KIA CO

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EDWARD & CATHERINE MORAN RESIDENCE

5000 WEST MERCER WAY
MERCER ISLAND, WASHINGTON 98040

STRUCTURAL CALCULATIONS

NOVEMBER 30, 2021
JOB NO: 171-2101

TABLE OF CONTENTS

DESIGN DATA:

Roof Loads-
Dead Load = 15 psf
Live Load = 25 psf (Snow)

Floor Loads-
Dead Load = 15 psf
Live Load = 40 psf

WIND:

110 MPH
Exposure "B"

SEISMIC:

Zip Code: 98040

Ss = 1.439
S1 = 0.552

Fa = 1.00
Fv = 1.50

Sds = 0.959
Sd1 = 0.552

Above values per Soil's Report by: Nelson Geotech. Associates, Inc., File No. 1211520, September 27, 2021.

Soil Bearing = 1500 psf (Per Soil's Report)

D-1/1

ROOF JOIST-1:

SPAN = 11.00 FT

USE: 2x12 HF #2

Fb =	980	PSI
Fv =	75	PSI
b =	1.5	IN
h =	11.25	IN
A =	16.88	IN^2
S =	31.64	IN^3
I =	177.98	IN^4
E =	1600	KSI

Duration Factor =	1.15	
Turb. W =	2.00	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	30.00	PLF
W(LL) =	50.00	PLF
W(TL) =	80.00	PLF
M (max)=	1.21	K-FT
R (max)=	0.44	K
V (max)=	0.37	K

fb =	0.40	KSI	OK
fv =	0.03	KSI	OK

TL-Deflection =	0.09	IN	L/	1426
DL-Deflection =	0.03	IN	L/	3804

KIA CO

Project/Subject: MORAD RESID, MERCER ISLAND, WA.

By: A.G. | Sheet No.: RB-1/6

Date: 11-21 | Job No.: 171-1901

ROOF JOIST-2: (Double joist @ Dormer)

SPAN = 11.00 FT

USE: (2)-2x12 HF #2

Fb =	980	PSI
Fv =	75	PSI
b =	3	IN
h =	11.25	IN
A =	33.75	IN^2
S =	63.28	IN^3
I =	355.96	IN^4
E =	1600	KSI

Duration Factor = 1.15

Turb. W =	5.00	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	75.00	PLF
W(LL) =	125.00	PLF
W(TL) =	200.00	PLF
M (max)=	3.03	K-FT
R (max)=	1.10	K
V (max)=	0.91	K

fb =	0.50	KSI	OK
fv =	0.04	KSI	OK

TL-Deflection =	0.12	IN	L/	1141
DL-Deflection =	0.04	IN	L/	3043

KIA CO

Project/Subject: MORAD RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: RB-2/6

Date: 11-21 | Job No.: 171-1901

ROOF BEAM-1:

SPAN = 3.50 FT

USE: 4x6 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	5.5	IN
A =	19.25	IN^2
S =	17.65	IN^3
I =	48.53	IN^4
E =	1600	KSI

Duration Factor =	1.15	
Turb. W =	11.00	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	165.00	PLF
W(LL) =	275.00	PLF
W(TL) =	440.00	PLF
M (max)=	0.67	K-FT
R (max)=	0.77	K
V (max)=	0.57	K

fb =	0.40	KSI	OK
fv =	0.04	KSI	OK

TL-Deflection =	0.02	IN	L/	2195
DL-Deflection =	0.01	IN	L/	5853

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: EB-3/6

Date: 11-21 | Job No.: 171-1901

ROOF BEAM-2:

SPAN = 5.50 FT

USE: 4x6 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	5.5	IN
A =	19.25	IN^2
S =	17.65	IN^3
I =	48.53	IN^4
E =	1600	KSI

Duration Factor =	1.15	
Turb. W =	10.00	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	150.00	PLF
W(LL) =	250.00	PLF
W(TL) =	400.00	PLF
M (max)=	1.51	K-FT
R (max)=	1.10	K
V (max)=	0.92	K

fb =	0.89	KSI	OK
fv =	0.06	KSI	OK

TL-Deflection =	0.11	IN	L/	622
DL-Deflection =	0.04	IN	L/	1659

ROOF BEAM-3

SPAN = 4.00 FT

USE: 6x8 DF #1

Fb =	1300	PSI
Fv =	85	PSI
b =	5.5	IN
h =	7.5	IN
A =	41.25	IN^2
S =	51.56	IN^3
I =	193.36	IN^4
E =	1700	KSI

Duration Factor =	1.15	
Turb. W =	2.00	FT
X =	1.75	FT
DL =	15.00	PSF
LL =	25.00	PSF
P(DL) =	1568.00	LBS
P(LL) =	2613.00	LBS
P(TL) =	4181.00	LBS
W(DL) =	30.00	PLF
W(LL) =	50.00	PLF
W(TL) =	80.00	PLF
M (max)=	4.28	K-FT
R (max)=	1.99	K
V (max)=	1.94	K

fb =	0.865	KSI	OK
fv =	0.061	KSI	OK

TL-Deflection =	0.031	IN	L/	1563
DL-Deflection =	0.018	IN	L/	2605

ROOF BEAM-4:

SPAN = 18.00 FT

USE: 3.5"x14" 1.9E Microllam LVL

Fb =	2600	PSI
Fv =	285	PSI
b =	3.5	IN
h =	14	IN
A =	49.00	IN^2
S =	114.33	IN^3
I =	800.33	IN^4
E =	1900	KSI

Duration Factor =	1.15	
Turb. W =	11.00	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	165.00	PLF
W(LL) =	275.00	PLF
W(TL) =	440.00	PLF
M (max)=	17.82	K-FT
R (max)=	3.96	K
V (max)=	3.45	K

fb =	1.63	KSI	OK
fv =	0.09	KSI	OK

TL-Deflection =	0.68	IN	L/	316
DL-Deflection =	0.26	IN	L/	843

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: EB-6/6

Date: 11-21 | Job No.: 171-1901

FB-1: (TYP. HEADER)

