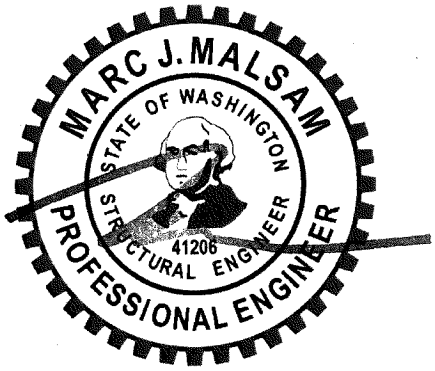
STRUCTURAL CALCULATIONS FOR:

KONERU RESIDENCE

6610 E MERCER WAY
MERCER ISLAND, WA

ARCHITECT: MCCULLOUGH ARCH

DECEMBER 23, 2021



MALSAM
TSANG
STRUCTURAL
ENGINEERING

122 S JACKSON ST | SUITE 210 | SEATTLE WA 98104 | 206.789.6038 T | 206.789.6042 F

DESIGN CRITERIA IBC 2018

DEAD LOADS

FLAT ROOF		FLOOR	
Rigid Insulation	2 psf	1-1/8Gyp+1/4tile	18 psf
3/4" Plywood	2.4 psf	w/ hydro. tubing	- -
TJI @ 24" o.c.	1.5 psf	1 1/8" Plywood	3.6 psf
Gyp Board (5/8")	2.8 psf	Truss @ 16" o.c.	4.0 psf
MEP	1.5 psf	Gyp Board (5/8")	2.8 psf
Solar panel	8.0 psf	MEP	1.5 psf
(where occurs)	-		
Total	18.2 psf	Total	29.9 psf
Use	20.0 psf (Typ. roof)	Use	30.0 psf
Use	30.0 psf (w/pea gravel)		

MISC. LOADS	
16 gage roof steel deck w/ 2" ave. pea gravel	28 psf
(where; washed pea gravel=9.5 psf per inch thk)	- -
3/4" Stucco (lath & plaster) wall fin.	8 psf
Wood slat arch'l wall feature	5 psf

LIVE LOADS/OCCUPANCY

		ROOF LIVE		FLOOR LIVE		DECK LIVE	
Risk Category	II	Snow =	25 psf	Occupancy =	40 psf	Occupancy =	60 psf
Roof Deck	No			Stair/Corridor =	40 psf		
Common Access	No						

SEISMIC CRITERIA ASCE 7-16 Ch. 11 & Ch. 12

Imp. Factor =	1.00	Seismic Ht, hn=	28 ft
Site Class =	E	T, Building=	0.24
R Value =	6.5	Ts=	0.63

Geo. Ground Hazard? **No w/ASCE 11.4.8 Excep's**

S_s =	1.45		F_a =	1.200	Table 11.4-1
S_1 =	0.5		F_v =	1.850	Table 11.4-2
S_{ms} =	1.740	x 2/3 =	S_{ds} =	**1.059**	Eqn. 11.4-3
S_{m1} =	0.925	x 2/3 =	S_{d1} =	**0.567**	Eqn. 11.4-4

C_{SULT} =	**0.163**	ASCE 7 12.8, ELF, procedure used.
C_{SALL} =	**0.114**	ASCE 7 12.9, MRSA, procedure not used.

T/Ts= 0.385 ≤ 1

Okay, Cs Eqn. 12.8-2

SEISMIC WEIGHT ASCE 7-16 12.7.2

Partitions = 15 psf

***Roof weight = 1/2 Partition + Roof DL**

***Floor weight = Full Partition + Floor DL**

FLAT ROOF 26.0 psf ROOF=37.0 psf (w/ gravel)

FLOOR 45.0 psf

SEISMIC DESIGN CATEGORY IBC 1613.2.5

Seismic DC= D

WIND CRITERIA ASCE 7-16 Ch. 27 Directional Procedure

V =	110 mph	K_d =	0.85
Exposure =	C	G =	0.85
h =	28 ft	K_{zt} =	1.00

Roof Slope = FLAT : 12 = 0 °

PRESSURE COEFFICIENTS (Cp)

Windward Wall = 0.8 Windward Roof = N/A

Leeward Wall = -0.5 Leeward Roof = N/A

PRESSURE (PSF) $q = 0.00256K_zK_{zt}K_dV^2$

Ht	K_z	q_z	$0.6xq_z$ [1]	q_h	P_{WW}	P_{LW}	P_{WALL}	P_{ROOF}
0-15	0.85	22.4	13.4		9.1	6.6	**15.7**	
15-20	0.90	23.7	14.2		9.7	6.6	**16.2**	
20-25	0.94	24.7	14.8		10.1	6.6	**16.7**	
25-30	0.98	25.8	15.5	15.5	10.5	6.6	**17.1**	**N/A**
30-35	1.02	26.9	16.1		11.0	6.6	**17.5**	
35-40	1.04	27.4	16.4		11.2	6.6	**17.8**	
40-45	1.07	28.2	16.9		11.5	6.6	**18.1**	
45-50	1.09	28.7	17.2		11.7	6.6	**18.3**	

[1] Per IBC 2018 1605.3.1 Basic Load Combinations

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KONERU RESIDENCE
Project

6610 E MERCER WAY

MERCER ISLAND, WA

10/22/2021
Date

0426-2021-03-01
Proj. No.

JCM
Design

DC1
Sheet

COMPONENTS & CLADDING ASCE 7-16 CHAPTER 30

WIND CRITERIA FROM DC1

V = 110 mph K_d = 0.85
Exposure = C K_{zt} = 1.00
h = 28 ft

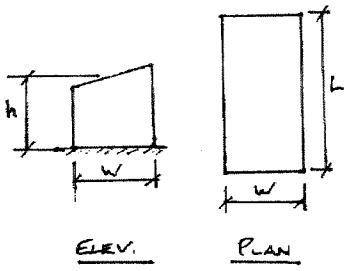
Roof Slope = FLAT : 12 = 0 °

Bldg Type = Enclosed Building

GC_{pi} = 0.18 Table 26.11-1

K_h = 0.968 Table 30.3-1
q_h = 25.5 Eqn 30.3-1
0.6 x q_h = 15.3 Per IBC 2018 Basic Load Combinations

BUILDING GEOMETRY



ELEV. PLAN

W = 63 ft
L = 132 ft
h = 28 ft

a = 6.3 ft

USE PART 1 FOR h < 60'

PART 1: h < 60'

CHAPTER 30.4

MONOSLOPE ROOF 3o < Q < 10o

ROOF PRESSURES				
ZONE	GCp(+)	GCp(-)	0.6p(+)	0.6p(-)
1	0.3	-1.1	7.3	-19.6
2	0.3	-1.3	7.3	-22.6
2'	0.3	-1.6	7.3	-27.2
3	0.3	-1.8	7.3	-30.3
3'	0.3	-2.6	7.3	-42.5

WALL PRESSURES				
ZONE	GCp(+)	GCp(-)	0.6p(+)	0.6p(-)
4	0.9	-0.99	16.5	-17.9
5	0.9	-1.26	16.5	-22.0

Note: When θ < 10°, GCp values are reduced by 10% per Figure 30.4-1 Note 5

CHAPTER 30.9 - PARAPETS

Note: parapet values assume parapet is at roof level

LOAD CASE A: 0.6p = 39.2
LOAD CASE B: 0.6p = 34.4

USE: 0.6p = 39.2

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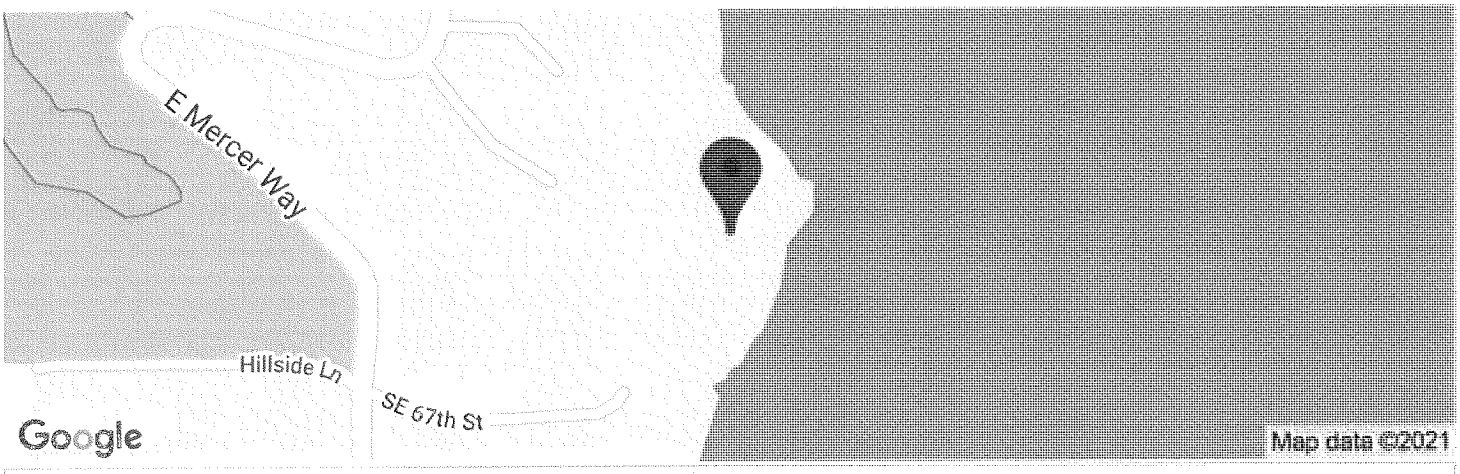
JCM
Design
DC1 - 1
Sheet

OSHPD

Koneru Residence

6610 E Mercer Way, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5437445, -122.2093429



Date	10/21/2021, 2:09:01 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	E - Soft Clay Soil

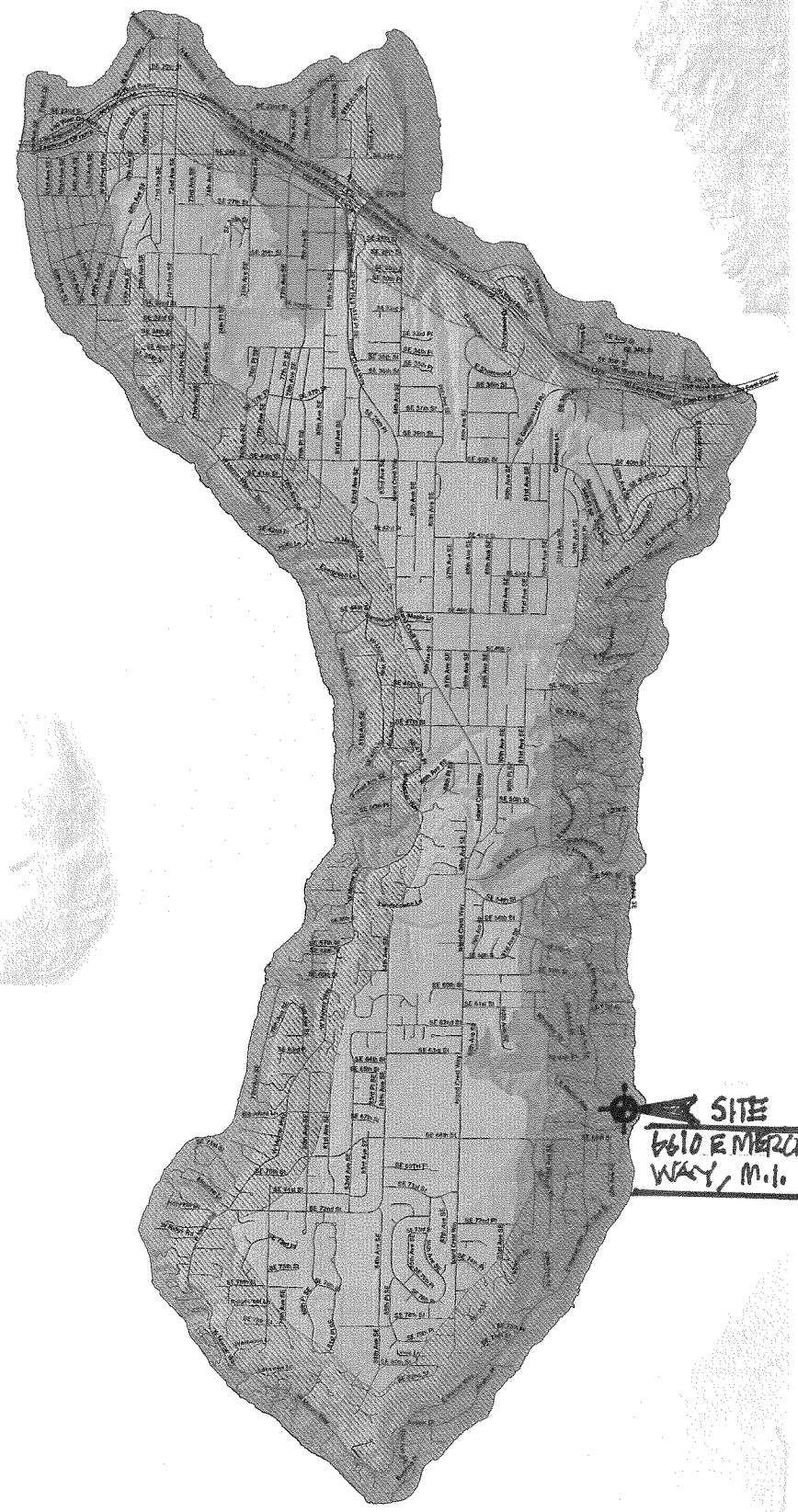
Type	Value	Description
S_S	1.448	MCE_R ground motion. (for 0.2 second period)
S_1	0.501	MCE_R ground motion. (for 1.0s period)
S_{MS}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	null -See Section 11.4.8	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	null -See Section 11.4.8	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.62	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.682	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.448	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.606	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	4.294	Factored deterministic acceleration value. (0.2 second)
S1RT	0.501	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.558	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.643	Factored deterministic acceleration value. (1.0 second)
PGAd	1.425	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.902	Mapped value of the risk coefficient at short periods
C_{R1}	0.899	Mapped value of the risk coefficient at a period of 1 s

Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island
April 2008

0 0.5 1 Kilometers 1:12,000
0 0.5 1 Miles
TN



WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS
(ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the Kzt factor to be utilized for each specific project. The Kzt factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

Please note – The Kzt values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

WIND EXPOSURE CATEGORIES:

Wind Exposure Category	
	Exposure 'C' (1500 feet from Lake)
	Exposure 'B' (all other areas)

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_zt Factor :

K_zt Factor	
	$K_zt = 1.0$
	$K_zt = 1.3$
	$K_zt = 1.6$
	$K_zt = 1.9$

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer Island. This map shows the minimum wind exposure category and the minimum wind speed-up, "K_zt" factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically indentified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

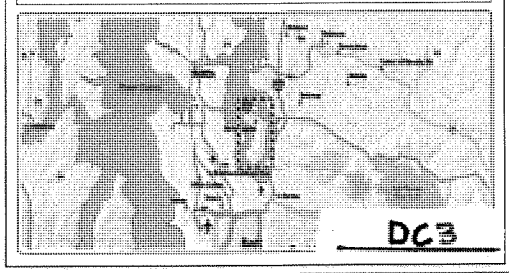
This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

