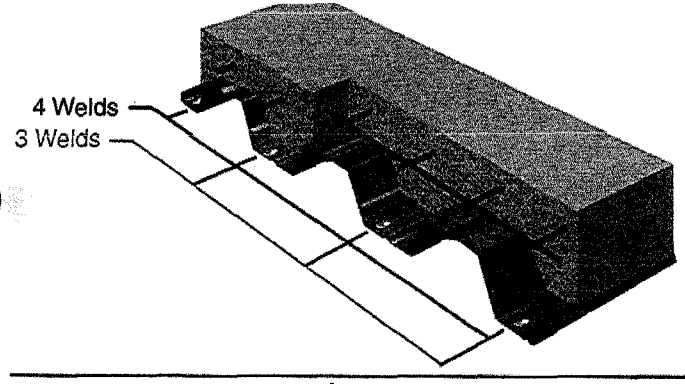
$V_{ult} = 1.2(60 \text{ psf} \cdot 9/2) + 1.6(4350) = 7284$ plf

From (table 8c)

$\phi V_n = (6927 + 7966)1/2$

$\phi V_n = 7447$ plf o.k.

∴ Use Verco W3-6½" Formlock



W3 FORMLOK™

6½ in. (165 mm) TOTAL SLAB DEPTH ■
Normal Weight Concrete ■
145 pcf (2,320 kg/m³)
60.4 psf (2,892 N/m²)
Galvanized or Phosphatized/Painted ■
1 Hour Fire Rating ■

Deck Weight and Section Properties

Gage	Weight (psf, *N/m²*) Galv G60 *Z180*	Weight (psf, *N/m²*) Phos/ Painted	Properties per ft (*m*) of Width I in.⁴ *mm⁴*	+S in.³ *mm³*	−S in.³ *mm³*	Allowable Reactions per ft (*m*) of Width (lb, *N*) End Bearing 2" *51 mm*	End Bearing 3" *76 mm*	End Bearing 4" *102 mm*	Interior Bearing 4" *102 mm*	Interior Bearing 5" *127 mm*
19	2.7 *129.3*	2.6 *124.5*	1.075 *1,468,007*	0.674 *36,236*	0.683 *36,720*	374 *5,458*	434 *6,334*	495 *7,224*	1241 *18,111*	1421 *20,738*
18	2.9 *138.9*	2.7 *129.3*	1.203 *1,642,802*	0.767 *41,236*	0.767 *41,236*	507 *7,399*	583 *8,508*	659 *9,617*	1528 *22,299*	1740 *25,393*
16	3.5 *167.6*	3.3 *158.0*	1.509 *2,060,672*	0.960 *51,612*	0.960 *51,612*	942 *13,747*	1062 *15,499*	1181 *17,235*	2309 *33,697*	2597 *37,900*

Allowable Superimposed Loads (psf, *kN/m²*)

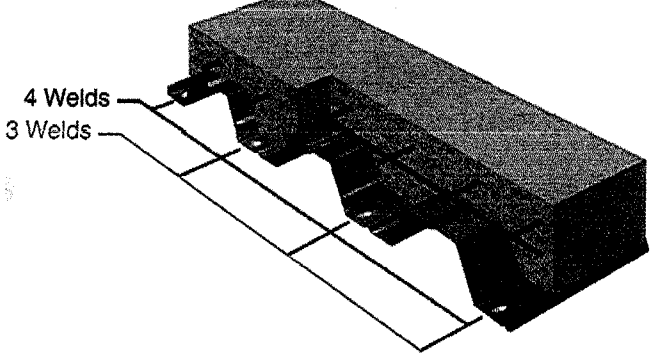
Gage	Spans	Span (ft-in., *mm*) 8'-0" *2,440*	8'-6" *2,590*	9'-0" *2,740*	9'-6" *2,900*	10'-0" *3,050*	10'-6" *3,200*	11'-0" *3,350*	11'-6" *3,510*	12'-0" *3,660*	12'-6" *3,810*	13'-0" *3,960*	13'-6" *4,110*	14'-0" *4,270*	14'-6" *4,420*	15'-0" *4,570*
19	1	400 *19.2*	388 *18.6*	353 *16.9*	322 *15.4*	272 *13.0*	216 *10.3*	196 *9.4*	178 *8.5*	162 *7.8*	147 *7.0*	134 *6.4*	123 *5.9*	112 *5.4*	103 *4.9*	94 *4.5*
	2	400 *19.2*	388 *18.6*	353 *16.9*	322 *15.4*	296 *14.2*	273 *13.1*	196 *9.4*	178 *8.5*	162 *7.8*	147 *7.0*	134 *6.4*	123 *5.9*	112 *5.4*	103 *4.9*	94 *4.5*
	3	400 *19.2*	388 *18.6*	353 *16.9*	322 *15.4*	296 *14.2*	273 *13.1*	252 *12.1*	234 *11.2*	162 *7.8*	147 *7.0*	134 *6.4*	123 *5.9*	112 *5.4*	103 *4.9*	94 *4.5*
18	1	400 *19.2*	400 *19.2*	385 *18.4*	352 *16.9*	323 *15.5*	275 *13.2*	219 *10.5*	199 *9.5*	181 *8.7*	166 *7.9*	152 *7.3*	139 *6.7*	127 *6.1*	117 *5.6*	107 *5.1*
	2	400 *19.2*	400 *19.2*	385 *18.4*	352 *16.9*	323 *15.5*	298 *14.3*	276 *13.2*	199 *9.5*	181 *8.7*	166 *7.9*	152 *7.3*	139 *6.7*	127 *6.1*	117 *5.6*	107 *5.1*
	3	400 *19.2*	400 *19.2*	385 *18.4*	352 *16.9*	323 *15.5*	298 *14.3*	276 *13.2*	256 *12.3*	238 *11.4*	223 *10.7*	152 *7.3*	139 *6.7*	127 *6.1*	117 *5.6*	107 *5.1*
16	1	400 *19.2*	400 *19.2*	400 *19.2*	400 *19.2*	385 *18.4*	355 *17.0*	329 *15.8*	286 *13.7*	227 *10.9*	208 *10.0*	191 *9.1*	176 *8.4*	162 *7.8*	150 *7.2*	139 *6.7*
	2	400 *19.2*	400 *19.2*	400 *19.2*	400 *19.2*	385 *18.4*	355 *17.0*	329 *15.8*	305 *14.6*	284 *13.6*	266 *12.7*	191 *9.1*	176 *8.4*	162 *7.8*	150 *7.2*	139 *6.7*
	3	400 *19.2*	400 *19.2*	400 *19.2*	400 *19.2*	385 *18.4*	355 *17.0*	329 *15.8*	305 *14.6*	284 *13.6*	266 *12.7*	249 *11.9*	234 *11.2*	213 *10.2*	150 *7.2*	139 *6.7*

Shoring required in shaded areas to right of heavy line

Diaphragm Shear Values, q (plf, *kN/m*)