SPAN = 4.50 FT

USE: 4x8 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	7.25	IN
A =	25.38	IN^2
S =	30.66	IN^3
I =	111.15	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	1.00	FT	
DL =	325.00	PSF	(15x7.5'+15x7.5'+10x10')
LL =	488.00	PSF	(25x7.5'+40x7.5')
W(DL) =	325.00	PLF	
W(LL) =	488.00	PLF	
W(TL) =	813.00	PLF	
M (max)=	2.06	K-FT	
R (max)=	1.83	K	
V (max)=	1.34	K	
fb =	0.81	KSI	OK
fv =	0.08	KSI	OK

TL-Deflection =	0.04	IN	L/	1280
DL-Deflection =	0.02	IN	L/	3203

FB-2: (Roof Beam @ Great Room)

SPAN = 6.50 FT

USE: 4x8 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	7.25	IN
A =	25.38	IN^2
S =	30.66	IN^3
I =	111.15	IN^4
E =	1600	KSI

Duration Factor =	1.15	
Turb. W =	11.00	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	165.00	PLF
W(LL) =	275.00	PLF
W(TL) =	440.00	PLF
M (max)=	2.32	K-FT
R (max)=	1.43	K
V (max)=	1.16	K

fb =	0.79	KSI	OK
fv =	0.06	KSI	OK

TL-Deflection =	0.10	IN	L/	785
DL-Deflection =	0.04	IN	L/	2093

USE: 4x10 D.F. #2

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G.

Date: 11-21

Sheet No.: FB-2/14

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FB-3: (BTWN DEN & PORCH)

SPAN = 5.50 FT

USE: 4x10 DF #2

Fb =	1050	PSI
Fv =	95	PSI
b =	3.5	IN
h =	9.25	IN
A =	32.38	IN^2
S =	49.91	IN^3
I =	230.84	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	1.00	FT	
DL =	385.00	PSF	(15x11'+15x8'+10x10')
LL =	595.00	PSF	(25x11'+40x8')
W(DL) =	385.00	PLF	
W(LL) =	595.00	PLF	
W(TL) =	980.00	PLF	
M (max)=	3.71	K-FT	
R (max)=	2.70	K	
V (max)=	1.94	K	
fb =	0.89	KSI	OK
fv =	0.09	KSI	OK

TL-Deflection =	0.05	IN	L/	1208
DL-Deflection =	0.02	IN	L/	3075

FB-4: (BTWN MUD RM & PORCH)

SPAN = 5.50 FT

USE: 4x10 DF #2

Fb =	1050	PSI
Fv =	95	PSI
b =	3.5	IN
h =	9.25	IN
A =	32.38	IN^2
S =	49.91	IN^3
I =	230.84	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	1.00	FT	
DL =	370.00	PSF	(15x13'+15x5'+10x10')
LL =	525.00	PSF	(25x13'+40x5')
W(DL) =	370.00	PLF	
W(LL) =	525.00	PLF	
W(TL) =	895.00	PLF	
M (max)=	3.38	K-FT	
R (max)=	2.46	K	
V (max)=	1.77	K	
fb =	0.81	KSI	OK
fv =	0.08	KSI	OK

TL-Deflection =	0.05	IN	L/	1323
DL-Deflection =	0.02	IN	L/	3200

FB-5: (@ PORCH)

SPAN = 8.50 FT

USE: 4x12 DF #2

Fb =	965	PSI
Fv =	95	PSI
b =	3.5	IN
h =	11.25	IN
A =	39.38	IN^2
S =	73.83	IN^3
I =	415.28	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	1.00	FT	
DL =	280.00	PSF	(15x11'+15x1'+10x10')
LL =	315.00	PSF	(25x11'+40x1')
W(DL) =	280.00	PLF	
W(LL) =	315.00	PLF	
W(TL) =	595.00	PLF	
M (max)=	5.37	K-FT	
R (max)=	2.53	K	
V (max)=	1.97	K	
fb =	0.87	KSI	OK
fv =	0.08	KSI	OK

TL-Deflection =	0.11	IN	L/	970
DL-Deflection =	0.05	IN	L/	2061

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: FB-5/14

Date: 11-21 | Job No.: 171-1901

FB-6: (At Porch)

SPAN = 12.50 FT

USE: 6x12 DF #1

Fb =	1350	PSI
Fv =	170	PSI
b =	5.5	IN
h =	11.5	IN
A =	63.25	IN^2
S =	121.23	IN^3
I =	697.07	IN^4
E =	1500	KSI

Duration Factor =	1.00		
Turb. W =	1.00	FT	
DL =	228.00	PSF	(15x2'+15x6.5'+10x10')
LL =	310.00	PSF	(25x2'+40x6.5')
W(DL) =	228.00	PLF	
W(LL) =	310.00	PLF	
W(TL) =	538.00	PLF	
M (max)=	10.51	K-FT	
R (max)=	3.36	K	
V (max)=	2.85	K	
Cv =	1.00		
Fb =	1355	PSI	
fb =	1.04	KSI	OK
fv =	0.07	KSI	OK

TL-Deflection =	0.28	IN	L/	531
DL-Deflection =	0.12	IN	L/	1252

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Project/Subject: MORAD RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: FB-6/14

Date: 11-21 | Job No.: 171-1901

FB-7: (C GABLE)

SPAN = 19.00 FT

USE: 5 1/8x16.5 GLB

Fb =	2400	PSI
Fv =	165	PSI
b =	5.125	IN
h =	16.5	IN
A =	84.56	IN^2
S =	232.55	IN^3
I =	1918.51	IN^4
E =	1800	KSI

Duration Factor =	1.00		
Turb. W =	1.00	FT	
DL =	15.00	PSF	
LL =	40.00	PSF	
W(DL) =	355.00	PLF	(15x6'+15x11'+10x10')
W(LL) =	590.00	PLF	(25x6'+40x11')
W(TL) =	945.00	PLF	
M (max)=	42.64	K-FT	
R (max)=	8.98	K	
V (max)=	7.68	K	
Cv =	0.9590		
F'b =	Fb x Cv = 2.30	KSI	
fb =	2.20	KSI	OK
fv =	0.14	KSI	OK

TL-Deflection =	0.80	IN	L/	284
DL-Deflection =	0.30	IN	L/	756

Camber = 0.30 IN

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G.