DEFINITIONS:

K_zt factor	The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.
Exposure B	The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.
Exposure C	The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.
Wind Speed	Minimum 85 mph 3-second gust per IRC Figure R301.2(4)



DC3

LATERAL ANALYSIS AND DESIGN:

① WIND ANALYSIS: — BOTH DIRECTIONS

LEVEL	TRIB. HT (FT)	$V_{WIND\ ALLOW}$ - FULL WIND (PLF)	$V_{WIND\ ALLOW}$ - WINDWARD (PLF)
ROOF DIAP.	$2.75 + 1 + 10/2$ $= 8.75'$	$= 17.1 * 2.75' + 16.7 * 5' + 16.2 * 1$ $= 146.7\ \#/'$	$= 10.5 * 2.75 + 10.1 * 5' + 9.7 * 1 = 89.0\ \#/'$
UPPER FLR. DIAP.	$10/2 + 2 + 12/2$ $= 13.0'$	$= 16.2 * 4' + 15.7 * 9' = 206.1\ \#/'$	$= 9.7 * 4' + 9.1 * 9' = 120.7\ \#/'$

② SEISMIC ANALYSIS:

LEVEL	AREA (#)	WT. (K)	HT (FT)	$W_i H_i$ (K-FT)	DISTRIB.	$E_{LATERAL}$ (ALLOW.) DIAP. DES. FORCE (K)
ROOF DIAP.	$5580 * 26\ PSF + 1250 * 18.5\ PSF$	168.0^K	22	3695	0.55	26.00 ✓
UPPER FLOOR & LOWER ROOF DIAP.	$4385 * 45\ PSF + 760 * 37\ PSF + 515 * 28^{33} + 140 * 15 + 100^K (12\frac{1}{2} + 2) * 8$	250.0^K	12	3000	0.45	21.50
		$\Sigma W_i = 418.0^K$		$\Sigma = 6695$		

$V_{SX\ ULT.} = 0.163\ (418.0) = 68.0$

$V_{SX\ ALLOW.} = 0.114 (418.0) = 47.5$

ASCE 12.10.1;
INERTIAL DIAP DES. FORCE

(EQN. 12-10.2)

$F_{Px} = 0.2\ S_{DS}\ I_e * W_{Px}$ — (ULT.)

$= 0.2 * 1.059 * 1.0 * W_{Px} / 1.4$

$F_{Px} = 0.15\ W_{Px}$ — (ALLOW.)

ROOF DIAP. ——— 25.35k — N/G

UPPER FLOOR & LOWER FLR DIAP ——— ✓ 37.75^K > 21.50

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PROJECT: KONERU RES.

DATE: 10/22/21

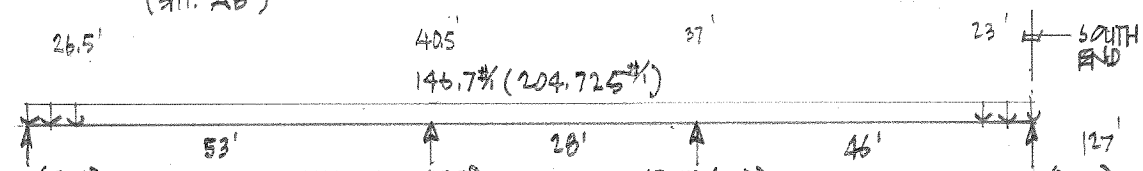
PROJECT NO: 0426-2021-03

DESIGN: JCM

SHEET: L-1

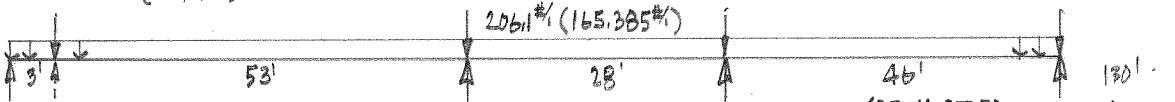
// LATERAL DESIGN ; EAST-WEST EXPO ; SEISMIC LOAD IN PARENTHESIS !

UPPER FLR. RF. DIAP. / UPPER FLR. SW ;
ht = 10' (SHT. A8)



R (K) ;	3.9 (5.4)	5.94 (8.3)	5.43 (7.5)	3.37 (4.7)
ℓ (FT) ;	9+3 = 12	21+8+9 = 38	21+23.5 = 44.5	4+4 = 8
v (PLF) ;	325 (450)	156 (218)	122 (171)	421 (588)
SW ;	SW3-1	~~SW6~~ SW4	~~SW6~~ SW4	SW3-2
OT (K) ;	3.2 (4.5)	1.5 (2.1)	1.2 (1.7)	4.2 (5.8)
HD ;	(3) CS16 OR HDU4	(2) CS16	CS16	(4) CS16
H/L ;	(2x450) 2x3/10 = 540#/' — OK?	N/A	N/A	(2x450) 2x4/10 = 720#/' OK?

UPPER FLR. DIAP. / MAIN FLR. SW
ht = 12'-UNO (SHT. A6)



R ;	10 (10.3)	14.30 (15.0)	13.0 (13.7)	SDPWS-PERFO. SW-TAB.4.3.3.5	8.1 (8.5)
ℓ ;	5+12+6+6+6 = 35	13+16 = 29	13.5+24 = 37.5	1.0	26 (4+4)+20 = 28
v ;	286 (144)	493 (517)	847 (365)		289 (304)
SW ;	SW3 — for H/L	SW2	~~SW3~~ SW2		~~SW4~~ SW3
OT ;	3.4 (3.5) — UNSTACK 6.6 (7.9) — STACK	5.9 (6.2)	4.1 (4.3) — UNSTACK 5.3 (6.0)	STACK	3.4 (3.6) 7.6 (7.8)
HD ;	HDU4 ; HDU8	HDU8	HDU8		(2) HDU5 HDU4 HDU5
H/L ;	450x2x5/12 = 375#/' — OK?	N/A	N/A		N/A

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KONERU RES.
PROJECT

10/29/21
DATE

0426-2021-03
PROJECT NO

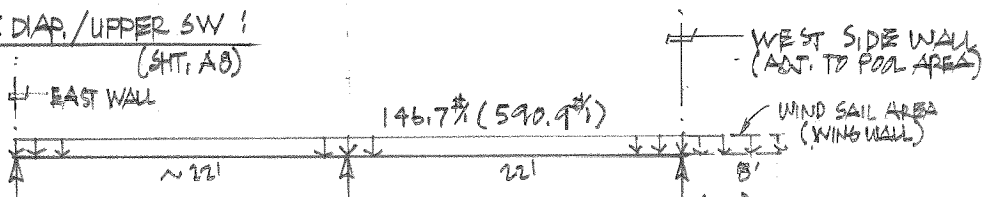
JCM
DESIGN

L-2
SHEET

LATERAL DESIGN ; NORTH-SOUTH EXPO. ;

UPPER FLR. RF. DIAP./UPPER SW ;

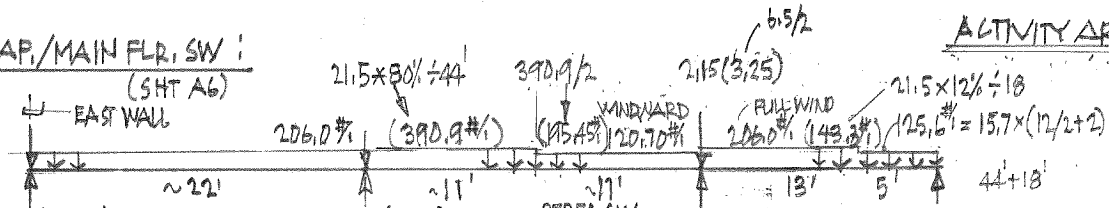
ℓe = 10' (SHT. A8)



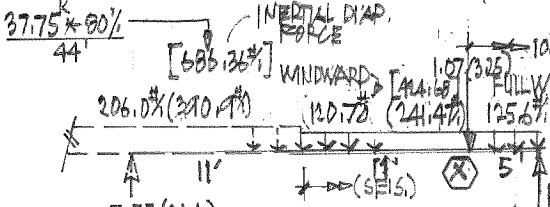
R ;	1.16(6.5)	3.23(13.0)	2.77(6.5)
Σ ;	6.4+6.33=12.75	12+8.5+12+8+13=53.5	10+5.75+5+23.5=44.25
V ;	125(510)	60(243)	63(147)
SW ;	SW2	SW4	SW6
DT ;	1.20(5.0)	N/C (2.4)	N/C (1.4)
HD ;	(3)CS16 OR HDU5	(2)CS16	CS16
H/L ;	N/A	N/A	N/A

UPPER FLR. DIAP./MAIN FLR. SW ;

ℓe = 12' (SHT A6)



R ;	3.87(10.8)	7.55(21.6)	5.45(6.7)	1.45(1.30)
Σ ;	4.5+9×2+5.3=27.8	14.5+10+22.5+21=68	10 Co(2+5)=7	33
V ;	139(388)	111(318)	178(957)	44(40)
SW ;	SW2	SW4	SW2-2	SW6
DT ;	1.16(4.6) UNSTACK ; 2.16(8.6) STACK	1.3(3.8) – UNSTACK	STACK – 9.2(12.8)	N/CRIT
HD ;	HDU5 HDU11	HDU5	HDU8 + HDU5 ON 6×8	–
H/L ;	600×2×4.5/12 = 450#/'	N/A	N/A	–



GARAGE + MECH. + SERV. AREA

R ;	10
Σ ;	303(710)
V ;	SW3-2 ⇒ SW2-2
SW ;	3.6(8.5)
DT ;	HDU11 ON 6X
HD ;	N/A
H/L ;	

SEIS.; V; = [240.4#/' / 2 × 11' + 21.5K × 8%] ÷ 16
= (241.87#/') – E.L.F.

DC = [686.36 / 2 × 11' + 37.75K × 8%] ÷ 16
= [424.68#/']
– INERTIAL DIAP. FORCE

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KONERU RES.
PROJECT

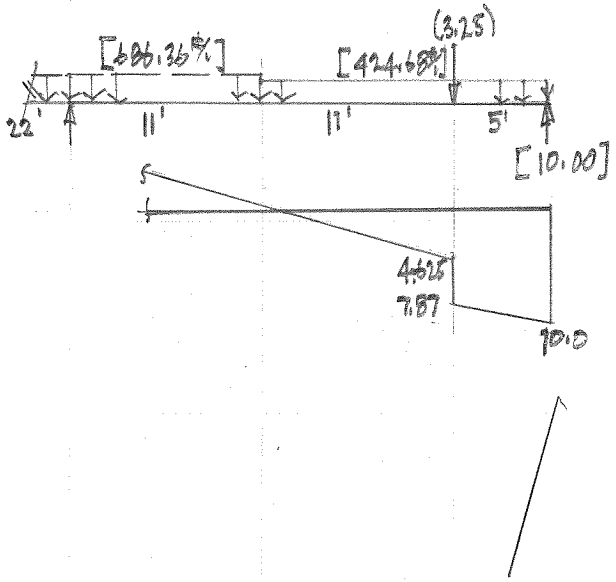
11/2/21
DATE

0426-2021-03
PROJECT NO

JCM
DESIGN

L-3
SHEET

(X) – DIAP. CHK. DUE TO VERT. IRREG. / SW OFFSET:



$V_{DIAP} \approx 7.8^{K}/54' * 25\%$

$= 181\#/' < 230\#/'$ – UNBLOCKED CASE-1 – OK!

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KONERU RES.
PROJECT

11/3/21
DATE

0426-2021-03
PROJECT NO

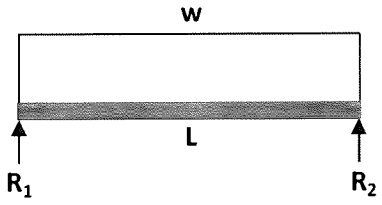
JCM
DESIGN

L-4
SHEET

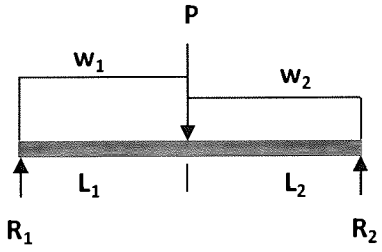
TYPICAL BEAM CASES

***ASSUME CASE 1 FOR ALL BEAMS U.N.O.**

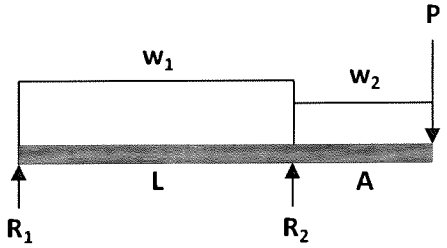
CASE #1: (C1)



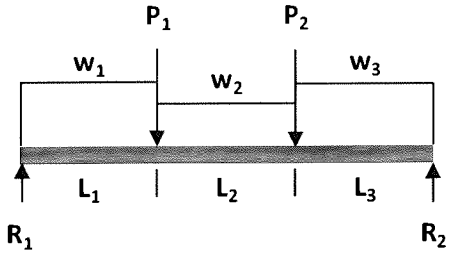
CASE #2: (C2)



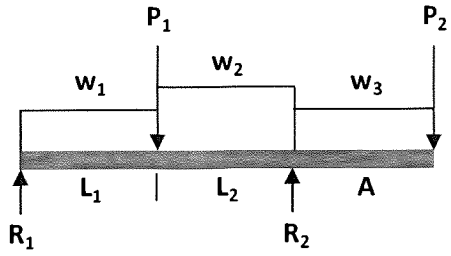
CASE #3: (C3)



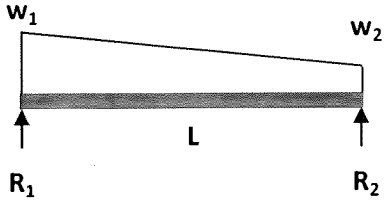
CASE #4: (C4)



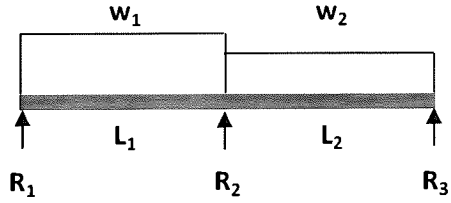
CASE #5: (C5)



CASE #6: (C6)



CASE #7: (C7)



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Project	KONERU RESIDENCE
	6610 E MERCER WAY
	MERCER ISLAND, WA
Date	10/19/2021
Proj. No.	0426-2021-03-01
Design	JCM
Sheet	DC4 – V1

VERTICAL DESIGN:

ROOF FRAMING - #200's

#201 - 11 7/8" TJI - 360's @ 24" OC:

- DL = 20 PSF; SNOW = 25 PSF
- SEE FORTE-WEB OUTPUT — OK?