Gage	Welds	Span (ft-in., *mm*) 8'-0" *2,440*	8'-6" *2,590*	9'-0" *2,740*	9'-6" *2,900*	10'-0" *3,050*	10'-6" *3,200*	11'-0" *3,350*	11'-6" *3,510*	12'-0" *3,660*	12'-6" *3,810*	13'-0" *3,960*	13'-6" *4,110*	14'-0" *4,270*	14'-6" *4,420*	15'-0" *4,570*
19	q3	2375 *34.66*	2355 *34.37*	2340 *34.15*	2325 *33.93*	2310 *33.71*	2295 *33.49*	2285 *33.35*	2275 *33.20*	2265 *33.06*	2260 *32.98*	2250 *32.84*	2240 *32.69*	2235 *32.62*	2230 *32.54*	2225 *32.47*
	q4	2540 *37.07*	2510 *36.63*	2480 *36.19*	2455 *35.83*	2430 *35.46*	2410 *35.17*	2390 *34.88*	2370 *34.59*	2350 *34.30*	2340 *34.15*	2330 *34.00*	2315 *33.78*	2300 *33.57*	2290 *33.42*	2280 *33.27*
18	q3	2390 *34.88*	2370 *34.59*	2350 *34.30*	2335 *34.08*	2320 *33.86*	2305 *33.64*	2295 *33.49*	2280 *33.27*	2270 *33.13*	2260 *32.98*	2255 *32.91*	2245 *32.76*	2235 *32.62*	2230 *32.54*	2225 *32.47*
	q4	2590 *37.80*	2555 *37.29*	2520 *36.78*	2490 *36.34*	2460 *35.90*	2440 *35.61*	2420 *35.32*	2400 *35.03*	2380 *34.73*	2365 *34.51*	2350 *34.30*	2335 *34.08*	2320 *33.86*	2310 *33.71*	2300 *33.57*
16	q3	2445 *35.68*	2420 *35.32*	2395 *34.95*	2375 *34.66*	2355 *34.37*	2335 *34.08*	2320 *33.86*	2305 *33.64*	2295 *33.49*	2280 *33.27*	2270 *33.13*	2260 *32.98*	2250 *32.84*	2240 *32.69*	2235 *32.62*
	q4	2710 *39.55*	2670 *38.97*	2630 *38.38*	2595 *37.87*	2560 *37.36*	2530 *36.92*	2500 *36.48*	2475 *36.12*	2450 *35.76*	2430 *35.46*	2410 *35.17*	2395 *34.95*	2380 *34.73*	2365 *34.51*	2350 *34.30*

W3 FORMLOK decks with structural concrete fill may be considered rigid diaphragms, with F < 1 (*5.7*).



W3 FORMLOK™

6¼ in. (159 mm) TOTAL SLAB DEPTH ■
Light Weight Concrete ■
110 pcf (1,760 kg/m³)
43.5 psf (2,083 N/m²)
Galvanized or Phosphatized/Painted ■
2 Hour Fire Rating ■

Deck Weight and Section Properties

Gage	Weight (psf, *N/m²*) Galv G60 *Z180*	Weight (psf, *N/m²*) Phos/ Painted	Properties per ft (*m*) of Width I in.⁴ *mm⁴*	+S in.³ *mm³*	−S in.³ *mm³*	Allowable Reactions per ft (*m*) of Width (lb, *N*) End Bearing 2" *51 mm*	End Bearing 3" *76 mm*	End Bearing 4" *102 mm*	Interior Bearing 4" *102 mm*	Interior Bearing 5" *127 mm*
19	2.7 *129.3*	2.6 *124.5*	1.075 *1,468,007*	0.674 *36,236*	0.683 *36,720*	374 *5,458*	434 *6,334*	495 *7,224*	1241 *18,111*	1421 *20,738*
18	2.9 *138.9*	2.7 *129.3*	1.203 *1,642,802*	0.767 *41,236*	0.767 *41,236*	507 *7,399*	583 *8,508*	659 *9,617*	1528 *22,299*	1740 *25,393*
16	3.5 *167.6*	3.3 *158.0*	1.509 *2,060,672*	0.960 *51,612*	0.960 *51,612*	942 *13,747*	1062 *15,499*	1181 *17,235*	2309 *33,697*	2597 *37,900*

Allowable Superimposed Loads (psf, *kN/m²*)

Gage	Spans	Span (ft-in., *mm*) 8'-0" *2,440*	8'-6" *2,590*	9'-0" *2,740*	9'-6" *2,900*	10'-0" *3,050*	10'-6" *3,200*	11'-0" *3,350*	11'-6" *3,510*	12'-0" *3,660*	12'-6" *3,810*	13'-0" *3,960*	13'-6" *4,110*	14'-0" *4,270*	14'-6" *4,420*	15'-0" *4,570*
19	1	400 *19.2*	372 *17.8*	338 *16.2*	309 *14.8*	284 *13.6*	262 *12.5*	235 *11.3*	183 *8.8*	168 *8.0*	154 *7.4*	142 *6.8*	131 *6.3*	121 *5.8*	111 *5.3*	103 *4.9*
	2	400 *19.2*	372 *17.8*	338 *16.2*	309 *14.8*	284 *13.6*	262 *12.5*	242 *11.6*	225 *10.8*	209 *10.0*	154 *7.4*	142 *6.8*	131 *6.3*	121 *5.8*	111 *5.3*	103 *4.9*
	3	400 *19.2*	372 *17.8*	338 *16.2*	309 *14.8*	284 *13.6*	262 *12.5*	242 *11.6*	225 *10.8*	209 *10.0*	196 *9.4*	183 *8.8*	131 *6.3*	121 *5.8*	111 *5.3*	103 *4.9*
18	1	400 *19.2*	400 *19.2*	369 *17.7*	338 *16.2*	310 *14.8*	286 *13.7*	264 *12.6*	241 *11.5*	203 *9.7*	172 *8.2*	158 *7.6*	146 *7.0*	135 *6.5*	125 *6.0*	116 *5.6*
	2	400 *19.2*	400 *19.2*	369 *17.7*	338 *16.2*	310 *14.8*	286 *13.7*	264 *12.6*	246 *11.8*	229 *11.0*	214 *10.2*	158 *7.6*	146 *7.0*	135 *6.5*	125 *6.0*	116 *5.6*
	3	400 *19.2*	400 *19.2*	369 *17.7*	338 *16.2*	310 *14.8*	286 *13.7*	264 *12.6*	246 *11.8*	229 *11.0*	214 *10.2*	200 *9.6*	188 *9.0*	176 *8.4*	125 *6.0*	116 *5.6*
16	1	400 *19.2*	400 *19.2*	400 *19.2*	400 *19.2*	370 *17.7*	341 *16.3*	316 *15.1*	293 *14.0*	273 *13.1*	255 *12.2*	197 *9.4*	182 *8.7*	169 *8.1*	157 *7.5*	146 *7.0*
	2	400 *19.2*	400 *19.2*	400 *19.2*	400 *19.2*	370 *17.7*	341 *16.3*	316 *15.1*	293 *14.0*	273 *13.1*	255 *12.2*	239 *11.4*	224 *10.7*	211 *10.1*	157 *7.5*	146 *7.0*
	3	400 *19.2*	400 *19.2*	400 *19.2*	400 *19.2*	370 *17.7*	341 *16.3*	316 *15.1*	293 *14.0*	273 *13.1*	255 *12.2*	239 *11.4*	224 *10.7*	211 *10.1*	199 *9.5*	188 *9.0*

Shoring required in shaded areas to right of heavy line

Diaphragm Shear Values, q (plf, *kN/m*)