Sheet No.: FB-7/14

Date: 11-21

Job No.: 171-1901

FB-8: (BTWN DINING & GREAT RM)

SPAN = 14.00 FT

USE: 5 1/4x11 7/8" 1.9E, Microllam LVL

Fb =	2600	PSI
Fv =	285	PSI
b =	5.25	IN
h =	11.875	IN
A =	62.34	IN^2
S =	123.39	IN^3
I =	732.62	IN^4
E =	1900	KSI

Duration Factor = 1.00

Turb. W =	1.00	FT	
DL =	385.00	PSF	(15x11'+15x8'+10x10')
LL =	595.00	PSF	(25x11'+40x8')
W(DL) =	385.00	PLF	
W(LL) =	595.00	PLF	
W(TL) =	980.00	PLF	
M (max)=	24.01	K-FT	
R (max)=	6.86	K	
V (max)=	5.89	K	
fb =	2.34	KSI	OK
fv =	0.14	KSI	OK

TL-Deflection =	0.61	IN	L/	276
DL-Deflection =	0.24	IN	L/	703

FB-9: (BTWN KITCHEN & FOYER)

SPAN = 10.50 FT

USE: 5 1/4x11 7/8" 1.9E, Microllam LVL

Fb =	2600	PSI
Fv =	285	PSI
b =	5.25	IN
h =	11.875	IN
A =	62.34	IN^2
S =	123.39	IN^3
I =	732.62	IN^4
E =	1900	KSI

Duration Factor =	1.00	
Turb. W =	12.00	FT
DL =	15.00	PSF
LL =	40.00	PSF
W(DL) =	180.00	PLF
W(LL) =	480.00	PLF
W(TL) =	660.00	PLF
M (max)=	9.10	K-FT
R (max)=	3.47	K
V (max)=	2.81	K

fb =	0.88	KSI	OK
fv =	0.07	KSI	OK

TL-Deflection =	0.13	IN	L/	972
DL-Deflection =	0.04	IN	L/	3563

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: FB-9/14

Date: 11-21 | Job No.: 171-1901

FB-10: (BTWN FOYER & STAIR)

SPAN = 8.50 FT

USE: 4x12 DF #2

Fb =	965	PSI
Fv =	95	PSI
b =	3.5	IN
h =	11.25	IN
A =	39.38	IN^2
S =	73.83	IN^3
I =	415.28	IN^4
E =	1600	KSI

Duration Factor =	1.00	
Turb. W =	10.00	FT
DL =	15.00	PSF
LL =	40.00	PSF
W(DL) =	150.00	PLF
W(LL) =	400.00	PLF
W(TL) =	550.00	PLF
M (max)=	4.97	K-FT
R (max)=	2.34	K
V (max)=	1.82	K

fb =	0.81	KSI	OK
fv =	0.07	KSI	OK

TL-Deflection =	0.10	IN	L/	1049
DL-Deflection =	0.03	IN	L/	3847

KIA CO

Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G.

Date: 11-21

Sheet No.: FB-10/14

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FB-11: (GARAGE)

SPAN = 5.50 FT

USE: 4x8 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	7.25	IN
A =	25.38	IN^2
S =	30.66	IN^3
I =	111.15	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	12.00	FT
DL =	15.00	PSF
LL =	40.00	PSF
W(DL) =	180.00	PLF
W(LL) =	480.00	PLF
W(TL) =	660.00	PLF
M (max)=	2.50	K-FT
R (max)=	1.82	K
V (max)=	1.42	K
fb =	0.98 KSI	OK
fv =	0.08 KSI	OK

TL-Deflection =	0.08	IN	L/	864
DL-Deflection =	0.02	IN	L/	3167

KIA CO

Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. Sheet No.: FB-11/14

Date: 11-21 Job No.: 171-1901

FB-12: (CANTILEVER)

SPAN = 3.50 FT

USE: 4x6 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	5.5	IN
A =	19.25	IN^2
S =	17.65	IN^3
I =	48.53	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	12.00	FT
DL =	15.00	PSF
LL =	40.00	PSF
W(DL) =	180.00	PLF
W(LL) =	480.00	PLF
W(TL) =	660.00	PLF
M (max)=	1.01	K-FT
R (max)=	1.16	K
V (max)=	0.85	K
fb =	0.69	KSI OK
fv =	0.07	KSI OK
TL-Deflection =	0.03	IN L/ 1463
DL-Deflection =	0.01	IN L/ 5366

USE: 4x8

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Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: FB-12/14

Date: 11-21 | Job No.: 171-1901

FB-13: (DOWN KITCHEN & STAIR)

SPAN =	4.50	FT	
USE: 4 x 12 DF #2			
Fb =	965	PSI	
Fv =	95	PSI	
b =	3.5	IN	
h =	11.25	IN	
A =	39.38	IN^2	
S =	73.83	IN^3	
I =	415.28	IN^4	
E =	1600	KSI	
Duration Factor =	1.00		
Turb. W =	1.00	FT	
X =	2.50	FT	
DL =	15.00	PSF	
LL =	40.00	PSF	
P(DL) =	640.00	LBS	
P(LL) =	1700.00	LBS	
P(TL) =	2340.00	LBS	
W(DL) =	15.00	PLF	
W(LL) =	40.00	PLF	
W(TL) =	55.00	PLF	
M (max)=	2.74	K-FT	
R (max)=	1.42	K	
V (max)=	1.37	K	
fb =	0.445	KSI	OK
fv =	0.052	KSI	OK
TL-Deflection =	0.012	IN	L/ 4384
DL-Deflection =	0.005	IN	L/ 11692

FB-14: (Porch Roof Beam)

SPAN = 11.00 FT

USE: 4x8 DF #2

Fb =	1140	PSI
Fv =	95	PSI
b =	3.5	IN
h =	7.25	IN
A =	25.38	IN^2
S =	30.66	IN^3
I =	111.15	IN^4
E =	1600	KSI

Duration Factor =	1.15	
Turb. W =	3.50	FT
DL =	15.00	PSF
LL =	25.00	PSF
W(DL) =	52.50	PLF
W(LL) =	87.50	PLF
W(TL) =	140.00	PLF
M (max)=	2.12	K-FT
R (max)=	0.77	K
V (max)=	0.69	K

fb =	0.72	KSI	OK
fv =	0.04	KSI	OK

TL-Deflection =	0.26	IN	L/	509
DL-Deflection =	0.10	IN	L/	1357

KIA CO

Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: FB-14/14

Date: 11-21 | Job No.: 171-1901

FLOOR JOIST-1: (Porch Joists)

SPAN = 13.00 FT

USE: 2x10 HF #2 @ 12" o.c.