#202 - UPSET RF BEAM O/BDRM 01 SLIDING @ EAST WALL: (C-3)

$W_1' = (20+25)\,20.5/2 = 0.465$

$\ell = 20$; $A = 1.5$; $P \approx 0$

$R_1 = 4.62$

$R_2 = 5.40$

$M = 23.0$

$fv = 66$

$fb = 1.118$

$\Delta_{TL\,cspan} = 0.45'' \sim \ell/531$ — OK? GLB 5 1/2 x 15

#203 A/B - RB2 RIM @ EAST WALL:

$W = 45\ PSF \times 11.5'/2 + 10\#/' = 45\#/'$

$\ell = 22.5'$

$R = 0.151$

$M = 2.85$

$fv = 17$

$fb = 0.415$

$\Delta_{TL} = 0.34'' \sim \ell/787$ — OK?

#204 A/B - RB2 SKTLT BM. O/TUB:

$W = (20+25)\,3/2 = 180$

$\ell = 19$

$R = 1.71$

$M = 8.11$

$fv = 55$; $\Delta_{TL} = 0.64'' \sim \ell/327$

$fb = 1.118$ — OK?

#205 - RIM/BM @ BATH-1 EAST WALL:

$W = 0.465$ (SIM. #202) ; $\ell_{MAX} = 12.5$

$R = 2.9$

$M = 9.10$

$fv = 73$; $\Delta_{TL} = 0.36'' \sim \ell/416$

$fb = 1.317$

OK? GL/PSL 5 1/4 x 9 1/2

#206 - RB2 DROPPED BM. O/BDRM-1 HALLWAY:

$W = (20+25)\,41/2 = 0.925$

$\ell_{MAX} = 9'$

$R = 4.2$

$M = 9.4$

$fv = 117$

$fb = 1.37$

$\Delta_{TL} = 0.155'' \sim \ell/695$ — OK?

#207 - TOP FLUSH RIM/BM. @ FOOTA WEST WALL:

$W = (20+25)(22/2+1) = 540$; $\ell_{MAX} = 8.5'$

$R = 2.3$; $M = 4.9$

$fv = 54$; $fb = 0.707$

$\Delta_{TL} = 0.089'' \sim \ell/1138$ — OK? RB2

#208 - BOT. FLUSH BM. SUPP. INVERTED TRUSS:

CHK. for DL+S LOAD COMBI.:

$W = (20+25)\,3/2 = 700\#/'$; $\ell_{MAX,1} = 28.5'$

$R = 10$; $M = 71.0$

$fv = 84$

$fb = 1.127$

$\Delta_{TL} = 0.639'' \sim \ell/534$ — GL 5 1/2 x 27 24F-V4

RECHK for DEFL; DL + LL from STAIR LOAD: (C-4)

(LL from ROOF & STAIR LOAD)

$\ell_1 = 6.5$; $\ell_2 = 15.5$; $\ell_3 = 6$

$P_1 = 1.45$; $P_2 = 1.05$

$W_1 = 820$; $W_2 = 660$; $W_3 = 1060$ (40 x 3 1/2)

$R_1 = 10.6$; $R_2 = 12.5$; $M = 75.75$

$fv = 102$; $\Delta_{TL} = 0.67 \sim \ell/501$ — OK?

$fb = 1.136$ GL 5 1/2 x 27 24F-V4

#209 - N/S ROOF BM. O/ BRIDGE:

CHK. for DL+S LOAD COMBI.:

$W = (20+25)\,41/2 = 0.925$; $\ell = 28.5$

$R = 13.2$; $M = 93.9$

$fv = 99$; $fb = 1.37$ — OK? GL 5 1/2 x 30

$\Delta_{TL} = 0.616'' \sim \ell/555$

CHK for DEFL. PER IBC 16-11 LOAD COMBI.: (C-4)

$\ell_1 = 6.5$; $\ell_2 = 15.5$; $\ell_3 = 6$ — $P_1 = 2.8$; $P_2 = 2.05$

$W_1 = 40 \times 41/2 = 820$; $W_2 = 40 \times \frac{29}{2} = 520$; $W_3 = 720 + 40 \times \frac{19}{2} = 1100$

$R_1 = 12.10$; $R_2 = 12.9$; $M = 74.6$

$\Delta_{TL} = 0.784'' \sim \ell/428$ >> $\ell/240$ — OK? GL 6 3/4 x 24

USE 8 3/4 x 24

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PROJECT: KONERU RES.

DATE: 11/5/21

PROJECT NO: 0426-2021-03

DESIGN: JCM

SHEET: V-2A

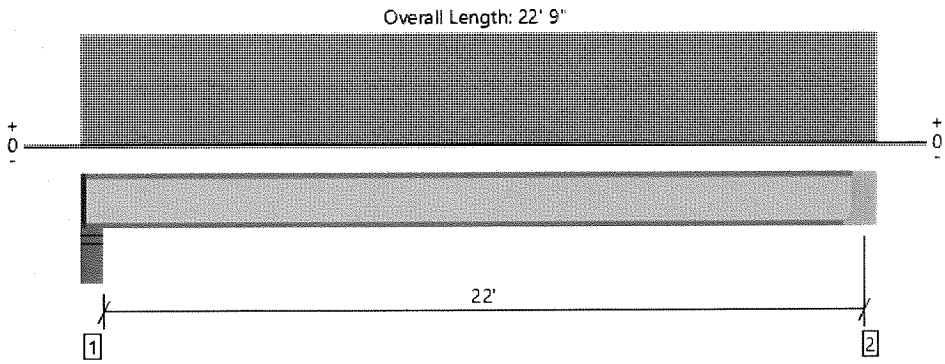
FORTE WEB

MEMBER REPORT

PASSED

Roof, #201 - Roof Rafters

1 piece(s) 11 7/8" TJI® 360 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	994 @ 22' 5 1/2"	1242 (1.75")	Passed (80%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	994 @ 22' 5 1/2"	1961	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5486 @ 11' 5"	7107	Passed (77%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.693 @ 11' 5"	1.104	Passed (L/382)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.248 @ 11' 5"	1.472	Passed (L/212)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	5.50"	4.25"	1.75"	457	571	1028	1 1/4" Rim Board
2 - Hanger on 11 7/8" LSL beam	3.50"	Hanger[1]	1.75" / - [2]	453	567	1020	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 10" o/c	
Bottom Edge (Lu)	22' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	IUS2.37/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 22' 9"	24"	20.0	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Joseph Marquez Malsam-Tsang Engineering (206) 602-5122 JosephM@malsam-tsang.com	

Weyerhaeuser

11/5/2021 12:44:45 AM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: 6700 108th Ave NE_Imported

V-28

ROOF FRMG \ CONT.:

#210 - FLUSH BEAM LIV/OUTDOOR PORCH!

W = (20+25)20/2 = 0.45
ℓ = 28.5
R = 6.4
M = 45.7
fv = 79
fb = 1.57
Δ TL INCL. SNOW = 1" ~ ℓ/313 >> ℓ/240
OK? GLB 5 1/2 x 19.5

#211 - GLB REL. RIM:

W = ~45#/' ; ℓ = 28.5'
R = 0.164
M = 4.6
fv = 22
fb = 0.167
Δ TL = 0.76" ~ ℓ/450 — OK?

#212 - 2ND FLR RF. AWNING/VISOR RAFTERS:

W = (20+25) 12/12 = 0.045 ; ℓ = 13'
R = 0.30
M = 0.95
fv = 42
fb = 1.293
Δ TL = 0.596" ~ ℓ/262 - OK? LVL 1 3/4 x 5 1/2 AT 12" OC

#213A/B-RF. AWNING HIGH RIM/BEAM:

W = (25+20) 13/2 = 0.295 , ℓ = 29
R = 4.278 ; M = 31.01 * 12 =
CHK W12x30: d = 12" ; bf = 6 1/2" ; tw = 1/4 ; tf = 7/16"
Ix = 238 ; Sx = 38.6
Δ TL = 0.68" ~ ℓ/512
Sx READ = M / Fy/Ωb = 12.43 — OK? W12x30
USE W12x35

#214 - HIGH STEEL BEAM/RIM SUPP. TRUSS END:

W = (20+25) 9/2 = 205#/'
ℓ = 28.5
R = 2.92
M = 20.815 * 12 = 250 K-'
CHK: for W12x30 : Ix = 238 ; Sx = 38.6
Δ TL = 0.44" ~ ℓ/776 — OK?
Sx READ = 8.341N3 — OK? — W12x30
USE W12x35

#215A/B-CANT. STEEL BM. - HIGH ; (C-3):

ℓ = 19.5 ; A = 13.0 ; P = R #213A/B = 4.28
W's ≈ 0.05
R1 = -2.58
R2 = 8.50
M- = - 59.9 * 12 =

CHK W12x35:
Ix = 285 ; Sx = 45.6
DL+LR LOAD COMBIN. ; P = (20+20) 13/2 x 29/2 = 3.77
Δ TL @ CANT. END = 1.44" ~ 2A/216 > 2A/120 ; 180 TAB. 16.01.3
OK?

LIVE ROOF COMBIN.:
P = 3.77/2 = 1.885
Δ LL @ CANT. END = 0.72" ~ 2A/433 > 2A/180 - OK?

#216A/B — STEEL BEAM HIGH:
NOT SUPPORTING BRG. LOAD
; USE W12x35 - TO MATCH #213;

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KONERU RES.
PROJECT

11/6/21
DATE

0426-2021-03
PROJECT NO

JCM
DESIGN

V-3
SHEET

ROOF FRMG. \ CONT.:

217 A/B – RIM/BEAM @ BDRMS 01 & 02 EAST WALL:

W = (20+25)22/2 = 495#/'
ℓMAX. = 15
R = 3.71
M = 13.92
fv = 100
fb = 2.11
ΔTL = 0.683" ~ ℓ/263 > ℓ/240 — PSL 5 1/4 x 9 1/2 2.120E

218 A/B – RB2 FLUSH BM:

W = (20+25) 5/2 = 115
ℓ = 21
R = 1.20
M = 6.34
fv = 40
fb = 0.925
ΔTL = 0.66" ~ ℓ/379 — OK?

219 – RIM/BM @ FITNESS SGD

W = (20+25) 21/2 = 475
ℓ = 8.5
R = 2.0
M = 4.3
fv = 47
fb = 0.622
ΔTL = 0.08" ~ ℓ/1293 — 6LBS 1/2 x 9 TOPFLUSH W/ TJI'S RAFTERS

220 – 4 x 8 HDR @ EXTR.

W = (20+25) 34.5/2 = 775
ℓ = 4
R = 1.55
M = 1.55
fv = 64
fb = 0.61 — ok?

221 – 4x8 INTR BR6. HDR:

W = (20+25) 41/2 = 925#/'
ℓ = 5
R = 2.3
M = 2.9
fv = 104
fb = 1.13 < 1.17 * 1.15 — OK?
ΔTL = 0.073" ~ ℓ/820

222 – 11 7/8" TJI-240 @ 24" OC RAFTERS:

DL = 20 PSF ; SNOW = 25 PSF

→ SEE FORTE-WEB OUTPUT

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PROJECT: KONERU RES.
DATE: 11/8/21
PROJECT NO: D426-2021-03
DESIGN: JCM
SHEET: V-4A

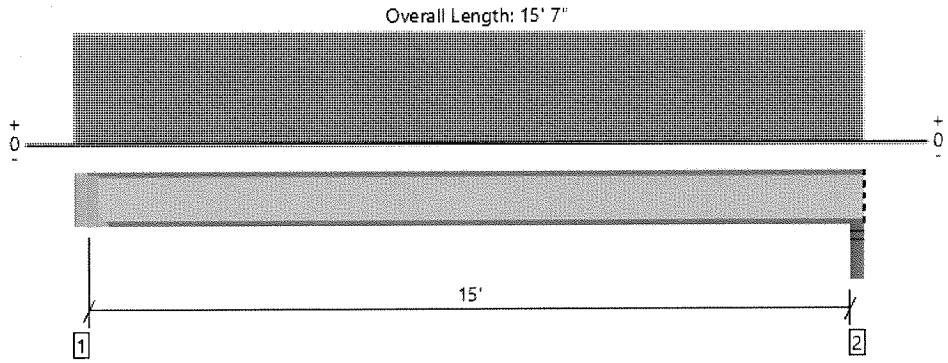
FORTE WEB

MEMBER REPORT

PASSED

Roof, #222 - Roof Rafters

1 piece(s) 11 7/8" TJI® 210 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	679 @ 3 1/2"	1156 (1.75")	Passed (59%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	679 @ 3 1/2"	1903	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2559 @ 7' 10"	4364	Passed (59%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.210 @ 7' 10"	0.754	Passed (L/860)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.379 @ 7' 10"	1.006	Passed (L/478)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Hanger on 11 7/8" LSL beam	3.50"	Hanger[1]	1.75" / - [2]	313	392	705	See note [1]
2 - Stud wall - DF	3.50"	3.50"	1.75"	310	388	698	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 7" o/c	
Bottom Edge (Lu)	15' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	IUS2.06/11.88	2.00"	N/A	10-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 15' 7"	24"	20.0	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Joseph Marquez Malsam-Tsang Engineering (206) 602-5122 JosephM@malsam-tsang.com	

Weyerhaeuser

11/9/2021 1:44:10 AM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: Koneru Res

@ UPPER FLOOR FRMG. ; #100's

└ 24" PRE-MFD FLOOR TRUSSES @ 16" OC ;

DL = 30 PSF ; LL = 40 PSF

#101 - RB1 RIM ;

W = (30+25) 2 1' = 55

ℓ_{MAX} = 21

R = 0.158

M = 3.03

fv = 38

fb = 0.885

Δ_{TL} = 0.625" ~ ℓ/396 — OK?

#102 - GAR. HDR. ; — RB3

W = (30+25) 8/2 = 0.22

ℓ = 18.5

R = 2.035

M = 9.141

fv = 42

fb = 0.874

Δ_{TL} = 0.419" ~ ℓ/529 — OK? RB3

#103A - GAR. HDR. ; RB2

W = 0.22

ℓ = 9.5

R = 1.05

M = 2.50

fv = 30

fb = 0.362

Δ_{TL} = 0.053" ~ ℓ/2140 — OK?

#103B - 4x8 HDRS

W = 0.22 ; ℓ_{MAX} = 4'

R = 0.44

M = 0.44

fv = 18

fb = 0.172 — OK?

#104 - BM. SUPP. NO. SW ABV. (TOP FLUSH W/ JJI PARTN.) ;

ℓ_1 = 8.5 ; ℓ_2 = 10 (C-2)

W_1 = (20+25) 2 1 + 15 x 10' + (30+40) 2 1 = 265

W_2 = (30+25) 2 1.5/2 = 70 #/'

P = U_W FR SEIS = 8.125 ; U_W = 3.120 Ω FACTOR PER ASCE 2.4.5 EQ 1-9

R_1 = 6.38 U_{SEIS} = 4.5 x 0.525 x 1.4 x 2.5 = 8.125 — GOVERNS!

R_2 = 4.8

M = 44.68 PER ASCE 2.4.5

fv = 110 < 290 x 1.2

fb = 3.126 < 2.9 x 1.2 = 3.48 — OK? RB4

RECHK BM. REACTIONS W/O UPLIFT for #105 ;

P = 0 ; W_1 = 265 #/' ; W_2 = 70 #/'

R_1 = 1.92 ; R_2 = 1.102

└ R_1 TO #105 BM DEFL. CHK.