Gage	Welds	Span (ft-in., *mm*) 8'-0" *2,440*	8'-6" *2,590*	9'-0" *2,740*	9'-6" *2,900*	10'-0" *3,050*	10'-6" *3,200*	11'-0" *3,350*	11'-6" *3,510*	12'-0" *3,660*	12'-6" *3,810*	13'-0" *3,960*	13'-6" *4,110*	14'-0" *4,270*	14'-6" *4,420*	15'-0" *4,570*
19	q3	1725 *25.17*	1710 *24.96*	1690 *24.66*	1675 *24.44*	1660 *24.23*	1650 *24.08*	1640 *23.93*	1630 *23.79*	1620 *23.64*	1610 *23.50*	1605 *23.42*	1595 *23.28*	1590 *23.20*	1580 *23.06*	1575 *22.99*
	q4	1890 *27.58*	1860 *27.14*	1830 *26.71*	1805 *26.34*	1780 *25.98*	1760 *25.69*	1740 *25.39*	1725 *25.17*	1710 *24.96*	1695 *24.74*	1680 *24.52*	1670 *24.37*	1660 *24.23*	1645 *24.01*	1630 *23.79*
18	q3	1745 *25.47*	1725 *25.17*	1705 *24.88*	1690 *24.66*	1670 *24.37*	1660 *24.23*	1645 *24.01*	1635 *23.86*	1625 *23.72*	1615 *23.57*	1605 *23.42*	1600 *23.35*	1590 *23.20*	1585 *23.13*	1575 *22.99*
	q4	1940 *28.31*	1905 *27.80*	1870 *27.29*	1845 *26.93*	1820 *26.56*	1795 *26.20*	1770 *25.83*	1750 *25.54*	1730 *25.25*	1715 *25.03*	1700 *24.81*	1690 *24.66*	1680 *24.52*	1665 *24.30*	1650 *24.08*
16	q3	1800 *26.27*	1770 *25.83*	1750 *25.54*	1725 *25.17*	1710 *24.96*	1690 *24.66*	1675 *24.44*	1660 *24.23*	1645 *24.01*	1635 *23.86*	1625 *23.72*	1615 *23.57*	1605 *23.42*	1595 *23.28*	1585 *23.13*
	q4	2070 *30.21*	2025 *29.55*	1980 *28.90*	1945 *28.39*	1910 *27.87*	1880 *27.44*	1850 *27.00*	1830 *26.71*	1810 *26.41*	1790 *26.12*	1770 *25.83*	1750 *25.54*	1730 *25.25*	1715 *25.03*	1700 *24.81*

W3 FORMLOK decks with structural concrete fill may be considered rigid diaphragms, with F < 1 (*5.7*).

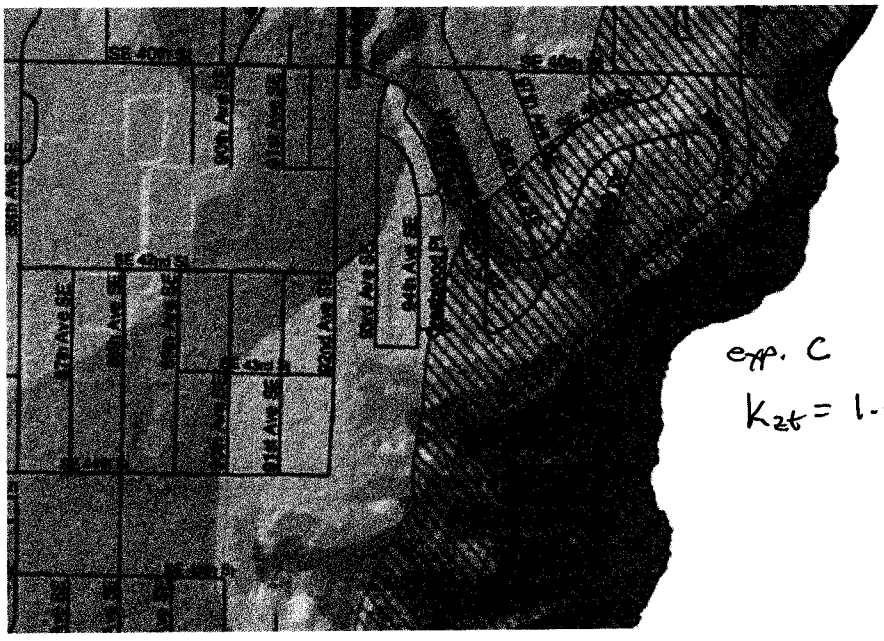
Table 8C - 3x12 Deck

Slab Thickness (In)	F_y = 40 ksi – Normalweight Concrete (145 pcf)				F_y = 40 ksi – Lightweight Concrete (115 pcf)			
	Φ V_n (22 ga)	Φ V_n (20 ga)	Φ V_n (18 ga)	Φ V_n (16 ga)	Φ V_n (22 ga)	Φ V_n (20 ga)	Φ V_n (18 ga)	Φ V_n (16 ga)
5.5	5181	6126	6364	6364	4386	4773	4773	4773
6	5573	6518	7148	7148	4680	5361	5361	5361
6.25	5776	6721	7553	7553	4831	5664	5664	5664
6.5	5982	6927	7966	7966	4987	5932	5974	5974
7	6408	7354	8818	8818	5306	6251	6614	6614
7.25	6628	7573	9062	9257	5471	6416	6943	6943
7.5	6852	7797	9286	9705	5639	6584	7279	7279
8	7312	8257	9746	10626	5984	6929	7969	7969
8.25	7549	8494	9983	11053	6161	7107	8324	8324
8.5	7790	8735	10224	11294	6342	7287	8686	8686

Table 8 Notes:

1. These tables assume f'_c = 3000 psi.
2. Slab thickness is overall slab thickness, including the deck.
3. Tabulated loads are in pounds per linear foot of deck-slab.


4346 East Mercer Way
Cedar Cove Rd
Cedar Cove Rd
Mercer Island
Washington 98040
47.567552, -122.208380


SE 40th St
SE 43rd St
80th Ave SE
81st Ave SE
82nd Ave SE
83rd Ave SE
84th Ave SE
85th Ave SE
86th Ave SE
87th Ave SE