Fb =	1075	PSI
Fv =	75	PSI
b =	1.5	IN
h =	9.25	IN
A =	13.88	IN^2
S =	21.39	IN^3
I =	98.93	IN^4
E =	1600	KSI

Duration Factor = 1.00

Turb. W =	1.00	FT
DL =	15.00	PSF
LL =	60.00	PSF
W(DL) =	15.00	PLF
W(LL) =	60.00	PLF
W(TL) =	75.00	PLF
M (max)=	1.58	K-FT
R (max)=	0.49	K
V (max)=	0.43	K

fb =	0.89	KSI	OK
fv =	0.05	KSI	OK

TL-Deflection =	0.30	IN	L/ 512
DL-Deflection =	0.06	IN	L/ 2562

KIA CO

Project/Subject: MORAD RESID. MERCER ISLAND, WA.

By: A.G. Sheet No.: MFB-1/1

Date: 11-21 Job No.: 171-1901

MFB-1:

SPAN = 8.00 FT

USE: 4x10 DF #2

Fb =	1050	PSI
Fv =	95	PSI
b =	3.5	IN
h =	9.25	IN
A =	32.38	IN^2
S =	49.91	IN^3
I =	230.84	IN^4
E =	1600	KSI

Duration Factor =	1.00	
Turb. W =	8.50	FT
DL =	15.00	PSF
LL =	40.00	PSF
W(DL) =	127.50	PLF
W(LL) =	340.00	PLF
W(TL) =	467.50	PLF
M (max)=	3.74	K-FT
R (max)=	1.87	K
V (max)=	1.51	K

fb =	0.90	KSI	OK	
fv =	0.07	KSI	OK	
TL-Deflection =	0.12	IN	L/	823
DL-Deflection =	0.03	IN	L/	3018

KIA CO

Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: MFB-2/7

Date: 11-21 | Job No.: 171-1901

MFB-2:

SPAN =	11.00	FT			
USE 6x10 DF #1					
Fb =	1350	PSI			
Fv =	170	PSI			
b =	5.5	IN			
h =	9.5	IN			
A =	52.25	IN^2			
S =	82.73	IN^3			
I =	392.96	IN^4			
E =	1600	KSI			
Duration Factor =	1.00				
Turb. W =	5.50	FT			
DL =	15.00	PSF			
LL =	40.00	PSF			
W(DL) =	82.50	PLF			
W(LL) =	220.00	PLF			
W(TL) =	302.50	PLF			
M (max)=	4.58	K-FT			
R (max)=	1.66	K			
V (max)=	1.42	K			
fb =	0.66	KSI	OK		
fv =	0.04	KSI	OK		
TL-Deflection =	0.16	IN	L/	833	
DL-Deflection =	0.04	IN	L/	3054	

KIA CO

Project/Subject: MORAD RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: MFB-3/7

Date: 11-21 | Job No.: 171-1901

MFB-3:

SPAN = 9.00 FT

USE: 4x12 DF #2

Fb =	965	PSI
Fv =	95	PSI
b =	3.5	IN
h =	11.25	IN
A =	39.38	IN^2
S =	73.83	IN^3
I =	415.28	IN^4
E =	1600	KSI

Duration Factor =	1.00	
Turb. W =	8.25	FT
DL =	15.00	PSF
LL =	40.00	PSF
W(DL) =	123.75	PLF
W(LL) =	330.00	PLF
W(TL) =	453.75	PLF
M (max)=	4.59	K-FT
R (max)=	2.04	K
V (max)=	1.62	K

fb =	0.75	KSI	OK
fv =	0.06	KSI	OK

TL-Deflection =	0.10	IN	L/	1071
DL-Deflection =	0.03	IN	L/	3928

KIA CO

Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A. G. | Sheet No.: MFB-4/7

Date: 11-21 | Job No.: 171-1901

MFB-4:

SPAN = 9.00 FT

USE: 3 1/2x11 7/8 1.5E LSL

Fb =	2250	PSI
Fv =	285	PSI
b =	3.5	IN
h =	11.875	IN
A =	41.56	IN^2
S =	82.26	IN^3
I =	488.41	IN^4
E =	1500	KSI

Duration Factor =	1.00	
Turb. W =	12.00	FT
DL =	30.00	PSF
LL =	80.00	PSF
W(DL) =	360.00	PLF
W(LL) =	960.00	PLF
W(TL) =	1320.00	PLF
M (max)=	13.37	K-FT
R (max)=	5.94	K
V (max)=	4.63	K
Cv =	0.9197	
F'b = Fb x Cv =	2.07	KSI
fb =	1.95	KSI OK
fv =	0.17	KSI OK

TL-Deflection =	0.27	IN	L/ 406
DL-Deflection =	0.07	IN	L/ 1489

KIA CO

Project/Subject: MORAN RESID. MERCER ISLAND, WA.

By: A.G.