#105 - FLR. BM. ADJ. TO GAR. DOORS ; ~(C-2);

ℓ_1 = 2 ; ℓ_2 = 30 ; P = R_1 #105 W/ UPLIFT - DL = 6.38 AND P = 1.92 W/O UPLIFT - TO BE USED FOR DEFLECTION CHK.

W_1 = (30+25) 25/2 = 690

W_2 = N/S 540 + 15 x 10' + (30+25) 5/2 + (30+40) 22/2 = 540 + 150 + 165 + 770 = 1625

BM. DESIGN CONSIDERING UPLIFT ;

R_1 = 30 ; R_2 = 26.34

M = 213.50

fv = 211 < 265 * CD

fb = 2.53 < 2.4 * CV (0.851) * CD (1.38) = 2.885 — OK?

Δ_{TL} = 1.44" ~ ℓ/266 (INCL. RF. SNOW + UPLIFT)

FOR BLB 6 3/4 x 30 24F-V4 — USE 33" DP.

CV = 0.851 ASCE 2.4.5

CD = 1.2 x 1.15 SNOW = 1.38

RECHK DEFL. W/O UPLIFT ; P = 1.92k

Δ_{TL} (INCL. SNOW) = 1.41" ~ ℓ/272 > ℓ/240 — OK?

= 1.0" ~ ℓ/362 (for BL 6 3/4 x 33)

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KONERU RES.
PROJECT

11/9/21
DATE

0426-2021-03
PROJECT NO

JGM
DESIGN

V-5
SHEET

UPPER FLOOR FRMG. \ CONT.:

#106 – GL 63/4 x 15 O/ SERVICE & POWDER RMS.:

$W = W_{\#105} = 1.625$ K/'

$\ell = 11'$ MAX. SPAN

$R = 8.94$

$M = 24.6$

$f_v = 102$

$f_b = 1.165$

$\Delta_{TL} = 0.157'' \sim \ell/843$

USE GL 6 3/4 x 33 (TO MATCH BM #105)

OK? GL 6 3/4 x 15 24F-V4

#107 – MECH. DI HEADER ; (C-2):

$\ell_1 = 4.25$; $\ell_2 = 1.25$; $W_6 \simeq 0$

$P_{TOT.} = R_{2\,\#105} + 1.625 \times 5/2$

$= 26.34 + 4.06 = 30.40$

$R_1 = 6.90$

$R_2 = 23.5$

$M = 29.40$

NDS 3.4.3.1

$f_v = 373 < 240\left(\frac{13}{14.5}\right)(1.2) = 432$ – OK?

ASCE 2.4.1.5 DUE TO FLR LOADS

$f_b = 1.243$

PSL 5 1/4 x 18 HER

#108 – RB3 DROPPED BEAM :

$W = W_{\#221} + 10 \times 10' + (30+40)\,3\,1/2$

$= 925 + 100 + 1085 = 2111$

$\ell = 7.5$

$R = 7.19$

$M = 14.84$

$f_v = 134$

$f_b = 1138$

$\Delta_{TL} = 0.108'' \sim \ell/828$ — OK?

#109 – BEAM/RIM O/ DN. EAST S.G.D.; (~C-2):

$\ell_1 = 20.5''$; $\ell_2 = 3.5''$

$W_1 = (30+40)\,19/2 + 15 \times 10 = 815$

$W_2 = (30+40)\,10/2 + 150 + W_{\#202} = 465 = 965$

W/O UPLIFT:

$P = R_{ABU\,\#205} + R_{GT} = 4.62 + 3.13 = 7.75$

UPLIFT: $U_{WIND} = 1.0$

$U_{SEIS} = 4.0 * 0.525 * 2.5 * 1.4 = 7.35$ GOVERNS

#109 \ CONT.: (C-2)

CHK. BM. W/O UPLIFT & DL+LL ONLY for DEFL

WHERE: $W_1 = 815$; $W_2 = 965$; $F = 7.75$

$\Delta_{TL\,UNIF.\,SNOW} = 0.1225'' \sim \ell/2351$ – OK

CHK W18 x 119 ; $F_y = 50$; $\Omega_b = 1.67$

$d = 19''$; $b_f = 11\,1/4''$

$t_w = 5/8''$; $t_f = 1\text{-}1/16''$

$I_x = 2190$; $S_x = 231$

RECHK. BM. W/ UPLIFT FOR CAPACITY:

$P_{TOT} = 7.75 + U_{SEIS}\,w/\,\Omega_0$ (7.35)

$= 15.1^K$

$R_1 = 12.0$

$R_2 = 23.1$ ← UPLIFT DOWNWARD ; UPLIFT UPWARD $R_2 = 10.6^K$

$M = 88.64^{K\text{-}'} * 12 = 1064$

$S_{X\,REQ'D} = 36\,IN^3 << S_{X\,PROV'D} = 231\,IN^3$ – OK

#110 – BEAM O/ KITC. S.G.D. ; (C-4):

$\ell_1 = 5.5$; $\ell_2 = 12$; $\ell_3 = 10$

$W_1 = W_{\#202} + 15 \times 10' + (30+25)\,13/2 + (30+40)\,10/2$

$= 465 + 150 + 355 + 350 = 1320$ K/'

$W_2 = W_3 = 150 + (30+25)\,13/2 + (30+40)\,19/2 = 1170$ K/'

W/O UPLIFT:

$P_1 = R_{ABU\,\#205} + R_{GT}$; $P_2 = 0.465 \times \frac{24.5}{2} = 5.0$

$= 2.19 + 3.18 = 6.0$

W/ UPLIFT:

SIM. TO #109

$U_W = 1.0$ OR

$U_{SEIS} = 4.0 * 0.525 * 2.5 * 1.4$

$= 7.35$

$\therefore P_{1\,TOT} = 6 + 7.35 = 13.35$

CHK W18 x 119; $F_y = 50$; $\Omega_b = 1.67$

$d = 19''$ $b = 11\,1/4''$; $t_w = 5/8''$; $t_f = 1\text{-}1/16''$

$I_x = 2190$ $S_x = 231$

$\Delta_{TL\,UNIF.\,SNOW} = 0.33'' \sim \ell/991$ — OK!

CHK BM. CAP. W/ UPLIFT; $P_{1\,TOT} = 13.35^K$

$R_1 = 29.0$; $R_2 = 22.0$; $M = 173.32 * 12 = 2080^{K\text{-}'}$

$S_{X\,REQ'D} = 70\,IN^3 << S_{X\,PROV'D} = 231$ – OK!

$P_{MAX\,FOR\,POST} = R_{2\,\#109}$ (UPLIFT UPWARD) $+ R_{1\,\#110} = 10.6 + 29 = 39.6^K$

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PROJECT: KONERU RES.

DATE: 11/10/21

PROJECT NO: 0426-2021-03

DESIGN: JCM

SHEET: V-6

UPPER FLOOR FRMG \ CONT.:

#111 - BEAM/RIM O/ LIVING DOOR+WDW:

W = 15 PSF × 10' = 150 #/' ; ℓ = 28'

TRY (2) HSS 7X5X1/2 WELDED TOGETHER

$I_{x\,EACH} = 60.6\ IN^4$; $S_x = 17.3\ IN^3$

WT = 35.1 #/'

$\Delta_{TL} = 0.159'' \sim \ell/560$ — OK (BM WT. N/INCL. PER IBC TAB. 1604.3, FOOTNOTE 8)

$R_{MAX1} = 3.1$

$M_{MAX1} = 21.6^{K-'}$; $S_{x\,REQD} = 8.3\ IN^3$ — N/CRITI. (@ Fy = 46 KSI — CONS.)

#112 - HSS 6X3X1/4 BRIDGE JSTS @ 36" OC:

W = ~(40+30) 3' = 0.127 ; ℓ = 5'

$M = 0.1844 \times 12 = 10.13^{K-'}$

HSS 6X3X1/4:

$I_x = 17$; $S_x = 5.66$

Fy = 50 ; Zb = 1.67

$S_{x\,REQD} = 0.34$ — OK? N/CRITI.

#113A/B - STEEL BM FOR BRIDGE

W = (40+30) 5/2 + 45 + 50 = 270 #/' (175; RAIL; BM WT.)

ℓ = 28' ; R = 3.8^K

CHK HSS 12X3 1/2X3/8:

$I_x = 156$; $S_x = 26$

$\Delta_{TL} = 0.76'' \sim \ell/440 >> \ell/240$ — OK? (DL+LL)

$M_{MAX1} = 26.5^{K}\ \ell/12 = 318^{K-'}$

$S_{x\,REQD} = 11.55 < S_{x\,PROV.} = 26$ — OK?

#114 - STEEL RIM/BM @ STAIRWELL WEST WALL:

$W_{REPL.} = 150$ #/' ; $W_{DBL.} = 200$ #/' (INCL. BM WT.) ; $\ell_{MAX} = 11.5'$

FLAT HSS 7X4X1/2 ; $I_y = 20.7$; $S_y = 10.4$

$\Delta_{TL} = 0.131'' \sim \ell/1053 >> \ell/360$ — OK?

R = 1.15 ; P_{MAX1} =

$M_{MAX1} = 3.31 * 12 =$ (@ Fy = 46 KSI — CONS.)

$S_{Y\,REQD} = 1.44 << S_{Y\,PROV.} = 10.4$ — OK?

→ SEE NEXT SHT. (V-7B) FOR OUT-OF-PLANE LOAD CHECK.

#115 - RIM/BM O/ OFFICE EAST WALL: (C-4)

$\ell_1 = 7.5$; $\ell_2 = 6.5$; $\ell_3 = 2.5$

$W_1 = W_2 = 150 + (30+40) \sim 20/2 = 850$

$W_3 = W_{\#117A} + 15 \times 10' + (30+40) \sim 20/2 =$

$= 495 + 150 + 700 = 1{,}345$ #/'

W/O UPLIFT:

$R_1 = 495^{\#/'} \times \frac{23}{2} = 5.7$

$R_2 = 495 \times 7/2 = 1.73$

W/ UPLIFT: (SIM. TO #110)

7.35

$P_2 = 1.73 +$ USE 9.1 w/ DL

$P_{UP} = 9.10^K$

CHK BM. FOR DEFL. W/O UPLIFT: (C-4)

$P_1 = 5.7$; $P_2 = 1.73$

$\Delta_{TL} = 0.325'' \sim \ell/606$

CHK BM. FOR CAP. WITH UPLIFT: (C-4)

$P_1 = 5.7$; $P_2 = 9.1$

$R_1 = 11.60$

$R_2 = 18.5$

$M = 63.0$

$f_v = 209$

$f_b = 1.87$ — OK? GL 5 1/2 X 21 24F-V4

BRG CAP. @ 2X BOT SUPP. 6X6:

$BRG.\ CAP. = 0.625 \times 5.5^2$

$= 18.9^K$ — OK?

#116 - RIM/BM O/ BDRM. 05 EAST WALL:

W = 150 + (30+40) 21/2 + (20+25) ~1 = 930

ℓ = 15.5

R = 7.2 ; $\Delta_{TL} = 0.158'' \sim \ell/1177$

$M = 27.93$

$f_v = 72$

$f_b = 0.83$

OK? GL 5 1/2 X 21 24F-V4

#117 - INTR BRG HDR @ OFFICE DOOR:

W = (30+40) 21/2 + 120 = 855 ; ℓ = 3.5'

R = 1.5

M = 1.3

$f_v = 68$

$f_b = 0.6$ — OK? (2) 2X8 OR 4X8

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DESIGN: JCM

SHEET: V-7A

CHK W8×21 COL. SUPPORTING BEAMS #110, #111, #128 AND GL RM/BM ;

$P_{TOT.} = 17.93 + 22 + 2.11 + 0.015 \times 12 \times 17/2$
$= 43.56 \simeq 44.0^K$

FOR W8×21 ; $d = 8\frac{1}{4}"$; $t_f = 5\frac{1}{4}"$
$t_w = 1/4"$; $t_f = 3/8"$

$A = 6.16 \square"$
$I_x = 75.3 IN^4$
$r_x = 3.49 IN$
$I_y = 9.77 IN^4$
$r_y = 1.26 IN$ ← GOVERNS
$E = 29{,}000 KSI$
$F_y = 50 KSI$
$\Omega_c = 1.67$
$K = 0.80$

$\phi P_n/\Omega_c = \frac{F_{cr} \times A_g}{\Omega_c}$ WHERE ;

$KL/r = \frac{0.80(12' \times 12")}{1.26 IN} = 91.42$

IF; $\frac{KL}{r} \leq 4.71\sqrt{\frac{E}{F_y}} =$
$91.42 \leq 113.43$

THEN; $F_{cr} = [0.658^{F_y/F_e}]F_y$; $F_{cr} = 27.14 KSI$

WHERE ; $F_e = \frac{\pi^2 E}{(KL/r_y)^2} = 34.24$

$\phi_b \frac{P_n}{\Omega_c} = \frac{F_{cr} \times A_g}{\Omega_c}$
$= 100 KIPS >> 44.0 KIPS$ — OK ; W8×21

CONT\ #114 - HSS 7×4×1/2 (LAID FLAT) BEAM BET. WINDOWS NEXT TO STAIR ;

FOR OUT-OF-PLANE LOADING
DEFLECTION LIMIT PER 1604.3.7; 1) & 2)
ZONE 5 = -22.0 PSF
ZONE 4 = -17.9 ≃ 18 PSF ← FOR DES.

HSS 7×4×1/2 ; $I_x = 50.7$; $S_x = 14.5$

$W = 18^{PSF} * 22^{PSF} * 24/2 * 0.7$ IBC TAB. 1604.3; FOOTNOTE ; f)
$= 264^{\#/'}$; $= 264 * 0.7 = 185^{\#/'}$
↳ FOR CAP. CHK. & CONN. ↳ FOR DEFL. CHK.

$L = 28'$

CHK. DEFLECTION — 1604.3.7 ; 2) ;

$\Delta_{TL\ MAX.} = L/240 + 1/4"$; $L = 28'$
$= 1.4" + 1/4" = 1.65"_{MAX.}$
FOR HSS 7×4×1/2 ; $I_x = 50.7 IN^4$;

$\Delta_{WIND} = 1.74" \sim L/193$ — NOT GOOD?

TRY HSS 8×4×5/8 ; $I_x = 82$; $S_x = 20.5$;

$\Delta_{WIND} = 1.076" \sim L/312 < L/240 + 1/4$
OK?

CHK. R & M ; $W = 264^{\#/'}$; $L = 28'$;

$R = 3.7$
$M = 25.9 \times 12" = 311^{K-"}$

$S_{x\ REQD} = 11.3$ (@ $F_y = 46 KSI$ - CONS.)
↳ N/CRIT.?

STAIR FRAMING CHK ;

MC 12×31 STRINGERS ; $L \simeq 15'_{MAX.}$

$W_{TOT.} = (40+20)4/2 + 45 = 165^{\#/'} + 31 = 196^{\#/'}$
$R = 1.46$
$M = 5.5^{K-'} \times 12 = 66^{K-"}$; $F_y = 36$; $\phi_b = 1.67$
$S_{x\ REQD} = \frac{M}{F_y/\Omega_b} = 3.08 IN^3 << 33.7 IN^3$ — OK?
$\Delta_{TL} = 0.104" \sim L/1723$ — OK?