exp. C

$K_{zt} = 1.0$

2010 ASCE 7 Wind Forces - Simple Diaphragm Low Rise Buildings

Based on ASCE7-10 Chapter 28

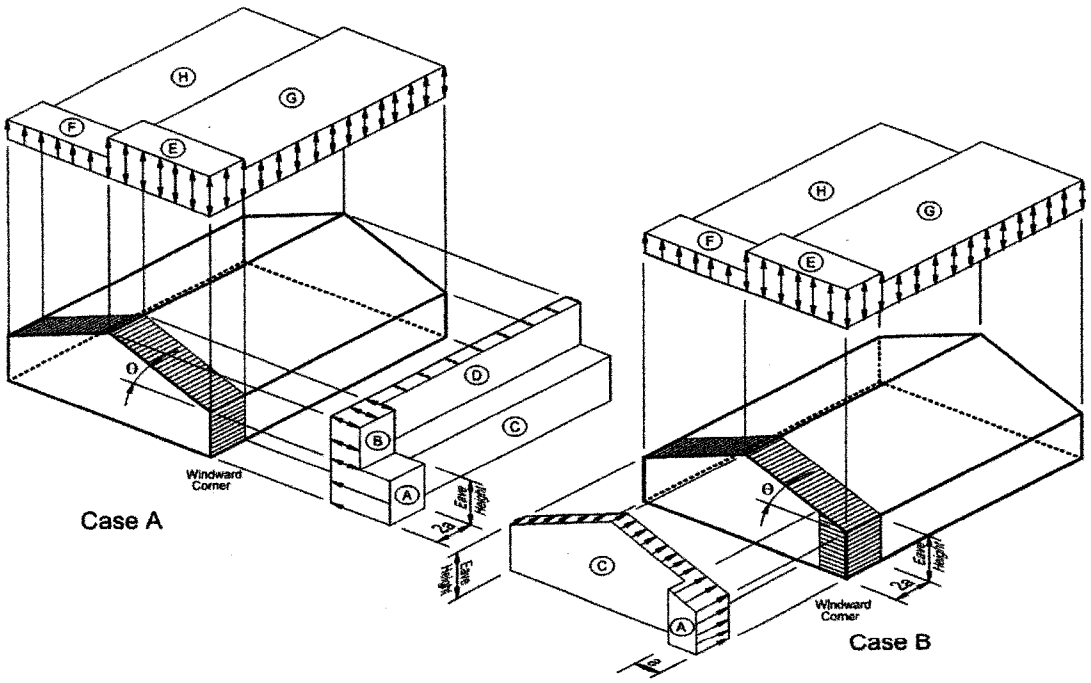
Risk Category	II	Table 1.5-1	Project	18062
Wind Speed	110	mph		**Valentin Residence**
Exposure Category	C		Date	1/27/2019
Topographic Factor	1.00	K_{zt}		
Mean Roof Height	30	ft		
Roof Pitch	0-5	degrees		
Adjustment Factor	1.40	λ, Figure 28.6-1		

Zone	λ	K_{zt}	P_{s30}	Total	
A	1.40	1.00	19.2	26.9	psf
B	1.40	1.00	-10.0	-14.0	psf
C	1.40	1.00	12.7	17.8	psf
D	1.40	1.00	-5.9	-8.3	psf

P_{s30} values from Figure 28.6-1

Calculate End Zone Distance, a

Least horizontal distance	32	ft	
10% Least Horizontal Distance	3.2	ft	
0.4h	12	ft	3.2
0.04 Least Horizontal Distance	1.28	ft	
3ft min	3	ft	3
End Zone Distance a:	3.2	ft	



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JOB 18062
SHEET NO. 79 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Lateral Analysis - Wind

Wind 110 mph exp. C $K_{zt} = 1.0$

Roof End zone - $(26.9)\,9/2 = 121$ plf
middle zone = $(17.8)\,9/2 = 80$ plf
Floor End zone - $26.9\left(\frac{9+11}{2}\right) = 269$ plf
middle $17.8\left(\frac{9+11}{2}\right) = 178$ plf
Floor End zone - $26.9\,(9+11)/2 = 269$ plf
middle $17.8\left(\frac{9+11}{2}\right) = 178$ plf

Upper Floor Shear Walls

			ASD
A	$121(7) + 80 \cdot 33/2 = 2407$	$\times .6 =$	$1444^{\#}$
B	$80\ 20/2 = 800$	$=$	$480^{\#}$
C	$121(7) + 80\ 25/2 = 1847$	$=$	$1108^{\#}$
1	$121(7) + 80 \cdot 18/2 = 1567$	$=$	$940^{\#}$
2	$80\ 61/2 = 2440$	$=$	$1464^{\#}$
3	$(121)(7) + 80\ 30/2 = 2047$	$=$	$1228^{\#}$
D	$121(7) + 80\ 37/2 = 2407$	$=$	$1444^{\#}$

Main Floor Shear Walls

A	$269(7) + 178\ 43/2 + 2407 = 8117$	$\times .6 =$	$4870^{\#}$
C	$269(7) + 178\ 26/7 + 800 + 2407 = 7404$	$=$	$4442^{\#}$
D	$269(7) + 178\ 43/2 + 2407 = 8117$	$=$	$4870^{\#}$
1	$269(7) + 178\ 29/2 + 1567 = 5764$	$=$	$3458^{\#}$
2	$178\ 62/2 + 2440 = 7958$	$=$	$4775^{\#}$
3	$269(7) + 178\ 30/2 + 2047 = 6600$	$=$	$3960^{\#}$

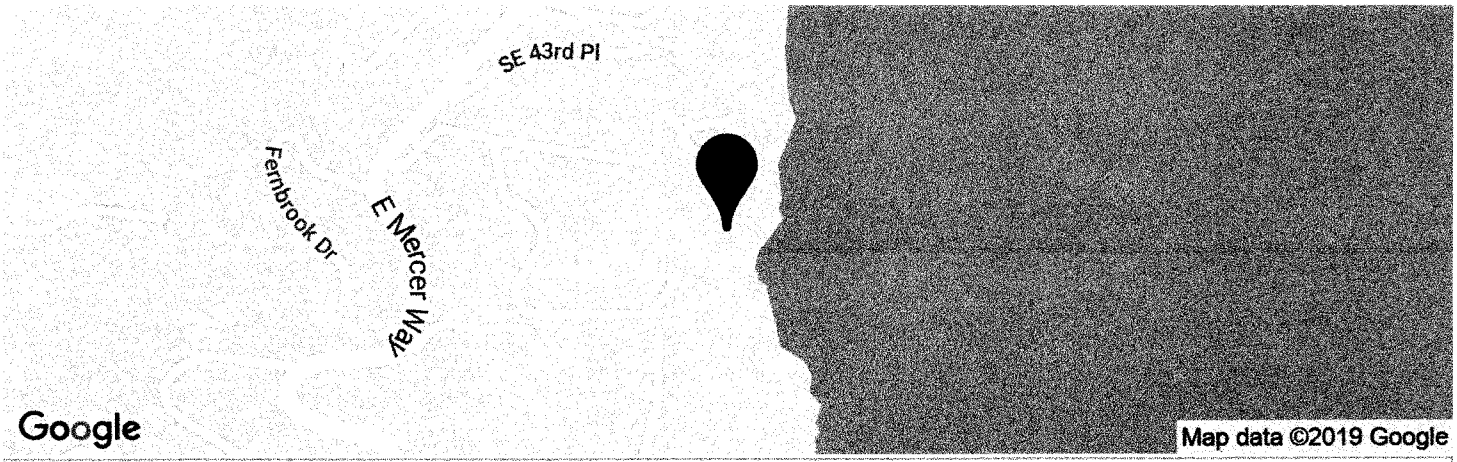
Basement Shear Walls

A, D	$269(7) + 178\ 43/2 + 8117 = 13827$	$\times .6 =$	$8296^{\#}$
3	$269(7) + 178\ 19/2 + 6600 = 9729$	$=$	$5837^{\#}$