Date: 11-21

Sheet No.: MFB-3/7

Job No.: 171-1901

MFB-5:

SPAN =	7.50	FT			
USE: 6x10 DF #1					
Fb =	1350	PSI			
Fv =	170	PSI			
b =	5.5	IN			
h =	9.5	IN			
A =	52.25	IN^2			
S =	82.73	IN^3			
I =	392.96	IN^4			
E =	1600	KSI			
Duration Factor =	1.00				
Turb. W =	1.00	FT			
DL =	255.00	PSF	← (15 x 8.5 x 2)		
LL =	681.00	PSF	← (40 x 8.5 x 2)		
W(DL) =	255.00	PLF			
W(LL) =	681.00	PLF			
W(TL) =	936.00	PLF			
M (max)=	6.58	K-FT			
R (max)=	3.51	K			
V (max)=	2.77	K			
fb =	0.95	KSI	OK		
fv =	0.08	KSI	OK		
TL-Deflection =	0.11	IN	L/	849	
DL-Deflection =	0.03	IN	L/	3117	

KIA CO

Project/Subject: MOLAD RESID. MERCER ISLAND, WA.

By: A.G. | Sheet No.: MFB-6/7

Date: 11-21 | Job No.: 171-1901

MFB-6:

SPAN =	6.67	FT			
USE: 6x10 DF #1					
Fb =	1350	PSI			
Fv =	170	PSI			
b =	5.5	IN			
h =	9.5	IN			
A =	52.25	IN^2			
S =	82.73	IN^3			
I =	392.96	IN^4			
E =	1600	KSI			
Duration Factor =	1.00				
Turb. W =	1.00	FT			
DL =	412.00	PSF	→ (15×8.5 + 15×9 + 15×10')	main, upper roof,	
LL =	951.00	PSF	→ (40×8.5 + 40×9 + 25×10')		
W(DL) =	412.00	PLF			
W(LL) =	951.00	PLF			
W(TL) =	1363.00	PLF			
M (max)=	7.58	K-FT			
R (max)=	4.55	K			
V (max)=	3.47	K			
fb =	1.10	KSI	OK		
fv =	0.10	KSI	OK		
TL-Deflection =	0.10	IN	L/	829	
DL-Deflection =	0.03	IN	L/	2743	

LATERAL ANALYSIS:

CODES: IBC 2018, ASCE 7-10

SEISMIC:

PROJECT ADDRESS: 5000 WEST MERCER WAY
MERCER ISLAND, WA 98040

* $S_S = 1.439$
  $S_1 = 0.552$

* $F_a = 1.000$
  $F_v = 1.500$

* $S_{DS} = 0.959$
  $S_{D1} = 0.552$

* ABOVE VALUES PER SOIL'S REPORT BY "NELSON GEOTECH. ASSOC., INC." FILE NO. 121520, NOVEMBER 20, 2020.

$I = 1.0$

$R = 6.5$ (WOOD SHEAR WALLS)

$\Omega = 3.0$

$C_d = 4.0$

$\rho = 1.0$ (BY INSPECTION)

KIA CO	Project/Subject: 5000 WEST MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-1/14
		Date: 11-21	Job No.: 17)-2101

$$C_S = \frac{S_{DS}}{(R/I)} = \frac{0.959}{(6.5/1)} = 0.1475$$

$W_{ROOF} = 15\ PSF + 5\ PSF\ (WALLS) = 20\ PSF$

$W_{FLOOR} = 15\ PSF + 10\ PSF\ (WALLS) = 25\ PSF$

$$V = C_S \cdot W = 0.1475\,(20+25) = 6.64\ PSF$$

LEVEL	w_i	H_i	$w_i H_i$	F_i (PSF)	V_i (PSF)	V_i (ASD)
ROOF	20	20'	400	4.09	4.09	$4.09/1.4 = 2.92$ PSF
MAIN	25	10'	250	2.55	6.64	$6.64/1.4 = 4.74$ PSF
			$\Sigma = 650$			

WIND:

$I_W = 1.0$

EXPOSURE ⟶ "B"