4×12 DF#2 TREADS ; ; $L = 3.5'$

DL = 10 ; LL = 40 PSF ; 300 LBS PT. LOAD ; DL = 10

$R = 0.09$
$M = 0.0765$
$f_v = 2.6$
$f_b = 0.04$
$\Delta_{TL} = 0.0025" \sim L/1706$
OK?

$R_1 = R_2 = 0.17$
$M = 0.278$
$F_v = 6.13$
$F_b = 0.1145$
$\Delta_{TL} = 0.0077 \sim L/543$
OK?

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V-7B
SHEET

UPPER FLOOR FRMG \ CONT.:

#118 - DROPPED BM @/HALLWAY ADJ. OFF.:

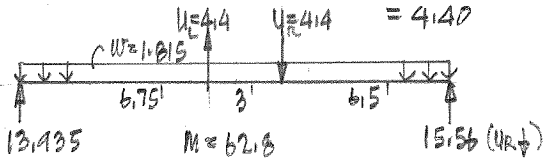
$W's = W_{\#221}^{.925} + 120 + (30+40)\frac{22}{2} = 1.815$

CHK. BM. W/O UPLIFT: $\ell = 16.25'$

$R = 14.75$
$m = 59.9$
$fv = 165$
$fb = 2.4$
$\Delta TL = 0.154'' \sim \ell/360$ — OK? PSL 7X16 2.2E

RECHK. BM W/ UPLIFT: Ω_0

$U_{SEIS} = 2.4 \times 0.525 \times 2.5 \times 4.4$
$= 4.40$



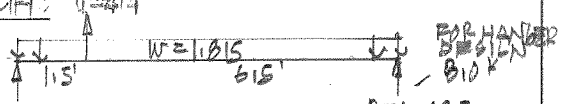
$fv = 176$
$fb = 2.1523$ — OK!

#119-A - PSL 7X16 CONT. DROPPED BM.:

$W = 1.815$; $\ell = 8$

$R = 7.26$; $fv = 65$
$M = 14.52$; $fb = 0.583$ — OK?

W/UPLIFT: $U = 4.14$



10.8 (U↓) — 3.8 (U↑)

DES. for #120 → R=6.435
(W/ UPLIFT ALSO for #119-B)

#119-B - GT. REAC. For DES. of #120: (C-2)

$\ell_1 = 4$; $\ell_2 = 12$; $P = 4.4$

$W's = W_{\#24}^{.75} + 120 + (30+40)4\frac{1}{2} = 2.48$

$R_1 = 23.10$; $R_2 = 21.0$! $R = 19.84$ (NO UPLIFT)

#120 - DROPPED BM./HDR.: (C-2)

$\ell_1 = 2.5$; $\ell_2 = 2.0$; $W's \simeq 0$

$P_{MAX_1} = 7.26 + 19.84 = 27.1^K$ — W/O UPLIFT

OR

$= 6.435 + 23 = 29.435^K$ — W/ UPLIFT

↳ GOVERNS?

$R_1 = 13$; $R_2 = 16.35$
$M = 32.70$
$fv = 292 < 290 \times 1.2 \times 1.15$ — OK?
$fb = 1.175 < 2.190 \times 1.2 \times 1.15$ — OK?

PSL 5 1/4 X16

#121 - GL 5 1/2 X 24 RIM/BM @ SO. WALL: (C-2)

$\ell_1 = 2.75$; $\ell_2 = 7.25$; $W's = 165$

$P = 19.84$; R#119 - NO UPLIFT

FOR SEIS. UPLIFT: Ω_0

$U_{SEIS} = 5.8 \times 0.525 \times 2.5 \times 1.4$
$= 10.65$

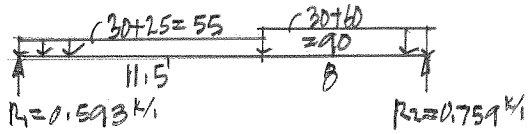
∴ $P_{NET} = 19.84 + 10.65 = 30.5$

$\Delta TL = 0.05 \sim \ell/2414$ — OK?

RECHK. BM CAP. — W/ UPLIFT:

$P = 30.5^k$
$R_1 = 22.94$
$R_2 = 9.2$
$m = 62.45$
$fv = 257 < 265 * C_D$ — OK?
$fb = 1.42 < 2.40 * C_D$

#122 - 11 7/8" TJI-360 @ 16"OC DECK+RAFTERS:



SEE FORTE-WEB OUTPUT

#123 - E/W BEAM @/ ACTIVITY ROOM: (C-2):

$\ell_1 = 5$; $\ell_2 = 15$

$W_1 = 0$; $W_2 = 1.50$ $\quad 1225^{\#}/'$

$P = [(30+25)5/2 + 150 + (30+25)15/2 + (30+40)15/2]\,19.5/2 = 11.195$

$R_1 = 9.80$
$R_2 = 4.40$
$M = 49.0$
$fv = 131$
$fb = 1.197$
$\Delta TL = 0.159'' \sim \ell/405$ — OK? PSL 7X16

OR

W10X30:

$\Delta TL = 0.157'' \sim \ell/418$

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V-8A
SHEET

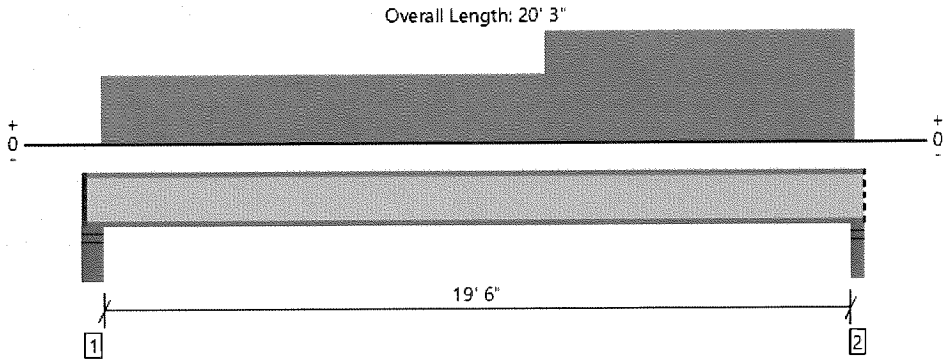
FORTE WEB

MEMBER REPORT

PASSED

Roof, #122 - Deck+Roof Rafters

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	713 @ 20' 1/2"	1505 (3.50")	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	706 @ 19' 11 1/2"	1705	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3306 @ 10' 5 9/16"	7107	Passed (47%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.286 @ 10' 5 1/4"	0.983	Passed (L/825)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.610 @ 10' 3 1/8"	1.311	Passed (L/387)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Stud wall - DF	5.50"	4.25"	1.75"	372	99	269	740	1 1/4" Rim Board
2 - Stud wall - DF	3.50"	3.50"	1.75"	329	384	115	828	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 2" o/c	
Bottom Edge (Lu)	20' 2" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	6" to 12'	16"	30.0	-	25.0	Default Load
2 - Uniform (PLF)	12' to 20'	N/A	30.0	60.0	-	

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Joseph Marquez Malsam-Tsang Engineering (206) 602-5122 JosephM@malsam-tsang.com	

Weyerhaeuser

11/11/2021 12:51:53 AM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: Koneru Res

V-8 B

UPPER FLOOR FRMG. \ CONT.:

#124 – N/S DROPPED BM. @ ACTIVITY NOOK:

$W = (20+25)\,35/2 + 120 + (30+40)\,35/2 = 2130$

$\ell = 16$

$R = 17$

$M = 68$

$f_v = 165 < 290 * 1.0$
$f_b = 2.116 < 2.9 * C_D$ — OK? PSL 7X18
$\Delta_{TL} = 0.46" \sim \ell/416$

#125 – N/S DROPPED BM @ BILLIARD TABLE:

$\ell_1 = 5$; $\ell_2 = 11$; $\ell_3 = 2.5$ (C-4)

$W_1 \simeq W_2 = (20+25)\,11 + 150 + 760 + (30+40)\,20/2$
$= 495 + 150 + 760 + 700 = 2100$

$W_2 = W_{\#124} = 2130$

$P_1 = 0$; $P_2 = R_{2\#123} = 4.14$

$R_1 = 20$

$R_2 = 23$

$M = 95$

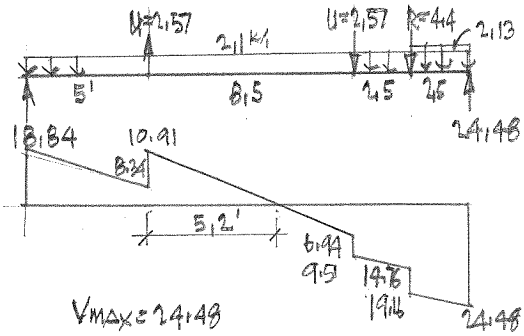
$f_v = 239 < 290 * 1.15$

$f_b = 3.03 < 2.90 * 1.15 = 3.335$ — OK?

$\Delta_{TL} = 0.87" \sim \ell/254 > \ell/240$ — OK? W/ SNOW LOAD PSL 7X18

BEAM BM. W/ UPLIFT:

$U_{SEIS} = 1.4 * 0.1525 * 2.5 * 11.4 = 2.57$



$V_{MAX} = 24.148$

$M_{MAX} = 96.32$ — OK? N/CRIT.

#126 – OUTDOOR RF. RIM/BM:

$W = (30+25)\,5.5/2 = 150\ \#/'$

$\ell = 27$

$R = 2.0$

$M = 13.67$

TRY W12X26:

$d = 12\tfrac{1}{4}"$; $I_x = 204$
$b_f = 6\tfrac{1}{2}"$; $S_x = 33.4$

$\Delta_{TL} = 0.3" \sim \ell/1069$
$S_{x\,REQD} = M/F_y/D_b = 5.5$ — OK?

#127 – OUTDOOR RF. CANT. RIM @ NORTH SIDE:

$\ell = 12.5$; $A = 5.5$; $P = 2.4$ (C-3)

$W's \simeq 0.05$

$R_1 = -0.805$

$R_2 = 4.10$

$M- = -13.96 * 12 = 168^{K-'}$

TRY 12X35:

$d = 12\tfrac{1}{2}"$; $I_x = 285$
$b_f = 6\tfrac{1}{2}"$; $S_x = 45.6$

$\Delta_{TL\,@\,B.S.} = -0.026" \sim \ell/5762$

$\Delta_{TL\,@\,END} = 0.09" \sim 2A/1447$

$S_{x\,REQD} = 5.16$ — N/CRIT.

#128 – OUTDOOR RF. CANT. MIDDLE RF. BM.:

$\ell = 12.5$; $A = 5.5$ (C-3)

$W's \simeq 0.05$

$P = 2.0 + 0.05 \times 28/2 = 2.7$; USE 5.0^K

$R_1 = -1.195$

$R_2 = 7.185$

$M- = -28.25 * 12 = 339^{K-'}$

TRY 12X35: WHERE: $P \simeq 5.0$

$\Delta_{TL\,@\,END} = 0.189" \sim \frac{2A}{595}$ — OK?

$S_{x\,REQD} = 11.32\ IN^3$ — OK?

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KONERU RES.
PROJECT

11/10/21
DATE

0426-2021-03
PROJECT NO

JCM
DESIGN

V-9
SHEET

WELDING CONNECTIONS AND SHEAR PL CAPACITY CHECKS:

"W" – FILLET WELD; $V_{CAP.}$:

$F_{EXX} = 70$ KSI

$\Omega = 2.0$

$W = 3/16"$; $W = 1/4"$

$$V_{CAP.} = \frac{0.6\, F_{EXX} * 0.707}{\Omega} * W$$

$V_{CAP.\ W=3/16"} = 2.794 \frac{K}{IN}$; $V_{CAP.\ W=1/4"} = 3.712 \frac{K}{IN}$

"t" PL SHEAR YIELDING; $V_{CAP.}$:

$$V_{CAP.} = \frac{0.60\, F_y}{\Omega} * t \quad ; \quad F_y = 36 \text{ KSI}, \ \Omega = 1.5$$

$t_{3/16"} = 2.70 \frac{K}{IN}$; $t_{1/4"} = 3.60 \frac{K}{IN}$

"t" PL SHEAR RUPTURE; V_{CAR}:

$$V_{CAP.} = \frac{0.60\, F_u}{\Omega} * t \quad F_u = 58 \text{ KSI}, \ \Omega = 1.5$$

$t_{3/16"} = 4.35 K/IN$; $t_{1/4"} = 5.80 K/IN$

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PROJECT: KONERU RES.

DATE: 11/11/24

PROJECT NO: 0426-2021-03

DESIGN: JCM

SHEET: V-10A

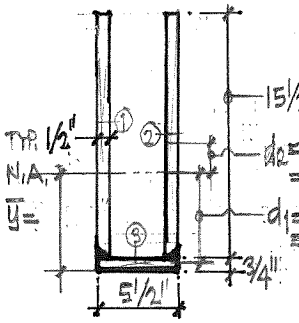
UPPER FLOOR FRMG. \ CONT.:

#129 - BUILT-UP STL. RF BM. @ VALLEY:

$W = (30+25)19/2 = 525^{\#}/' + 35 = 560^{\#}/'$

$l = 27'$

$R = 7.56$; $M = 51.0 \times 12'' = 612\ K\text{-}'$



$A_1 = 7.75\ \square''$
$A_2 = 7.75\ \square''$
$A_3 = 4.125\ \square''$
$A_T = 19.625\ \square''$

$\bar{y} = \frac{2[7.75 \times (15.5/2 + 3/4)] + 4.125 \times \frac{0.75}{2}}{A_T} = 8.18''$

$I_{NA} = \left[\frac{5.5 \times 0.75^3}{12} + 4.125 * d_1^2\right] + 2\left[\frac{0.5 \times 15.5^3}{12} + 7.75 * d_2^2\right]$
$= 170.5 + 32.43$
$= 494.788\ IN^4$

$S_x = I_{NA}/\bar{y} = 72.76\ IN^3$

WHERE; $F_y = 36$
$\Omega_b = 1.67$

$S_{x\,REQ} = \frac{M}{F_y/\Omega_b}$
$= 28.4\ IN^3$

$\Delta_{TL} = \frac{5\,W\,l^4}{384\,EI}$; $EI = 14,348\,852 \times 10^3$
$= 0.467'' \sim l/694 > l/180$ — OK!

#130 - STEEL ROOF PAN DECK W/ 2" MAX. GRAVEL BALLAST TOPPING:

SUPERIMPOSED LOAD TOT. $= \sim 20\,psf + 25$
$= 45\ PSF$ — OK?

SEE NEXT SHTS.
USING ASC STEEL DECK - GAGE 16
2WHF-36 OR D62WHF PANEL

HSS 5X5X1/4 ALLOW. AXIAL LOAD CAP.:

@ $kl \simeq 18'$; $P_n/\Omega_c = 76.4$ KIPS

② STRUCT. S.O.G./FDN./PIN PILES:

STRUCTURAL SLAB-ON-GRADE:

MIN. SLAB THICKNESS; ACI TAB. 9.3.1.1

= ONE END CONT. = $l/24$
└ MAX. CLR. SPAN; $l_n = 12'\text{-}0''$

= BOTH ENDS CONT. = $l/28$
└ MAX. CLR SPAN; $l_n = 14'\text{-}0''$

6" THK. SLAB

APPROX. DESIGN MOMENTS; TAB. 6.5.2:

MORE THAN (2) SPANS

$(+)M_{u\,MAX.} = \frac{W_u l_n^2}{11}$

$(-)M_{u\,MAX.} = \frac{W_u l_n^2}{10}$

HOUSE SLAB; $l_n = 14'$ MAX.