OSHPD

Valentin Residence

Latitude, Longitude: 47.567552, -122.208380

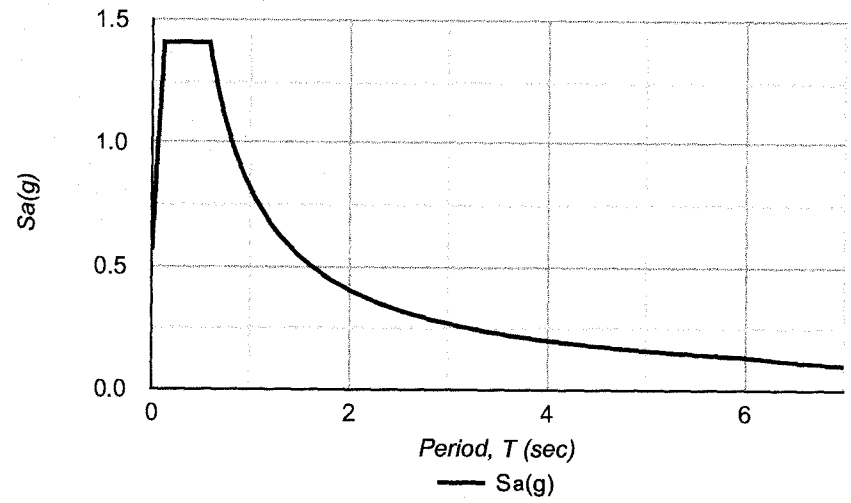


Date	1/12/2019, 6:53:32 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

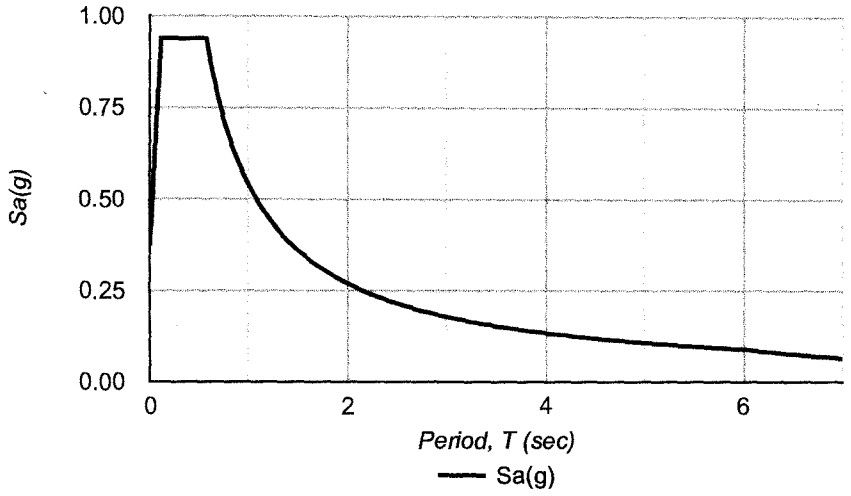
Type	Value	Description
S_S	1.408	MCE_R ground motion. (for 0.2 second period)
S_1	0.54	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.408	Site-modified spectral acceleration value
S_{M1}	0.81	Site-modified spectral acceleration value
S_{DS}	0.939	Numeric seismic design value at 0.2 second SA
S_{D1}	0.54	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.581	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.581	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.408	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.472	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.334	Factored deterministic acceleration value. (0.2 second)
S1RT	0.54	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.579	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.308	Factored deterministic acceleration value. (1.0 second)
PGAd	1.292	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.956	Mapped value of the risk coefficient at short periods
C_{R1}	0.933	Mapped value of the risk coefficient at a period of 1 s

MCER Response Spectrum



Design Response Spectrum



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Federal Way, Washington 98003
253.815.9182
forsmanengineering@comcast.net

JOB 18062
SHEET NO. 82 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Seismic - $S_{DS} = 0.919$

$V_3 = 7339\ (.7)\ (1.0) = 5137^{\#}$
$V_2 = 8436\ (.7)\ (1.0) = 5905^{\#}$
$V_1 = 2224\ (.7)\ (1.0) = 1557^{\#}$

Upper Floor Shear Walls

A $552/2280\ (5137) = 1244$
B $224/2280\ (5137) = 506^{\#}$
C $364/2280\ (5137) = 820^{\#}$
D $1140/2280\ (5137) = 2569^{\#}$
1 $364/2280\ (5137) = 820^{\#}$
2 $1140/2280\ (5137) = 2569^{\#}$
3 $776/2280\ (5137) = 1748^{\#}$

Main Floor Shear Walls

A $786/2280\ (5905) + 1244 = 3280^{\#}$
C $684/2280\ (5905) + 506 + 820 = 3098^{\#}$
D $1140/2280\ (5905) + 2569 = 5522^{\#}$
1 $448/2280\ (5905) + 820 = 1980^{\#}$
2 $1140/2280\ (5905) + 2569 = 5522$
3 $786/2280\ (5905) + 1748 = 3784^{\#}$

Lower Floor Shear Walls

A $668/1336\ (1557) + 3280 = 4059^{\#}$
D $668/1336\ (1557) + 5522 = 6301^{\#}$
1 $668/1336\ (1557) + 1980 = 2759^{\#}$

Seismic Vertical Distribution

Project: **18062**
Date: 1/27/2019

S_{DS}=	0.939
R=	6.5
I_e=	1.0
Cs=	0.144

Dead Loads:

Roof:	15	PSF
Wall:	10	PSF
Floor:	25	PSF

Level	Area	DL (psf)	w_i	h_i	$w_i * h_i$	%	v_i	
Roof	2280	15	34200	29	991800	0.41	7339	lbs
Upper Floor	2280	25	57000	20	1140000	0.47	8436	lbs
Main Floor	1336	25	33400	9	300600	0.12	2224	
		Total	124600		2432400			