BASIC WIND SPEED = 110 MPH

$K_{ZT} = 1.0$

$\lambda = 1.0$

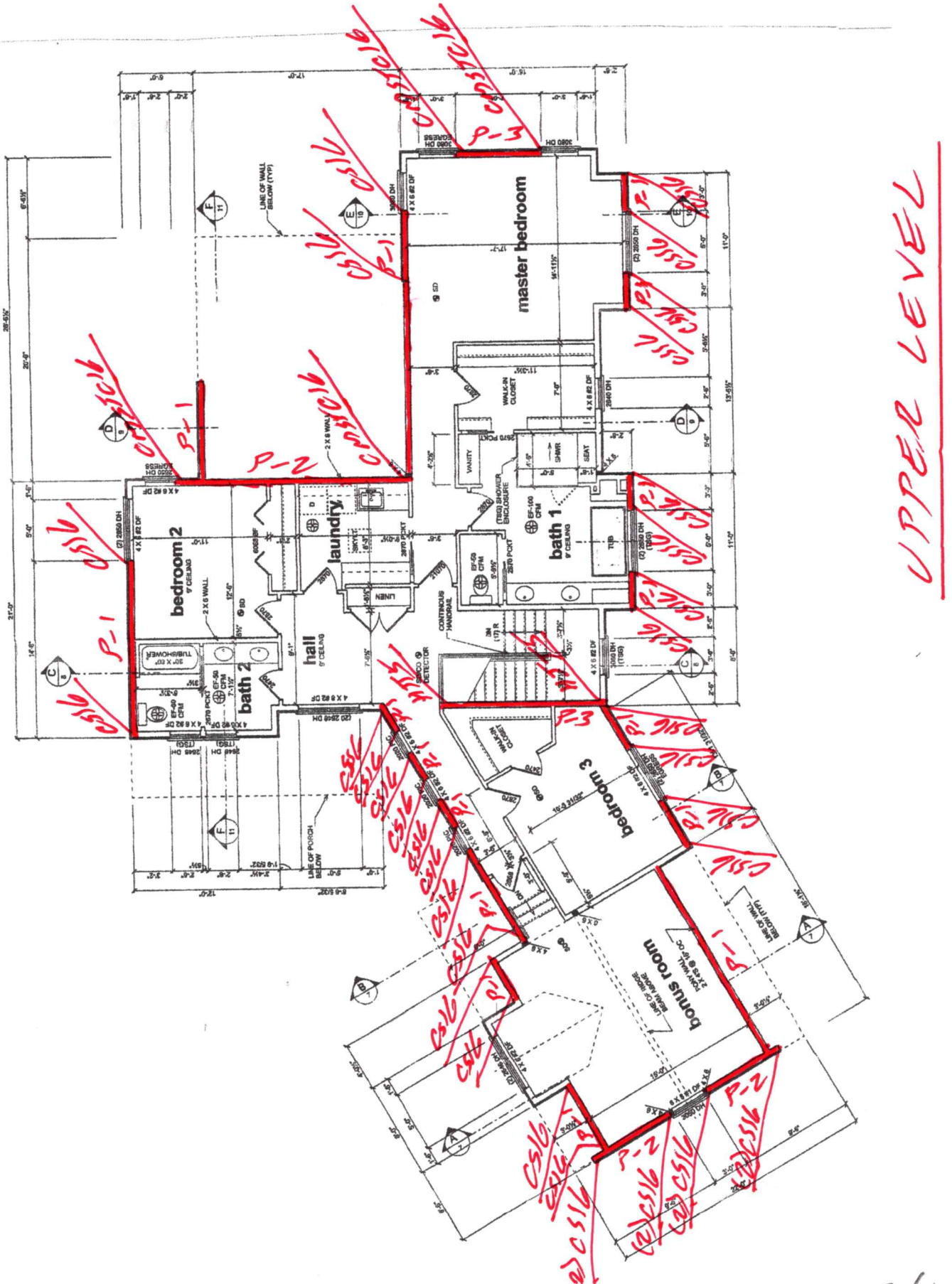
ZONE "A" = 21.6 ZONE "C" = 17.2

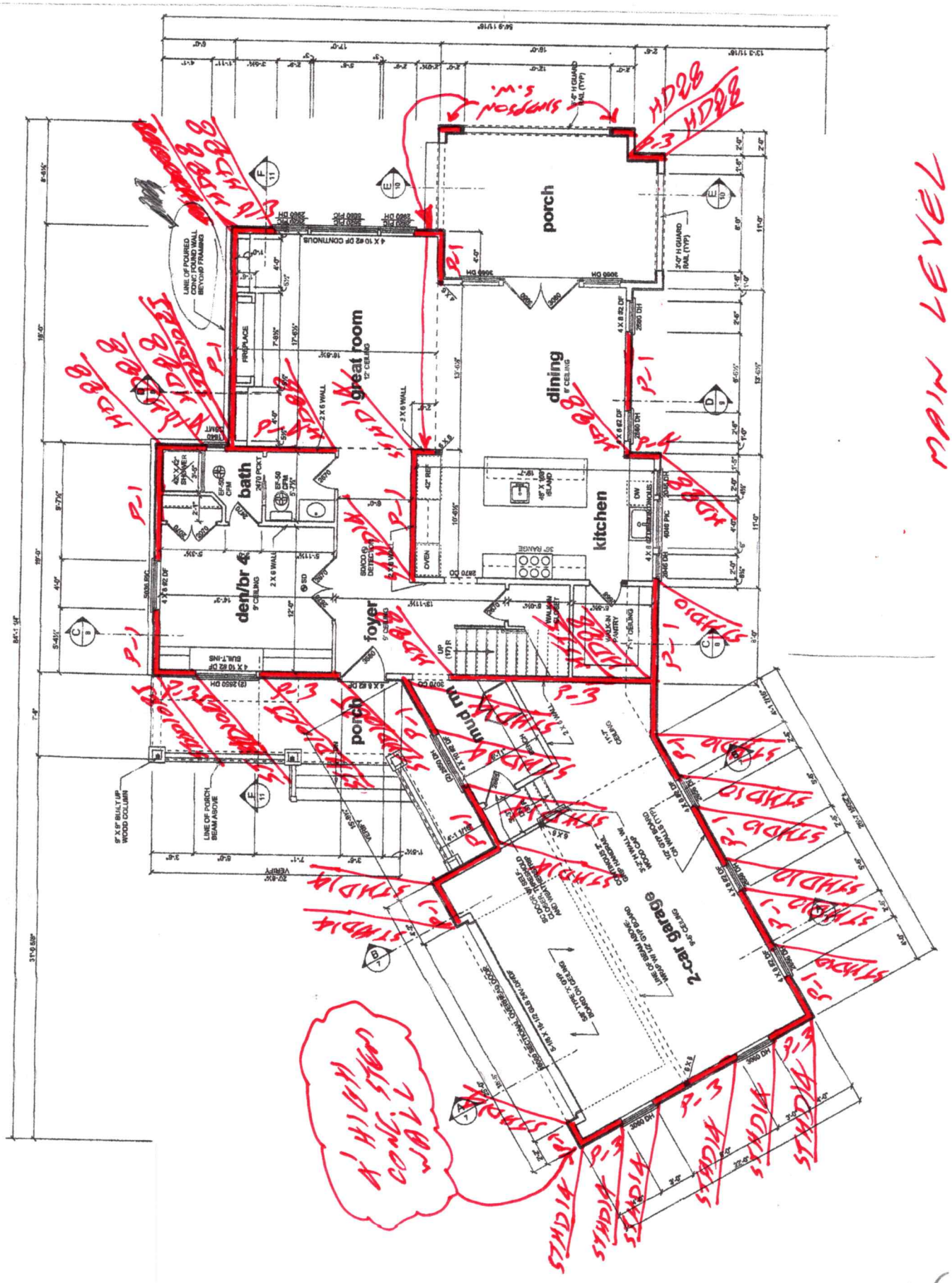
ZONE "B" = 14.8 ZONE "D" = 11.8

WIND SPEED = $21.6\ PSF / 1.6_{ASD} = 13.5\ PSF < 16\ PSF$ (MIN.)