$W_{u\,TOT.} = [150\,PCF\,(6/12) + 15\,PSF]\,12 + 40 * 1.6$
$= 108 + 64 = 172\ PSF \times 1' \simeq 175^{\#}/'$

$M_{u(+)\,MAX} = 175(14)^2/11 = 3120\ ^{\#}\text{-}'$

$M_{u(-)\,MAX} = 175(14)^2/10 = 3430^{\#}\text{-}'$ — GOVERNS!

$M_u = \phi \rho f_y b d^2 \left[1 - \frac{\rho f_y}{1.7 f'_c}\right]$

$\frac{f_y}{1.7 f'_c}\rho^2 - \rho + \frac{M_u}{\phi f_y b d^2} = 0$

WHERE; $f_y = 60000\ psi$; $f'_c = 2500\ PSI$
$\rho = 0.9$; $b = 1'$ STRIP
MAIN REINF. @ CT @ ½ (CENTERED) IN 6" SLAB ; $d = 3.125''$

$14.12\rho^2 - \rho + \frac{3430^{\#}\text{-}'}{0.9(60000)(12/12)(3.125)^2} = 0$ → 0.006

BY Q.F.; $\rho = 0.0066$

$A_{s\,REQ} = \rho b d = 0.257\ \square''$ — GOVERNS!

$A_{s\,MIN.} = \frac{200}{f_y} b_w d = 0.16\ \square''$

T&S REINF. $= 0.0018 b h = 0.12\ \square''$

USE #4 AT 9"/8"OC MAIN REINF. AND #4 @ 18"OC T&S — REBARS CENTERED ON 6" SLAB

USE #4 @ 12"OC FOR CLR SPAN; $l_n = 9'$ MAX

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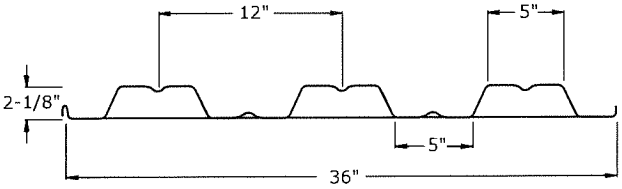
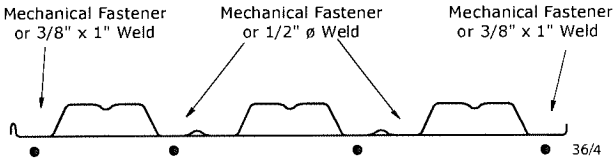
PROJECT: KONERU RES.
DATE: 11/11/21
PROJECT NO: 0426-2021-03
DESIGN: JCM
SHEET: V-10B

ASC STEEL DECK

DG2WHF-36 & 2WHF-36 4.2





Note: Weld sizes are effective not visible. Refer to AISI S100-2007 or AWS D1.3 for additional welding requirements.

Panel Properties

Gage	Weight	Base Metal Thickness	Yield Strength	Tensile Strength	Gross Section Properties				
					Area	Moment of Inertia	Distance to N.A. from Bottom	Section Modulus	Radius of Gyration
	w psf	t in	F_y ksi	F_u ksi	A_g in²/ft	I_g in⁴/ft	y_b in	S_g in³/ft	r in
20/20	3.54	0.035 / 0.036	50	65	1.008	0.770	0.65	0.496	0.874
20/18	4.01	0.035 / 0.047	50	65	1.147	0.820	0.58	0.504	0.845
20/16	4.53	0.035 / 0.059	50	65	1.299	0.864	0.53	0.510	0.815
18/20	4.13	0.047 / 0.036	50	65	1.187	0.961	0.72	0.648	0.900
18/18	4.61	0.047 / 0.047	50	65	1.326	1.025	0.66	0.658	0.879
18/16	5.12	0.047 / 0.059	50	65	1.477	1.083	0.61	0.667	0.856
16/20	4.78	0.059 / 0.036	50	65	1.381	1.159	0.79	0.809	0.916
16/18	5.25	0.059 / 0.047	50	65	1.520	1.235	0.73	0.822	0.901
16/16	5.77	0.059 / 0.059	50	65	1.671	1.306	0.68	0.833	0.884

Gage	Effective Section Modulus for Bending at F_y					Effective Moment of Inertia for Deflection at Service Load			
	Area	Section Modulus	Distance to N.A. from Bottom	Section Modulus	Distance to N.A. from Bottom	Moment of Inertia	Moment of Inertia	Uniform Load Only	
								$I_d = (2I_e+I_g)/3$	
	A_e+ in²/ft	S_e+ in³/ft	y_b in	S_e- in³/ft	y_b in	I_e+ in⁴/ft	I_e- in⁴/ft	I+ in⁴/ft	I- in⁴/ft
20/20	0.510	0.391	0.56	0.457	1.00	0.732	0.603	0.745	0.659
20/18	0.591	0.401	0.50	0.476	0.87	0.776	0.690	0.791	0.733
20/16	0.692	0.406	0.46	0.492	0.73	0.816	0.771	0.832	0.802
18/20	0.715	0.590	0.69	0.593	1.07	0.959	0.749	0.960	0.820
18/18	0.796	0.599	0.63	0.616	0.95	1.023	0.849	1.024	0.908
18/16	0.897	0.607	0.57	0.639	0.83	1.081	0.948	1.082	0.993
16/20	0.939	0.779	0.77	0.740	1.10	1.156	0.905	1.157	0.990
16/18	1.020	0.792	0.71	0.766	1.01	1.232	1.017	1.233	1.090
16/16	1.121	0.803	0.66	0.792	0.91	1.303	1.132	1.304	1.190

Reactions at Supports (plf) Based on Web Crippling

Gage	Condition	Bearing Length of Webs							
		Allowable (R_n/Ω)				Factored (ΦR_n)			
		1"	2"	4"	6"	1"	2"	4"	6"
22	End	316	393	503	588	483	602	770	899
	Interior	528	638	792	911	786	948	1178	1355
21	End	403	499	636	741	616	764	973	1133
	Interior	675	810	1001	1148	1004	1205	1489	1708
20	End	450	556	707	822	688	851	1081	1258
	Interior	755	903	1114	1275	1123	1344	1657	1897
19	End	633	777	980	1137	968	1188	1500	1739
	Interior	1066	1266	1549	1766	1585	1883	2304	2627
18	End	781	954	1199	1387	1195	1460	1835	2122
	Interior	1319	1559	1898	2158	1961	2318	2823	3211
16	End	1194	1445	1800	2072	1827	2211	2754	3170
		2027	2373	2862	3237	3015	3530	4257	4815

Web Crippling Constraints h=2.16" r=0.125" θ=64°

Y-10C

4.2 DG2WHF-36 & 2WHF-36

ASC STEEL DECK

Inward Allowable (f_b/Ω) and Factored (Φf_b) Distributed Load (lbs/ft²)

Gage	Span	Limit Condition	Panel Span (Support Spacing) 4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
16/20	SS	f_b/Ω	972	432	243	155	108	79	61	48	39
		Φf_b	1542	685	385	247	171	126	96	76	62
		L/360	790	234	99	51	29	18	12	9	6
		L/240	-	351	148	76	44	28	19	13	9
		L/180	-	-	198	101	59	37	25	17	13
		L/120	-	-	-	152	88	55	37	26	19
	DS	f_b/Ω	923	410	231	148	103	75	58	46	37
		Φf_b	1465	651	366	234	163	120	92	72	59
		L/360	-	-	203	104	60	38	25	18	13
		L/240	-	-	-	-	90	57	38	27	20
		L/180	-	-	-	-	-	-	51	36	26
		L/120	-	-	-	-	-	-	-	-	-
	TS	f_b/Ω	1154	513	288	185	128	94	72	57	46
		Φf_b	1831	814	458	293	203	149	114	90	73
		L/360	-	442	186	95	55	35	Exceeds Maximum Product Length		
		L/240	-	-	280	143	83	52			
		L/180	-	-	-	-	110	70			
		L/120	-	-	-	-	-	-			
16/18	SS	f_b/Ω	988	439	247	158	110	81	62	49	40
		Φf_b	1568	697	392	251	174	128	98	77	63
		L/360	842	249	105	54	31	20	13	9	7
		L/240	-	374	158	81	47	29	20	14	10
		L/180	-	-	210	108	62	39	26	18	13
		L/120	-	-	-	-	94	59	39	28	20
	DS	f_b/Ω	956	425	239	153	106	78	60	47	38
		Φf_b	1516	674	379	243	168	124	95	75	61
		L/360	-	-	224	115	66	42	28	20	14
		L/240	-	-	-	-	100	63	42	30	22
		L/180	-	-	-	-	-	-	56	39	29
		L/120	-	-	-	-	-	-	-	-	-
	TS	f_b/Ω	1194	531	299	191	133	98	75	59	48
		Φf_b	1895	842	474	303	211	155	118	94	76
		L/360	-	487	205	105	61	38	Exceeds Maximum Product Length		
		L/240	-	-	-	158	91	57			
		L/180	-	-	-	-	122	77			
		L/120	-	-	-	-	-	-			
16/16	SS	f_b/Ω	1002	445	250	160	111	82	63	49	40
		Φf_b	1589	706	397	254	177	130	99	78	64
		L/360	890	264	111	57	33	21	14	10	7
		L/240	-	396	167	85	49	31	21	15	11
		L/180	-	-	223	114	66	42	28	20	14
		L/120	-	-	-	-	99	62	42	29	21
	DS	f_b/Ω	988	439	247	158	110	81	62	49	40
		Φf_b	1568	697	392	251	174	128	98	77	63
		L/360	-	-	245	125	72	46	31	21	16
		L/240	-	-	-	-	109	68	46	32	23
		L/180	-	-	-	-	-	-	61	43	31
		L/120	-	-	-	-	-	-	-	-	-
	TS	f_b/Ω	1235	549	309	198	137	101	77	61	49
		Φf_b	1959	871	490	314	218	160	122	97	78
		L/360	-	531	224	115	66	42	Exceeds Maximum Product Length		
		L/240	-	-	-	172	100	63			
		L/180	-	-	-	-	133	84			
		L/120	-	-	-	-	-	-			

V-10D

Ø STRUCT. S.O.G. – FDN. – PINALES\CONT.:

HOUSE SLAB DESIGN \ CONT.:

$V_u = 1.15\, W_u \times \ell_n/2$
$= 1.15(175)(14/2) = 1408^{\#}$

SHEAR CAP. CHK.:

$V_{u\,CAP} = \phi\, 2\sqrt{f'c}\, b_w d$
$= 0.75 * 2 * \sqrt{2500}\,(12)(4)$
$= 3.6 \gg 2V_u = 2.81^k$ — OK!

Ø GAR. STRUCT. SLAB-ON-GRADE DES.:

PER IRC LOADING:
LL = 50 PSF OR (2) 2000 lbs WHEEL LOAD 5' APART OR 9' APART

AT DISCONT. END; $\ell_n = 12'$; $LL_{UNF} = 50$ PSF

$W_u = 1.2(150 \times 6/12) + 1.6 \times 50$
$= 90 + 80 = 170^{\#}/'$

$(-)M_{u\,MAX.} = \frac{170(12)^2}{10} = 2450^{\#\text{-}'}$

$(+)M_{u\,MAX.} = \frac{170(12)^2}{11} = 2225^{\#\text{-}'}$

LL=2000 lb PT. LOAD AT MIDSPAN $\ell_n = 12'$:

$W_{u_{DL}} = 90$; $P_{LL} = 2000 \times 1.6 = 3200^{\#}$

$M_{u_{TOT}} = \frac{90(12)^2}{10} + \frac{3200 \times 12}{8}$
$= 1295 + 4800 = 6095^{\#\text{-}'}$

AT INTERIOR SPAN; $\ell_n = 13'$:

$W_{DL} = 90$; $P_{LL} = 2000 \times 1.6 = 3200^{\#}$

$M_{u_{TOT.}} = \frac{90(13)^2}{11} + \frac{3200 \times 13}{8}$
$= 1380 + 5200 = 6580^{\#\text{-}'}$ ← for DESIGN

$14.12\rho^2 - \rho + \frac{6580^{\#\text{-}'}}{0.9(60000)(12/12)(3.25)^2}$ (0.0115)

BY Q.F.: $\rho = 0.0144$

$A_{S\,REQD} = \rho b d = 0.56\,\square''$ — GOVERNS!
$A_{S\,MIN.} = \frac{200}{f_y} b_w d = 0.130\,\square''$

∴ USE #5 AT 8" OC MAIN REINF. AND #4 AT 18" OC T&S REINF. – CENTER REBARS ON 6" SLAB.