Base Shear: 18000 lbs

Seismic Vertical Distribution - Middle Units

Project: **18062**
Date: 1/27/2019

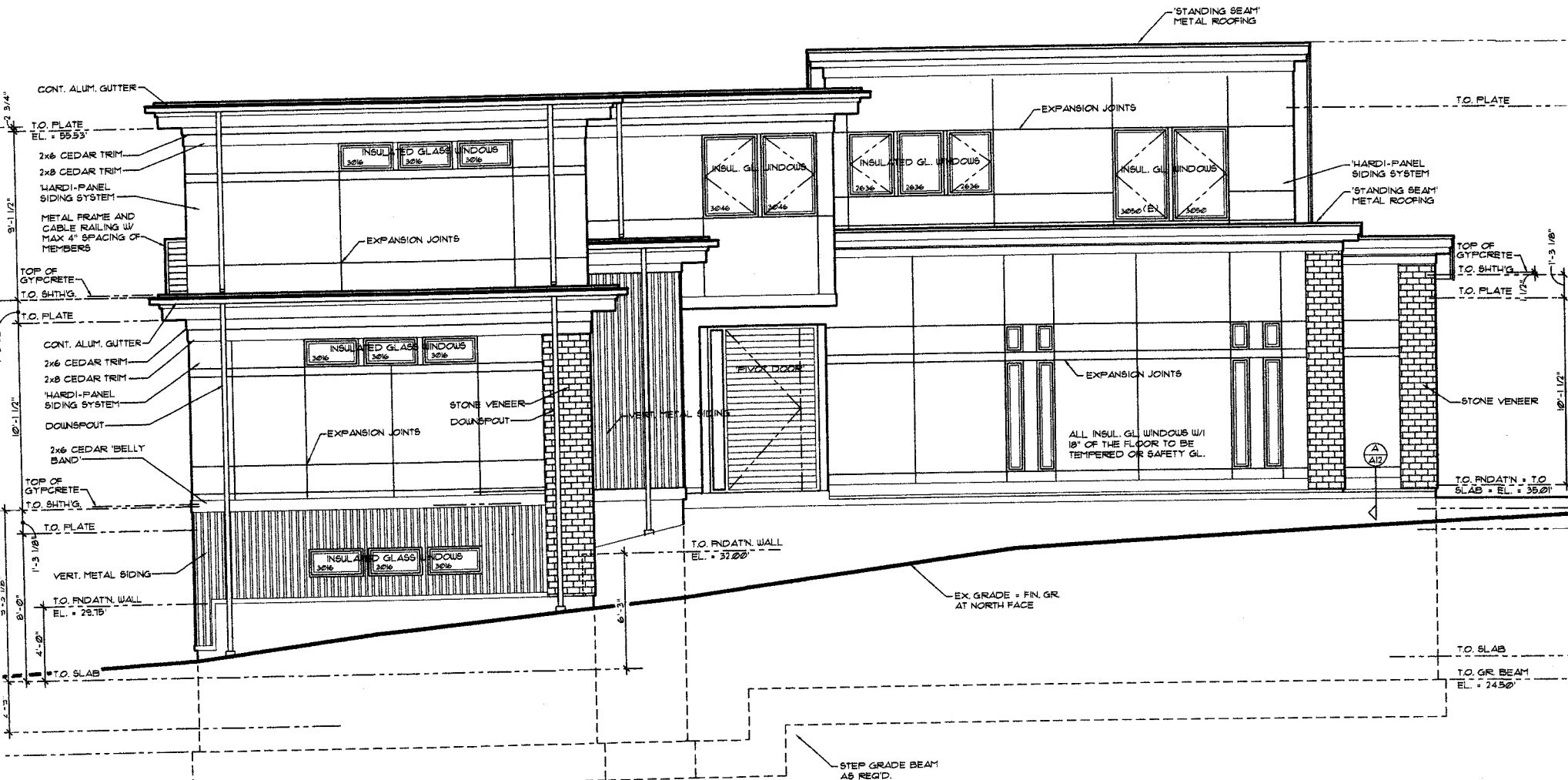
S_{DS}=	0.939
R=	6.5
I_e=	1.0
Cs=	0.144

Dead Loads:

Roof:	15	PSF
Wall:	10	PSF
Floor:	25	PSF

Level	Area	DL (psf)	w_i	h_i	$w_i * h_i$	%	v_i	
Roof	3065	15	45975	29	1333275	0.41	10339	lbs
Upper Floor	2806	25	70150	20	1403000	0.43	10880	lbs
Main Floor	2380	25	59500	9	535500	0.16	4153	
		Total	175625		3271775			

Base Shear: 25371 lbs


'STANDING SEAM' METAL ROOFING
CONT. ALUM. GUTTER
T.O. PLATE EL. = 55.53'
2x6 CEDAR TRIM
2x8 CEDAR TRIM
'HARDI-PANEL SIDING SYSTEM
METAL FRAME AND CABLE RAILING W/ MAX 4" SPACING OF MEMBERS
EXPANSION JOINTS
TOP OF GYPCRETE
T.O. SHTH'G.
T.O. PLATE
INSULATED GLASS WINDOWS 3016
INSUL. GL. WINDOWS 3046
INSULATED GL. WINDOWS 2636
INSUL. GL. WINDOWS 3050 (E)
'HARDI-PANEL SIDING SYSTEM
'STANDING SEAM' METAL ROOFING
T.O. PLATE
TOP OF GYPCRETE
T.O. SHTH'G.
T.O. PLATE
CONT. ALUM. GUTTER
2x6 CEDAR TRIM
2x8 CEDAR TRIM
'HARDI-PANEL SIDING SYSTEM
DOWNSPOUT
EXPANSION JOINTS
2x6 CEDAR 'BELLY BAND'
STONE VENEER
DOWNSPOUT
VERT. METAL SIDING
'PIVOT DOOR'
EXPANSION JOINTS
ALL INSUL. GL. WINDOWS W/I 18" OF THE FLOOR TO BE TEMPERED OR SAFETY GL.
STONE VENEER
A A12
T.O. FNDAT'N. = T.O SLAB = EL. = 35.01'
TOP OF GYPCRETE
T.O. SHTH'G.
T.O. PLATE
VERT. METAL SIDING
T.O. FNDAT'N. WALL EL. = 29.75'
T.O. FNDAT'N. WALL EL. = 32.00'
EX. GRADE = FIN. GR. AT NORTH FACE
T.O. SLAB
T.O. GR. BEAM EL. = 24.50'
STEP GRADE BEAM AS REQ'D.
9'-1 1/2"
10'-1 1/2"
1'-3 1/8"
8'-0"
4'-0"
6'-3"

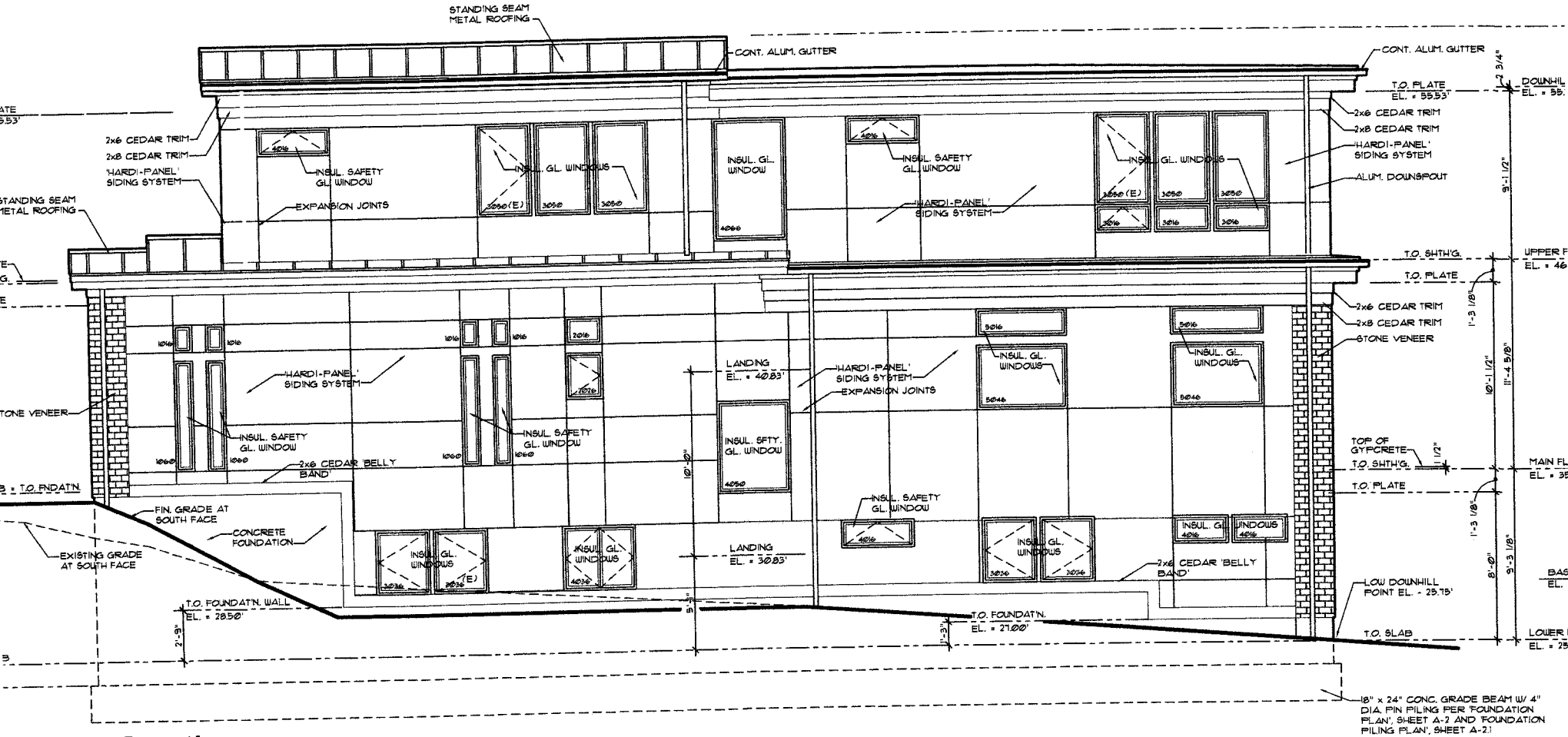
North

1/4" = 1'-0"