USE: 16 PSF

KIA CO	Project/Subject: 5000 WEST MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-2/14
		Date: 11-21	Job No.: 171-2101


master bedroom
bedroom 2
laundry
hall
bath 1
bath 2
bedroom 3
bonus room
UPPER LEVEL



FOUNDATION PLAN

L-4/14

SHEAR @ UPPER FLOOR:

(SEE L-3 FOR KEY PLAN)

$R1 = 240\ PLF \times 26.5'/2 = 3{,}180\ \#$

$V_1 = 3180\ \#/7' = 454\ PLF \rightarrow$ USE: P-3

$R2 = 240\ PLF \times 47.5'/2 = 5{,}700\ \#$

$V_2 = 5700\ \#/19' = 300\ PLF \rightarrow$ USE: P-2

$R3 = 240\ PLF \times 52'/2 = 6{,}240\ \#$

$V_3 = 6240/13' = 480\ PLF \rightarrow$ USE: P-3

$R4 = 240\ PLF \times 31'/2 = 3{,}720\ \#$

$V_4 = 3720/14' = 266\ PLF \rightarrow$ USE: P-2

$R5 = 240\ PLF \times 23'/2 = 2{,}760\ \#$

$V_5 = 2760/(14.5' + 7.5') = 126\ PLF \rightarrow$ USE: P-1

$R6 = 240\ PLF \times 41.5'/2 = 4{,}980\ \#$

$V_6 = 4980/(6' + 4' + 8' + 20') = 131\ PLF \rightarrow$ USE: P-1

$R7 = 240\ PLF \times 28.5'/2 = 2{,}220\ \#$

$V_7 = 2{,}220/(18' + 6' \times 2 + 3' \times 4) = 58\ PLF \rightarrow$ USE: P-1

KIA CO	Project/Subject: 5000 WEST MERCER WAY, MERCER ISLAND, WA.	By: A.G.	Sheet No.: L-5/14
		Date: 11-21	Job No.: 171-2101

SHEAR @ MAIN LEVEL:

(SEE L-5 FOR KEY PLAN)

$R_8 = 16\,PSF \times 4' \times \frac{8.5'}{2} + 3180\#(UPPER) = 3,452\#$

$V_8 = 3,452\# / (3' + 1.5' + 2) = 575\,PLF \longrightarrow$ USE; SIMPSON S.W.

$R_9 = 240\,PLF \times 18'/2 = 2,160\#$

$V_9 = 2,160\# / (3.5' + 2') = 393\,PLF \longrightarrow$ P-3 + SIMPSON S.W.

$R_{10} = 160\,PLF \times 47.5'/2 + 5,100\#(UPPER) = 9,500\#$

$V_{10} = 9,500\# / (4' + 8.5' + 2') = 576\,PLF \longrightarrow$ USE; P-4 + SIMPSON S.W.

$R_{11} = 160\,PLF \times 52'/2 + 6240\#(UPPER) = 10,400\#$

$V_{11} = 10,400\# / (16' + 7' + 3') = 400\,PLF \longrightarrow$ USE; P-3

$R_{12} = 160\,PLF \times 31'/2 + 3720\#(UPPER) = 6,200\#$

$V_{12} = 6,200\# / (8' + 4' + 4') = 388\,PLF \longrightarrow$ USE; P-3

$R_{13} = 160\,PLF \times 23'/2 + 2760\#(UPPER) = 4,600\#$

$V_{13} = 4600\# / (18' + 9.5' + 5') = 142\,PLF \longrightarrow$ USE; P-1

$R_{14} = 160\,PLF \times 41.5'/2 + 4980\#(UPPER) = 8,300\#$

$V_{14} = 8300\# / (3' + 2' + 6.5' + 2' + 11' + 4') = 244\,PLF \longrightarrow$ USE; P-1

(34')

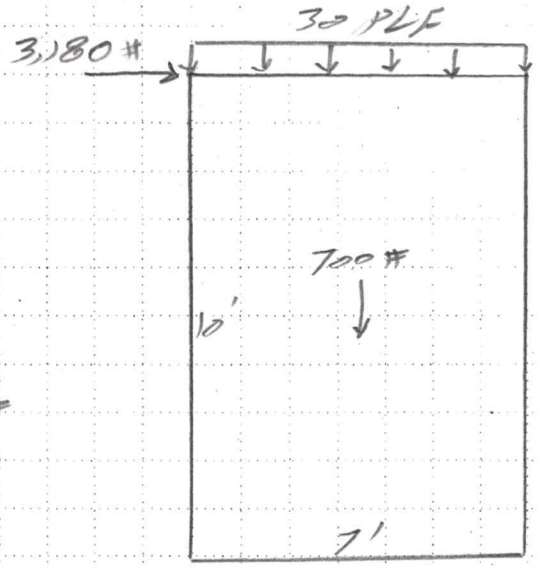
$R_{15} = 160\,PLF \times 30.5'/2 + 2220\#(UPPER) = 4,660\#$

$V_{15} = 4,660\# / (4' \times 2 + 5.5' + 2' + 12' + 6.5') = 124\,PLF \longrightarrow$ USE; P-1

(37.5')

KIA CO	Project/Subject: 5000 WEST MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-6/14
		Date: 11-21	Job No.: 171-210

HOLDOWN @ R1:



$M_{OT} = 31,800$ #'

$0.60 M_R = 1,911$ #'

$M_{NET} = 29,889$ #'

$T = 4,428$ lbs $< 4,585$ #

USE: CMSTC16

HOLDOWN @ R8:

USE: (2) - 24" WALLS

$V_{/WALL} = 3452/2 = 1,726$ #

WSW 24X10

ALLOW. LOAD = 2,215 # - O.K.