Ø POOL STRUCT. SLAB-ON-GRADE DES.:

$\ell_{n\,MAX.} = 9.5'$; SLAB THKNESS = 5"; d = 2.5"

$W_u = (62.4\text{ PCF} \times 7 \times 1.6) + (150\text{ PCF} \times 10/12 \times 1.2)$
$= 698 + 149 = 845^{\#}/'$

$M_u = W_u \ell_n^2/8 = 2150^{\#\text{-}'}$

$14.12\rho^2 - \rho + \frac{2150^{\#\text{-}'}}{0.9(60000)(1')(2.5)^2} = 0$ (0.0063)

BY Q.F.: $\rho = 0.0069$

$A_{S\,REQD} = \rho b d = 0.20\,\square''$ — GOVERNS!
$A_{S\,MIN} = \frac{200}{f_y} b_w d = 0.10\,\square''$

∴ #4 AT 10" OC MAIN REINF. AND #4 AT 18" OC T&S REINF. CENTER REBARS ON 5" SLAB

Ø OUTDOOR PATIO ADJ. TO POOL STRUCT. SLAB-ON-GRADE DESIGN:

$\ell_{n\,max.} = 9.5'$; SLAB THKNESS = $\frac{9.5' \times 12}{24} = 4.5''$ → USE 5" THK
d = 2.5"

$W_u = 1.6(60) + 1.2\left[\frac{(5+\sim3)}{12} \times 0.15\right] \approx 0.225^{k}/'$

NEG. M_u (2-SPANS):

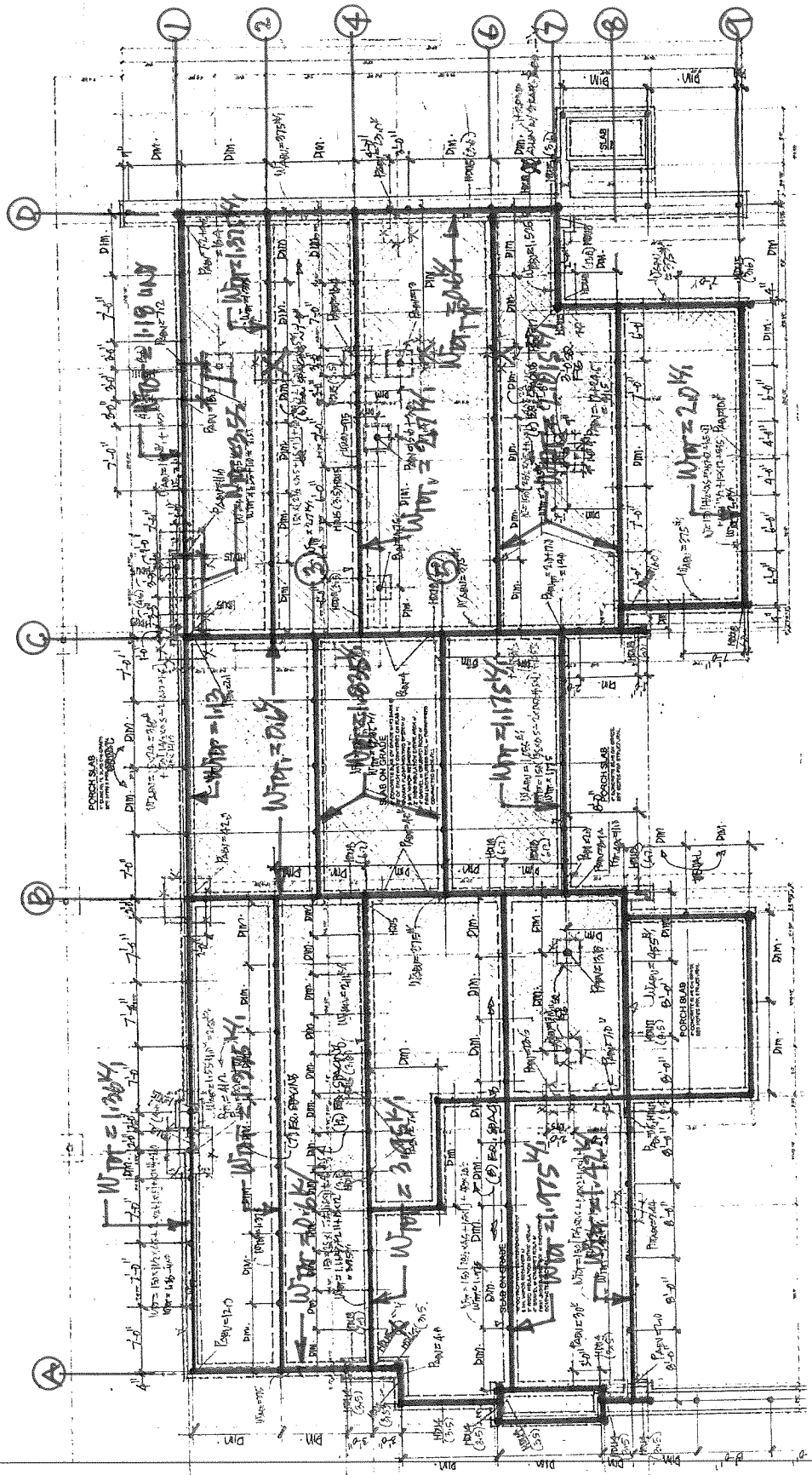
$-M_u = W_u \ell_n^2/9 = 2255^{\#\text{-}'}$

$14.12\rho^2 - \rho + \frac{2255^{\#\text{-}'}}{0.9(60000)(12/2)(2.5)^2} = 0$ (0.0066)

BY Q.F.; $\rho = 0.007$

$A_{S\,MIN.} = \rho b d = 0.21\,\square''$ ← GOVERNS!
$A_{S\,MIN} = 0.10\,\square''$

∴ #4 AT 10" OC MAIN REINF. AND #4 AT 18" OC T&S REINF. – CENTER REBARS ON 5" SLAB.



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PROJECT KOHERU RES.

DATE 11/23/21

PROJECT NO 0426-2021-03

DESIGN JCM

SHEET V-12

POOL RETWALL CALCULATIONS

KONERU RESIDENCE
6610 E MERCER WAY
MERCER ISLAMD, WA 98040

122 S JACKSON ST | SUITE 210 | SEATTLE WA 98104 | 206.789.6038 T | 206.789.6042 F

Project Name/Number : ~~(C02-D10) 200~~

PAR WALL ALONG WEST – 8H SES,

I-A

RetainPro (c) 1987-2019, Build 11.20.03.31
License : KW-06055289
License To : MALSAM TSANG ENGINEERING

Cantilevered Retaining Wall

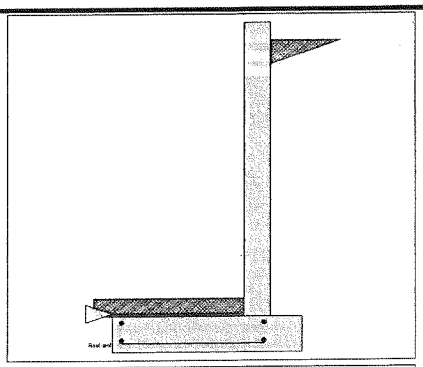
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	7.67 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	130.00 pcf
Footing||Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	56.0 #/ft
...Height to Top	=	7.67 ft
...Height to Bottom	=	0.50 ft
Load Type	=	Seismic (E) (Strength Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.46 Ratio < 1.5!
Slab Resists All Sliding !		
Total Bearing Load	=	2,625 lbs
...resultant ecc.	=	16.76 in
Soil Pressure @ Toe	=	1,586 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,220 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	27.4 psi OK
Footing Shear @ Heel	=	9.6 psi OK
Allowable	=	75.0 psi

OK! SEIS. INCLUDED

Sliding Calcs

Lateral Sliding Force	=	1,972.0 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	10.00
Rebar Placed at =	Edge

Design Data

fb/FB + fa/Fa =		0.732
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	2,518.8
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	7,052.7
Moment.....Allowable =		9,623.1
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	33.9
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type =		Medium Weight
Masonry Design Method =		ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

Project Name/Number : ~~(C02-D10) 200~~
I-B

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Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2671 in2/ft	
(4/3) * As :	0.3561 in2/ft	Min Stem T&S Reinf Area 1.568 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2671 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.372 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	3.50 ft
Heel Width	=	1.50
Total Footing Width	=	5.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,220	0 psf
Mu' : Upward	=	105,691	0 ft-#
Mu' : Downward	=	18,963	478 ft-#
Mu: Design	=	7,227	478 ft-#
Actual 1-Way Shear	=	27.37	9.56 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 5 @ 10.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.16 in, #5@ 14.21 in, #6@ 20.17 in, #7@ 27.50 in, #8@ 36.21 in, #9@ 45
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: No key defined

Min footing T&S reinf Area 1.30 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,690.9	2.89	4,886.2	Soil Over HL (ab. water tbl)	830.8	4.58	3,807.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.58	3,807.9
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=	281.1	5.09	1,429.2	* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	227.5	1.75	398.1
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	816.9	3.83	3,131.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	750.0	2.50	1,875.0
					Key Weight	=			
					Vert. Component	=			
Total	=	1,972.0	**O.T.M.** =	6,315.4	**Total =**		2,625.2 lbs	**R.M.=**	9,212.4

Resisting/Overturning Ratio = **1.46**
Vertical Loads used for Soil Pressure = 2,625.2 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

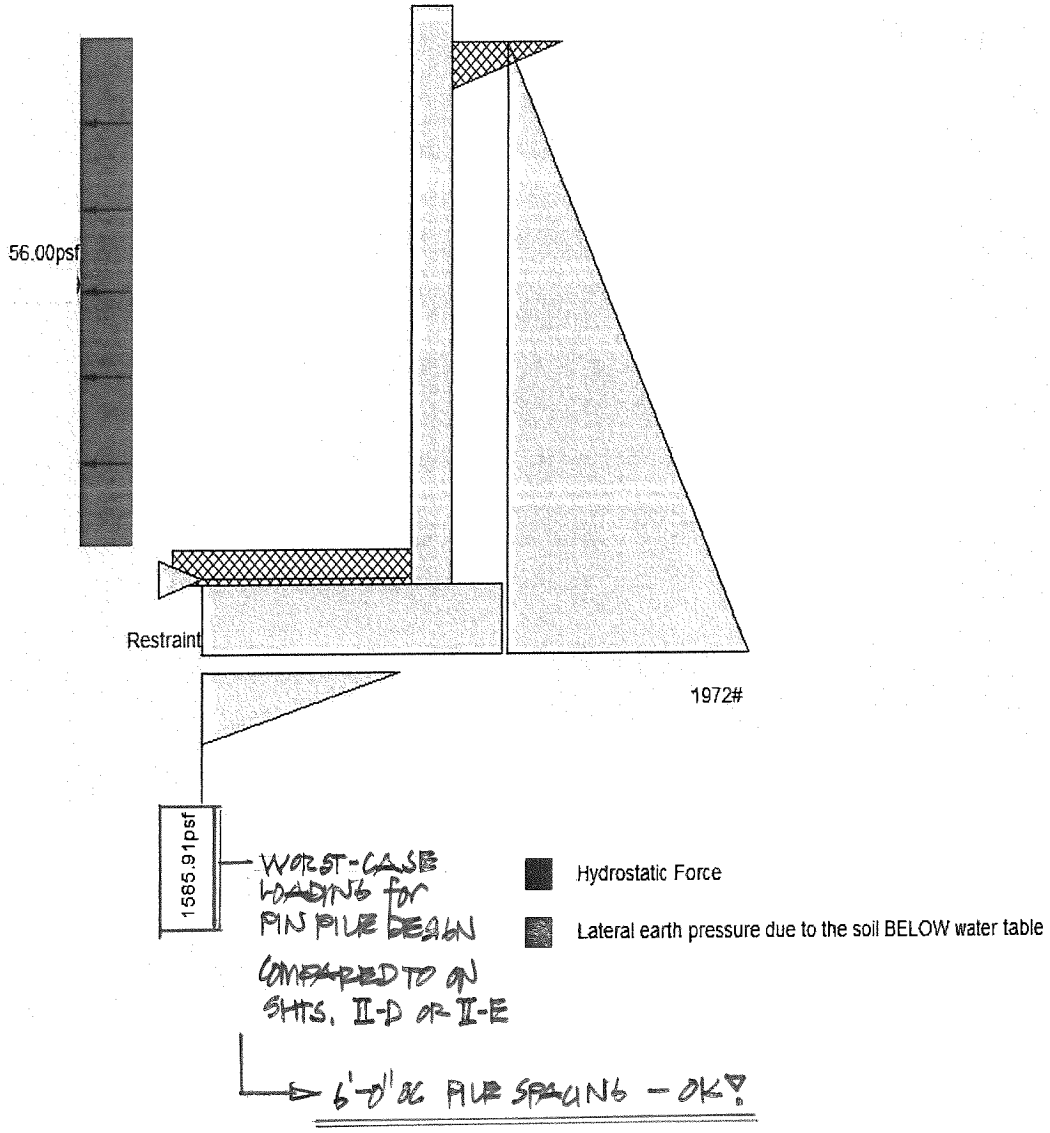
Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.072	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

POOL WALL ALONG WESTSIDE!



6'-0" OC PILE SPACING - OK?

Project Name/Number : ~~(C02-D10) 200~~
POOL WALL ALONG WEST SIDE — NO SEIS. CHK.
II-A

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Cantilevered Retaining Wall

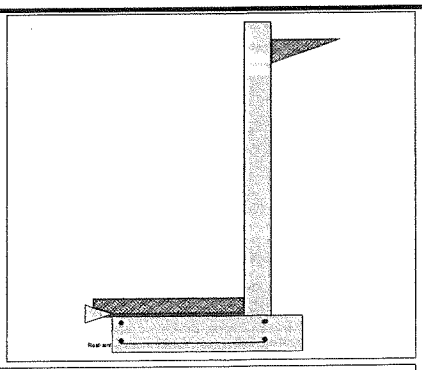
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	7.67 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	145.00 pcf
Footing||Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Strength Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.89 OK
Slab Resists All Sliding !		
Total Bearing Load	=	2,651 lbs
...resultant ecc.	=	10.21 in
Soil Pressure @ Toe	=	1,072 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,501 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	21.7 psi OK
Footing Shear @ Heel	=	8.8 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	1,690.9 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

Bottom

			Stem OK
Design Height Above Ftg	ft =		0.00
Wall Material Above "Ht"	=		Concrete
Design Method	=		LRFD
Thickness	=		8.00
Rebar Size	=		# 5
Rebar Spacing	=		10.00
Rebar Placed at	=		Edge
Design Data			
fb/FB + fa/Fa	=		**0.562**
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =		2,117.3
Moment....Actual			
Service Level	ft-# =		
Strength Level	ft-# =		5,412.5
Moment.....Allowable	=		9,623.1
Shear.....Actual			
Service Level	psi =		
Strength Level	psi =		28.5
Shear.....Allowable	psi =		75.0
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =		6.19
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =		100.0
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type	=		Medium Weight
Masonry Design Method	=		ASD
Concrete Data			
f'c	psi =		2,500.0
Fy	psi =		60,000.0

Project Name/Number : ~~(C02-D10) 200~~

II-B

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Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2049 in2/ft	
(4/3) * As :	0.2733 in2/ft	Min Stem T&S Reinf Area 1.568 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2475 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.372 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	3.50 ft
Heel Width	=	1.50
Total Footing Width	=	5.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,501	0 psf
Mu' : Upward	=	84,291	24 ft-#
Mu' : Downward	=	18,963	478 ft-#
Mu: Design	=	5,444	454 ft-#
Actual 1-Way Shear	=	21.71	8.79 psi
Allow 1-Way Shear	=	75.00	40.00 psi

Toe Reinforcing = # 5 @ 10.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: No key defined

Min footing T&S reinf Area 1.30 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,690.9	2.89	4,886.2	Soil Over HL (ab. water tbl)	830.8	4.58	3,807.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.58	3,807.9
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	253.8	1.75	444.1
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	816.9	3.83	3,131.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	750.0	2.50	1,875.0
					Key Weight	=			
					Vert. Component	=			
Total	=	1,690.9	**O.T.M.** =	4,886.2	**Total** =	2,651.5 lbs	**R.M.**=	9,258.4

Resisting/Overturning Ratio = **1.89**
Vertical Loads used for Soil Pressure = 2,651.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