HEIGHT LIMIT EL. = 59.01'
UPPER FLOOR EL. = 46.40'
MAIN FLOOR EL. = 35.01'
BASE ELEV. EL. = 29.01'
LOWER FLOOR EL. = 25.15'
T.O. PLATE EL. = 55.53'
T.O. GYPCRETE EL. = 46.53'
T.O. GYPCRETE EL. = 35.14'
T.O. SLAB = T.O. FNDTN. WALL
T.O. PLATE BELOW GARAGE (VERIFY)
T.O. SLAB
T.O. GR. BM. EL. = 24.50'
DOWNSPOUT
EXPANSION JOINTS
HARDI-PANEL SIDING SYSTEM
OVERHEAD GARAGE DOOR w/ ELEC. OPENER
INSUL. GLASS WINDOWS
FINISH GRADE AT WEST FACE
EXISTING GRADE AT WEST FACE
STEP GRADE BEAM AS REQ'D.
T.O. TRUSS EL. = 59.01'
2x6 CEDAR TRIM
2x8 CEDAR TRIM
CONT. ALUM. GUTTER
STONE VENEER
TOP OF GYPCRETE
T.O. SHTHG.

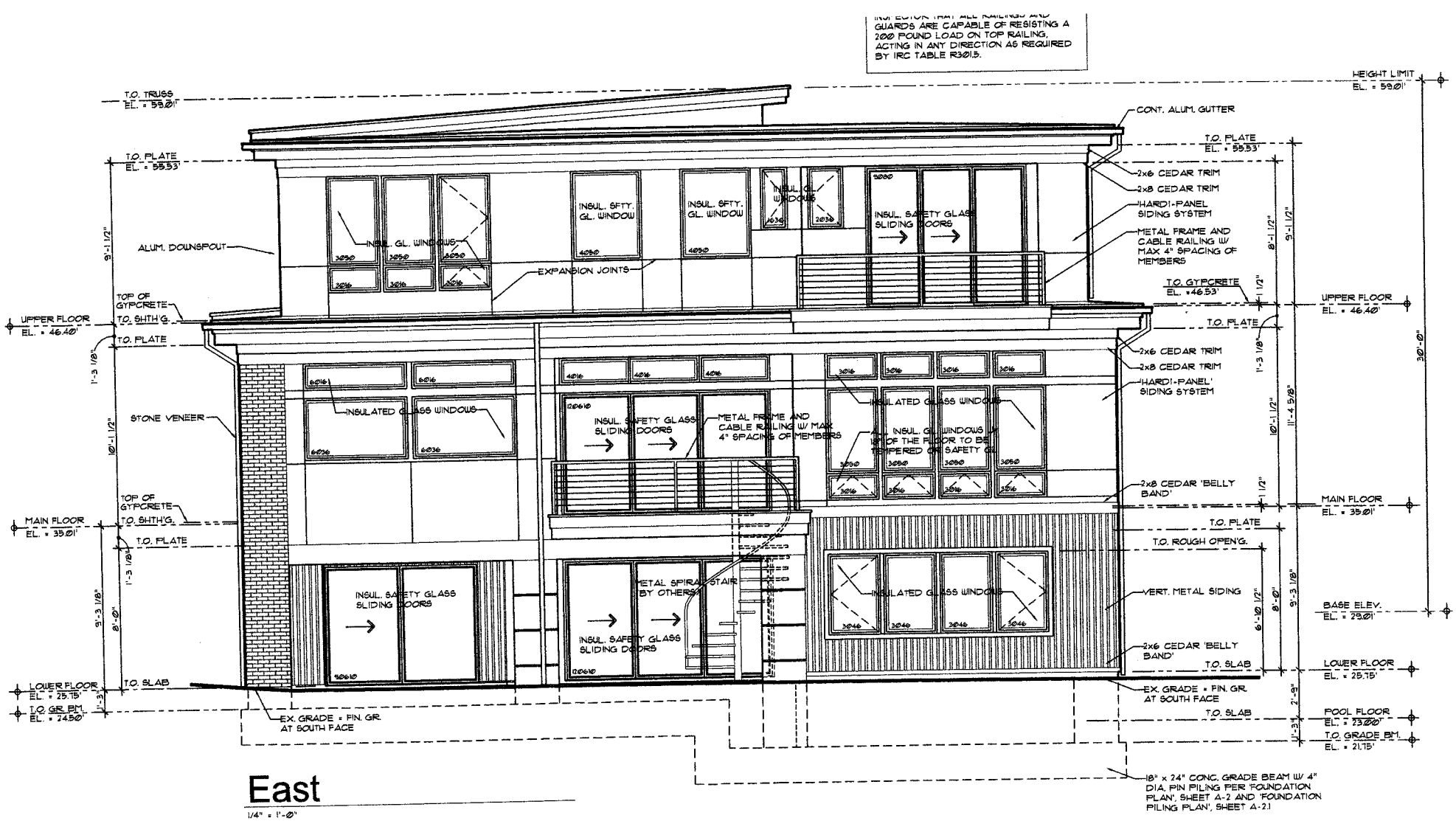
West

1/4" = 1'-0"


STANDING SEAM METAL ROOFING
CONT. ALUM. GUTTER
2x6 CEDAR TRIM
2x8 CEDAR TRIM
'HARDI-PANEL' SIDING SYSTEM
INSUL. SAFETY GL. WINDOW
EXPANSION JOINTS
INSUL. GL. WINDOWS
INSUL. GL. WINDOW
T.O. PLATE EL. = 55.53'
ALUM. DOWNSPOUT
T.O. SHTH'G.
STONE VENEER
LANDING EL. = 40.83'
INSUL. SFTY. GL. WINDOW
2x6 CEDAR 'BELLY BAND'
TOP OF GYPCRETE
FIN. GRADE AT SOUTH FACE
CONCRETE FOUNDATION
EXISTING GRADE AT SOUTH FACE
T.O. FOUNDAT'N. WALL EL. = 28.50'
T.O. FOUNDAT'N. EL. = 27.00'
LOW DOWNHILL POINT EL. = 25.75'
T.O. SLAB
18" x 24" CONC. GRADE BEAM W/ 4" DIA. PIN PILING PER 'FOUNDATION PLAN', SHEET A-2 AND 'FOUNDATION PILING PLAN', SHEET A-2.1

South

1/4" = 1'-0"