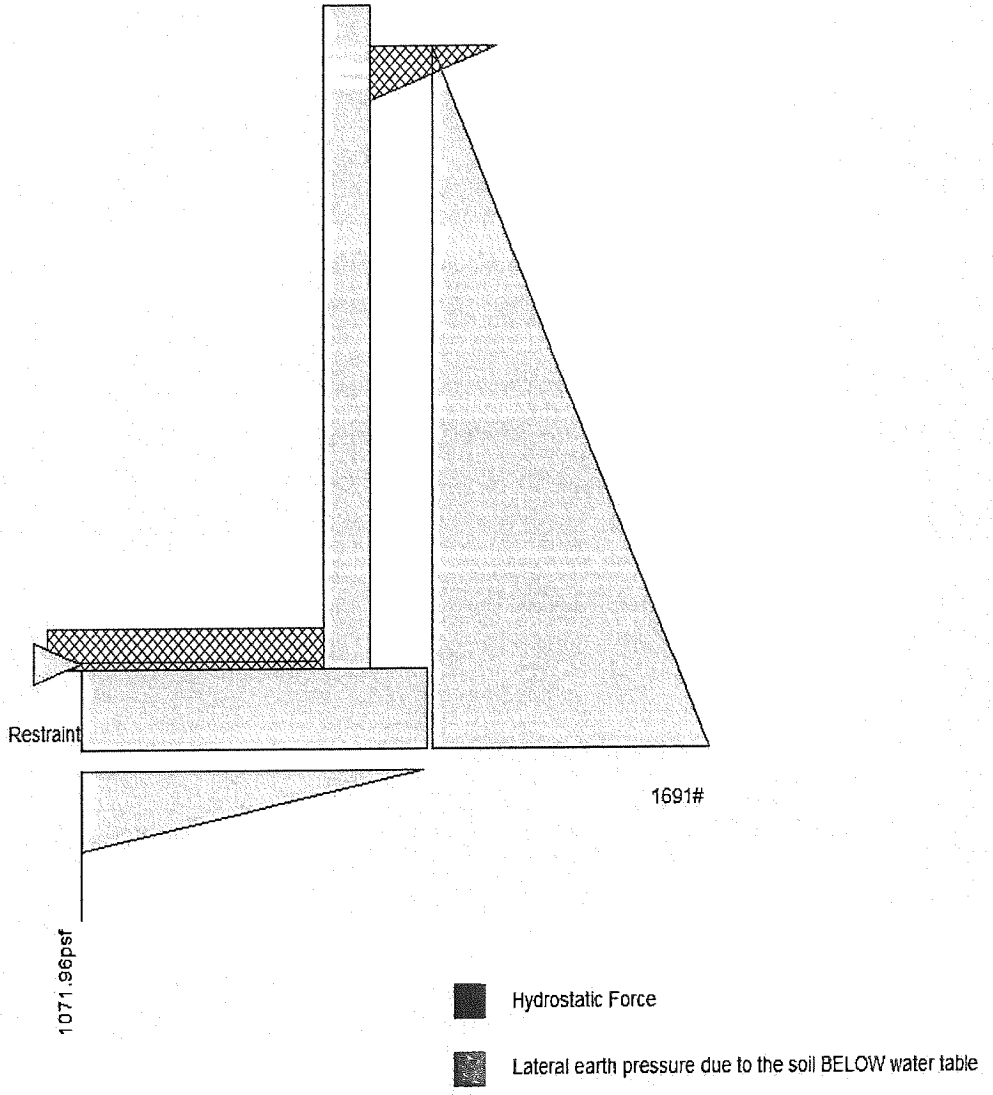
Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

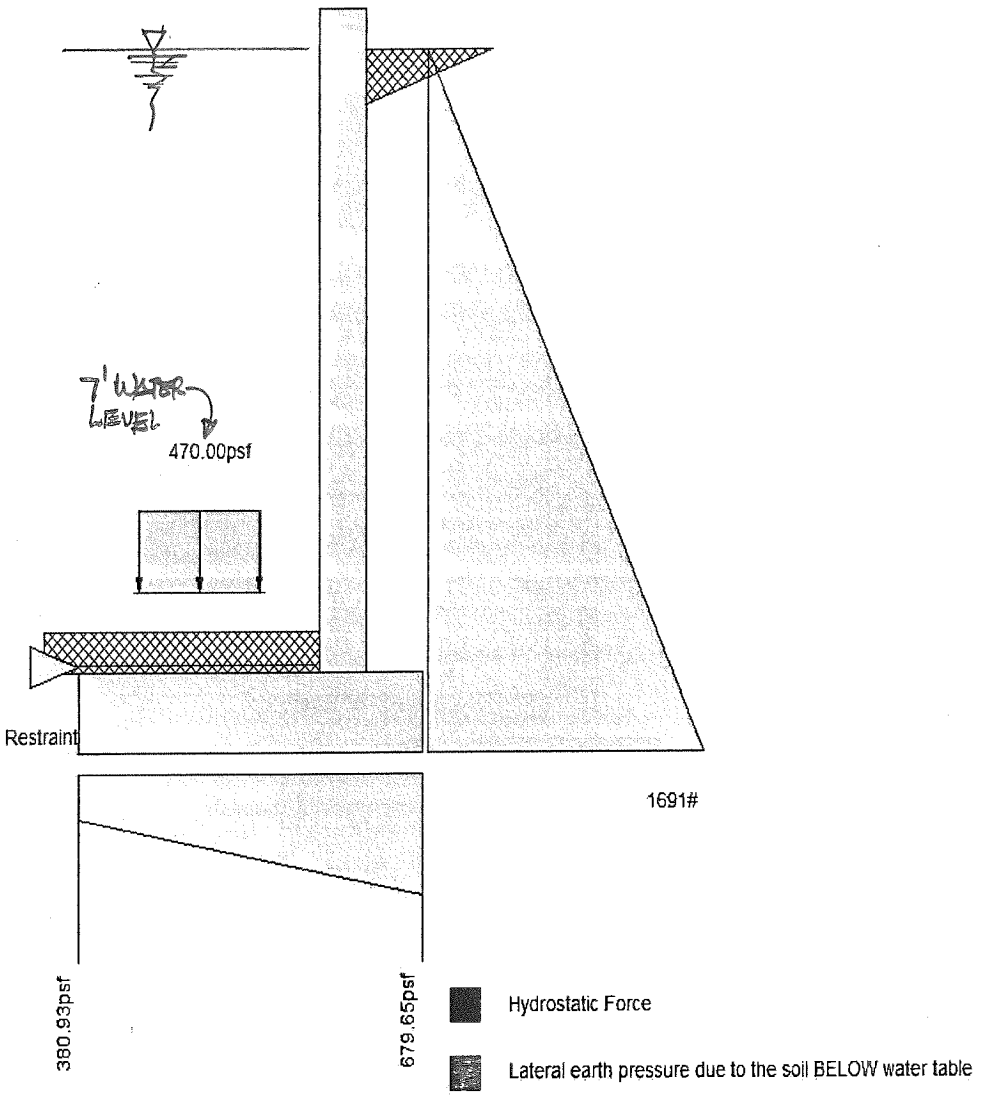
Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.049	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.


Restraint
1691#
1071.96psf
Hydrostatic Force
Lateral earth pressure due to the soil BELOW water table

POOL WALL ALONG WEST SIDE - NO SEIS;
WITH POOL WATER SURCHARGE CHK.

II-E



Project Name/Number : ~~(C02-D10) 200~~
POOL WALL ALONG EAST SIDE
W/ WATER PRESS. ONLY
III-A

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Cantilevered Retaining Wall

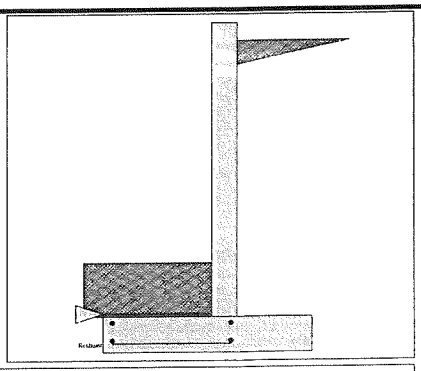
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	7.67 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	18.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	67.4 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	67.00 pcf
Soil Density, Toe	=	130.00 pcf
Footing||Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Strength Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.40	Ratio < 1.5!
Slab Resists All Sliding !			
Total Bearing Load	=	3,223 lbs	
...resultant ecc.	=	22.03 in	
Soil Pressure @ Toe	=	2,351 psf	~~NG~~ OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Exceeds Allowable!			
ACI Factored @ Toe	=	3,291 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	34.9 psi	OK
Footing Shear @ Heel	=	13.3 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,532.6 lbs

OK!
POOL SLAB+WATER NOT ACCOUNTED!
OK!
PIN FILE SUPPORTED

Stem Construction

Bottom

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	10.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.842**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	3,171.2
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	8,106.7
Moment.....Allowable	=	9,623.1
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	42.7
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.19
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	60,000.0

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

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Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.307 in2/ft	
(4/3) * As :	0.4093 in2/ft	Min Stem T&S Reinf Area 1.568 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.307 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.372 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	2.83 ft
Heel Width	=	2.67
Total Footing Width	=	5.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	3,291	0 psf
Mu' : Upward	=	103,751	0 ft-#
Mu' : Downward	=	14,445	1,598 ft-#
Mu: Design	=	7,442	1,598 ft-#
Actual 1-Way Shear	=	34.89	13.30 psi
Allow 1-Way Shear	=	75.00	40.00 psi

Toe Reinforcing = # 5 @ 10.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.90 in, #5@ 13.80 in, #6@ 19.58 in, #7@ 26.71 in, #8@ 35.17 in, #9@ 44
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: No key defined

Min footing T&S reinf Area 1.43 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Project Name/Number : ~~(C02-B10) 200~~

III-C

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Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		2,532.6	2.89	7,318.4	Soil Over HL (ab. water tbl)	1,029.4	4.50	4,630.4
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.50	4,630.4
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	551.9	1.42	780.9
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	816.9	3.16	2,584.1
					Earth @ Stem Transitions	=		
					Footing Weight	=	825.0	2.75	2,268.8
					Key Weight	=			
					Vert. Component	=			
Total	=	2,532.6	**O.T.M.** =	7,318.4	**Total** =	3,223.1 lbs	**R.M.=**	10,264.1

Resisting/Overturning Ratio = **1.40**
Vertical Loads used for Soil Pressure = 3,223.1 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

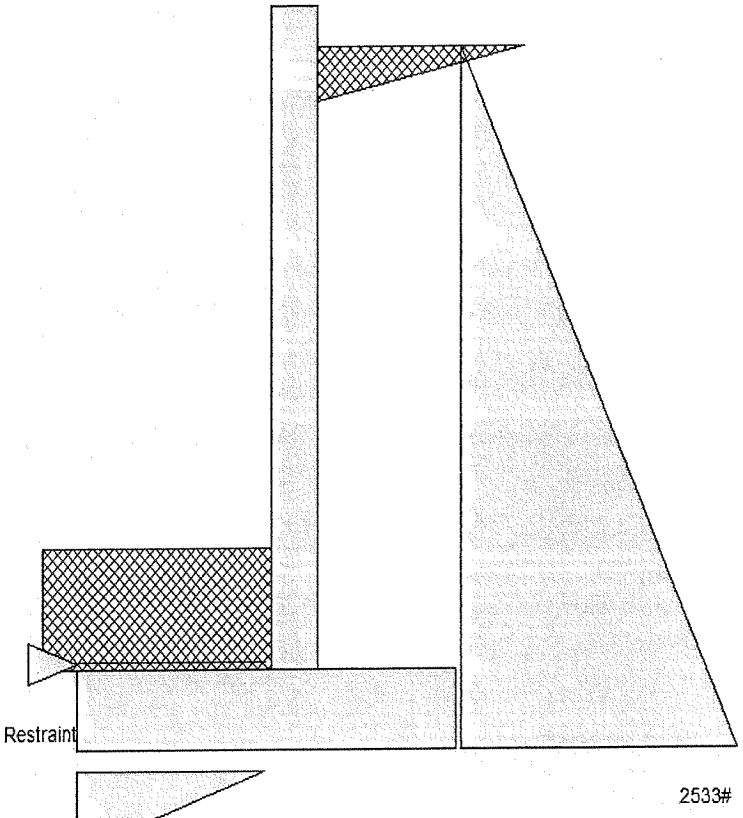
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.097	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

III-D

POOL WALL ALONG EAST SIDE



WORST-CASE LOADING FOR PIN PILE DESIGN ALONG EAST SIDE POOL WALL

Hydrostatic Force

Lateral earth pressure due to the soil BELOW water table

6'-0" OC MAX. PIN PILES -OK!

Project Name/Number : ~~(C02-D18) 200~~

POOL WALL ALONG SOUTH SIDE - NO SEIS.

IV-A

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Cantilevered Retaining Wall

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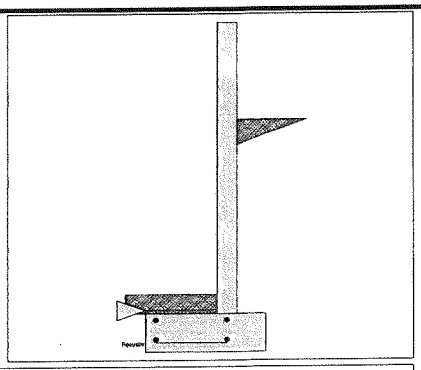
Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	2.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.96 OK
Slab Resists All Sliding !		
Total Bearing Load	=	1,605 lbs
...resultant ecc.	=	6.40 in
Soil Pressure @ Toe	=	1,107 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,550 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	10.1 psi OK
Footing Shear @ Heel	=	5.1 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	810.0 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

Bottom

			Stem OK
Design Height Above Ftg	ft =		0.00
Wall Material Above "Ht"	=		Concrete
Design Method	=		LRFD
Thickness	=		6.00
Rebar Size	=		# 4
Rebar Spacing	=		9.00
Rebar Placed at	=		Center
Design Data			
fb/FB + fa/Fa	=		**0.465**
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =		900.0
Moment....Actual			
Service Level	ft-# =		
Strength Level	ft-# =		1,500.0
Moment.....Allowable	=		3,222.4
Shear.....Actual			
Service Level	psi =		
Strength Level	psi =		25.0
Shear.....Allowable	psi =		75.0
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =		3.00
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =		75.0
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type	=		Medium Weight
Masonry Design Method	=		ASD
Concrete Data			
f'c	psi =		2,500.0
Fy	psi =		60,000.0

Project Name/Number : ~~(C02-D10) 200~~

IV-B

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Cantilevered Retaining Wall

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Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1243 in2/ft	
(4/3) * As :	0.1658 in2/ft	Min Stem T&S Reinf Area 1.080 in2
200bd/fy : 200(12)(3)/60000 :	0.12 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1243 in2/ft	#4@ 16.67 in #4@ 33.33 in
Provided Area :	0.2667 in2/ft	#5@ 25.83 in #5@ 51.67 in
Maximum Area :	0.4064 in2/ft	#6@ 36.67 in #6@ 73.33 in

Footing Data

Toe Width	=	1.75 ft
Heel Width	=	1.25
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,550	0 psf
Mu' : Upward	=	22,747	24 ft-#
Mu' : Downward	=	4,741	270 ft-#
Mu: Design	=	1,500	246 ft-#
Actual 1-Way Shear	=	10.08	5.06 psi
Allow 1-Way Shear	=	75.00	40.00 psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm
Key: No key defined

Min footing T&S reinf Area 0.78 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Project Name/Number : ~~(C02-D10) 200~~

IV-C

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Cantilevered Retaining Wall

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HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.63	1,279.7
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	105.0	0.88	91.9
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	562.5	2.00	1,125.0
					Earth @ Stem Transitions	=		
Total	=	810.0	**O.T.M.** =	1,620.0	Footing Weight	=	450.0	1.50	675.0
					Key Weight	=			
					Vert. Component	=			
					Total =		1,605.0 lbs	**R.M.=**	3,171.6

Resisting/Overturning Ratio = **1.96**
Vertical Loads used for Soil Pressure = 1,605.0 lbs

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Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

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(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.077	in

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IV-D

POOL WALL ALONG SOUTH SIDE