GUARDS ARE CAPABLE OF RESISTING A 200 POUND LOAD ON TOP RAILING, ACTING IN ANY DIRECTION AS REQUIRED BY IRC TABLE R301.5.
HEIGHT LIMIT EL. = 59.01'
T.O. TRUSS EL. = 59.01'
T.O. PLATE EL. = 55.53'
CONT. ALUM. GUTTER
2x6 CEDAR TRIM
2x8 CEDAR TRIM
HARDI-PANEL SIDING SYSTEM
METAL FRAME AND CABLE RAILING W/ MAX 4" SPACING OF MEMBERS
ALUM. DOWNSPOUT
INSUL. GL. WINDOWS
INSUL. SFTY. GL. WINDOW
INSUL. SAFETY GLASS SLIDING DOORS
EXPANSION JOINTS
T.O. GYPCRETE EL. = 46.53'
UPPER FLOOR EL. = 46.40'
TOP OF GYPCRETE
T.O. SHTH'G.
T.O. PLATE
STONE VENEER
INSULATED GLASS WINDOWS
METAL FRAME AND CABLE RAILING W/ MAX 4" SPACING OF MEMBERS
INSUL. GL. WINDOWS (1/2 OF THE FLOOR TO BE TEMPERED OR SAFETY GL.
2x8 CEDAR 'BELLY BAND'
MAIN FLOOR EL. = 35.01'
T.O. ROUGH OPEN'G.
METAL SPIRAL STAIR BY OTHERS
VERT. METAL SIDING
BASE ELEV. EL. = 29.01'
2x6 CEDAR 'BELLY BAND'
T.O. SLAB
LOWER FLOOR EL. = 25.75'
EX. GRADE = FIN. GR. AT SOUTH FACE
POOL FLOOR EL. = 23.00'
T.O. GR. BM. EL. = 24.50'
T.O. GRADE BM. EL. = 21.75'
18" x 24" CONC. GRADE BEAM W/ 4" DIA. PIN PILING PER 'FOUNDATION PLAN', SHEET A-2 AND 'FOUNDATION PILING PLAN', SHEET A-2.1
9'-1 1/2"
10'-1 1/2"
1'-3 1/8"
8'-0"
11'-4 5/8"
30'-0"
6'-10 1/2"
2'-9"
1'-3"

East

1/4" = 1'-0"

Shear Wall Summary Quackenbush Garage

Project: **16064**
Date: 1/15/2017

S_{DS}= 0.828

Dead Loads:
Roof: 15 PSF
Wall: 10 PSF
Floor: 14 PSF

Grid Line	Total Wall Length (ft)	Plate Height (ft)	Total Forces (lb) Wind	Seismic	Wall Forces (PLF) Wind	Seismic	Check Length (ft)	OTM (lb-ft) Wind	Seismic	Dead Load Trib (ft) Roof	Wall	Floor	DLRM (lb-ft)	Net uplift (lb) Wind	Seismic	Wall Type	Hold-down	Post	Anchor
Upper Floor Shear Walls																			
A	12	9	1444	1244	120	104	4	4332	3732	6	4		1440	867	759	P1-6	MST 37	(2)2x	
B	6	9	480	506	80	84	6	4320	4554	16	6		5940	126	280	P1-6			
C	6	9	1108	820	185	137	6	9972	7380	15	6		5670	1095	773	P1-6	MST 37	(2)2x	
D	17.5	9	1444	2569	83	147	8	5941	10570	6	8		5760	311	973	P1-6	MST 37	(2)2x	
1	18	9	940	820	52	46	18	8460	7380	4	18		24300	-340	-244	P1-6			
2	12	9	1464	2569	122	214	12	13176	23121	4	12		10800	558	1491	P1-6	MST 37	(2)2x	
3	7.5	9	1228	1748	164	233	3	4421	6293	6	3		810	1312	1967	P1-6	MST 37	(2)2x	
Main Floor Shear Walls																			
A	12	10	4870	3280	406	273	6	24350	16400	6	6	2	3924	3666	2417	P1-4	MST 60	(2)2x	
C	18.5	10	4442	3098	240	167	9	21610	15071	16	9	4	16038	1332	812	P1-6	HDU 2	(2)2x	5/8"
D	42	10	4870	5522	116	131	5.5	6377	7231	6	5.5	4	3721	754	987	P1-6	MST 37	(2)2x	
1	7	10	3458	1980	494	283	2	9880	5657	4	2	4	432	4810	2724	P1-4	HDU 8	(3)2x	7/8"
2	14	10	4775	5522	341	394	14	47750	55220	4	14	4	21168	2504	3212	P1-3	MST 48	(2)2x	
3	8	10	3960	3784	495	473	4	19800	18920	6	4	6	2192	4621	4465	P1-2	HDU 8	(3)2x	7/8"
Basement Floor Shear Walls																			
A	11.5	9	8296	4059	721	353	5	32463	15883	6	5	4	2950	6139	2891	P1-2	HDU 11	(4)2x	1"
D	20	9	8296	6301	415	315	3	11200	8506	6	3	8	1314	3470	2623	P1-4	HDU 8	(3)2x	7/8"
3	40	9	5837	2759													concrete piers		

Overturning Load Combinations based on ASCE 7-10	
0.6D + 0.6W	ASCE 7-10 section2.4
$(0.6-0.14S_{DS})D + 0.7Q_E$	ASCE 7-10 Section 12.4.2.3

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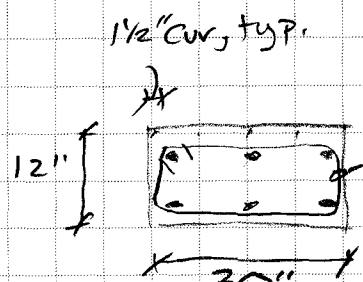
forsmanengineering@comcast.net

JOB
SHEET NO. 90 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Concrete Columns for Interest.-

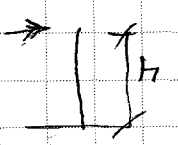


$d = 30" - 1\frac{1}{2}" - .5 - \frac{5}{16} - 2(\frac{1}{2}")$
$d = 28.688$
$d/2 = 13.3"$

Gridline load

$P = 5837/4 = 1460^{\#}$
Ult Expres

$h = 9'$



$M_{ULT} = 1.7 \times 1460^{\#} \times 9'/1000$
$= 22.3^{k'}$

See spread sheet
$\phi M_n = 31.8^{k'}$ o.k.

REINFORCED CONCRETE BEAM (ACI 318)

Beam Section

b	10.000	in
h	28.000	in
cover	0.750	in
d	26.625	in
Bar #	4	
No. Bars	2	
As	0.40	in^2
As min	1.33	in^2
As max	7.41	in^2
Tie #	3	
No. Bars	2	
Spa	10.000	in
Spa max	13.313	in
Av	0.22	in^2
Av min	0.13	in^2

Material

f'c	3,000	psi
Wc	155	pcf
Ec	3,488	ksi
fy	40,000	psi
Es	29,000	ksi

Analysis

phi shear	0.85	
phi flex	0.90	
Beta 1	0.85	
n	8.000	
rho	0.002	
k	0.143	
j	0.952	
Ag	266	in^2
Ig	15,729	in^4

Capacity

phi Vc	24.791	k
phi Vs	23.430	k
phi Vn	48.221	k
phi Mn	31.572	k-ft

Serviceability

M min	1.900	k-ft
fc min	47	psi
fs min	2,248	psi
M max	6.130	k-ft
fc max	152	psi
fs max	7,254	psi
fr	5,006	psi
fr allow	20,498	psi
Mcr	44.731	k-ft
dc	1.375	in
A	13.750	in^2
Z	19.325	k/in