KIA CO	Project/Subject: 5000 W MERCER WAY / MERCER ISLAND, WA	By: A.G.	Sheet No.: L-7/54
		Date: 11-21	Job No.: 171-2101

HOLDOWNS R2 & R10:

UPPER LEVEL

$M_{O.T.} = 57{,}000\ \#'$

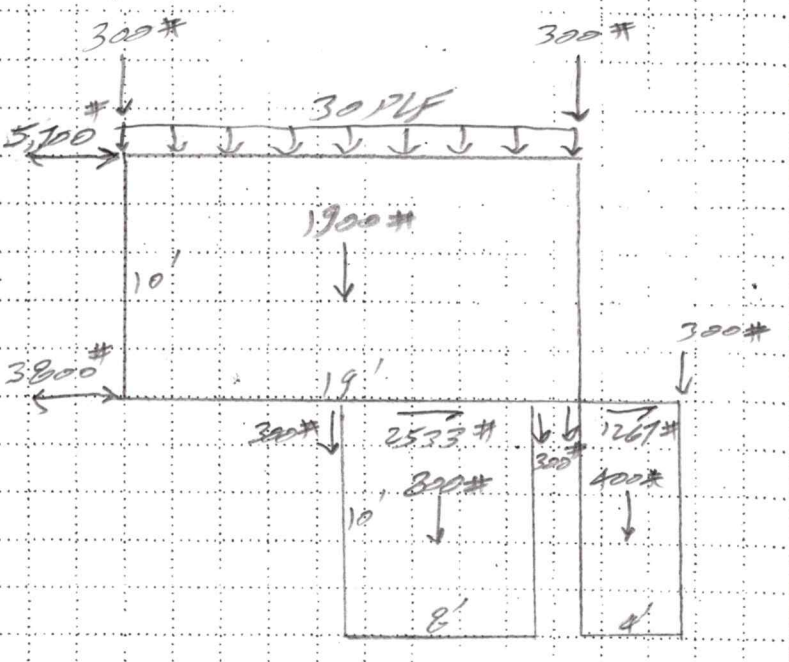
$M_R = 29{,}165\ \#'$

$0.6M_R = 17{,}499\ \#'$

$M_{NET} = 39{,}501\ \#'$

$T_1 = 2{,}135\ \# < 4{,}585\ \#$

USE: CMSTC16



LOWER LEVEL

4'-WALL

$M_{O.T.} = 25{,}330\ \#'$

$M_R = 5{,}600\ \#'$

$0.6M_R = 3{,}360\ \#'$

$M_{NET} = 21{,}970\ \#'$

$T_2 = 2{,}929\ \#$

$T_1 + T_2 = 5{,}064\ \# < 9{,}230\ \#$

HDQ8
W/4x6 DF POST

2'-WALL

$M_{O.T.} = 12{,}670\ \#'$

$M_R = 2{,}000\ \#'$

$0.6M_R = 1{,}200\ \#'$

$M_{NET} = 11{,}470\ \#'$

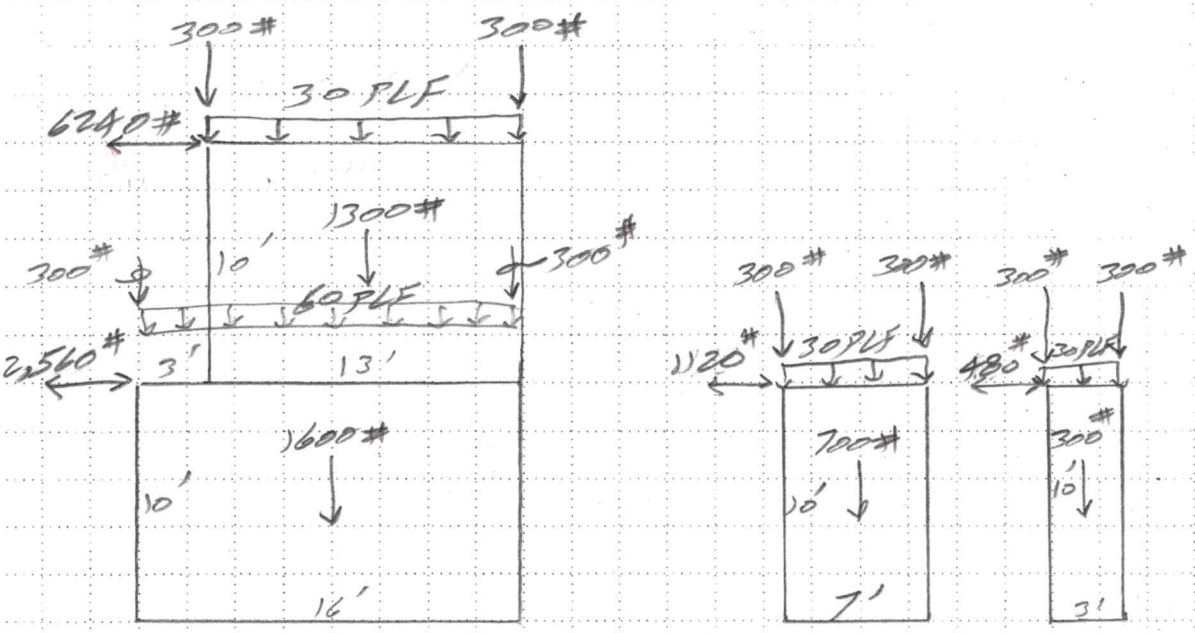
$T_2 = 3{,}277\ \#$

$T_1 + T_2 = 5{,}412\ \# < 9{,}230\ \#$

HDQ8
W/4x6 DF POST

KIA CO	Project/Subject: MORAN RESID. MERCER ISLAND, WA.	By: A.G.	Sheet No.: L-8/14
		Date: 11-21	Job No.: 171-1901

HOLDOWN @ R3 & L11:



UPPER LEVEL:

$M_{O.T.} = 62,400\ \#'$

$M_R = 14,885\ \#'$

$0.6M_R = 8,931\ \#'$

$M_{NET} = 53,469\ \#'$

$T_1 = 4,194\ \# < 4,670\ \#$

HTT5 HOLDOWN w/(2)-2x6 OR 4x6

LOWER LEVEL:

$M_{O.T.} = 150,400\ \#'$

$M_R = 40,165\ \#'$

$0.6M_R = 24,099\ \#'$

$M_{NET} = 126,301\ \#'$

$T = 8,148\ \# < 9,230\ \#$

HDQ8 w/ 4x6 DF POST

$M_{O.T.} = 1,200\ \#'$

$M_R = 5,285\ \#'$

$0.6M_R = 3,171\ \#'$

$M_{NET} = 8,029\ \#'$

$T = 1,190\ \#$

USE: STHD10RS

$M_{O.T.} = 4,800\ \#'$

$M_R = 1,485\ \#'$

$0.6M_R = 891\ \#'$

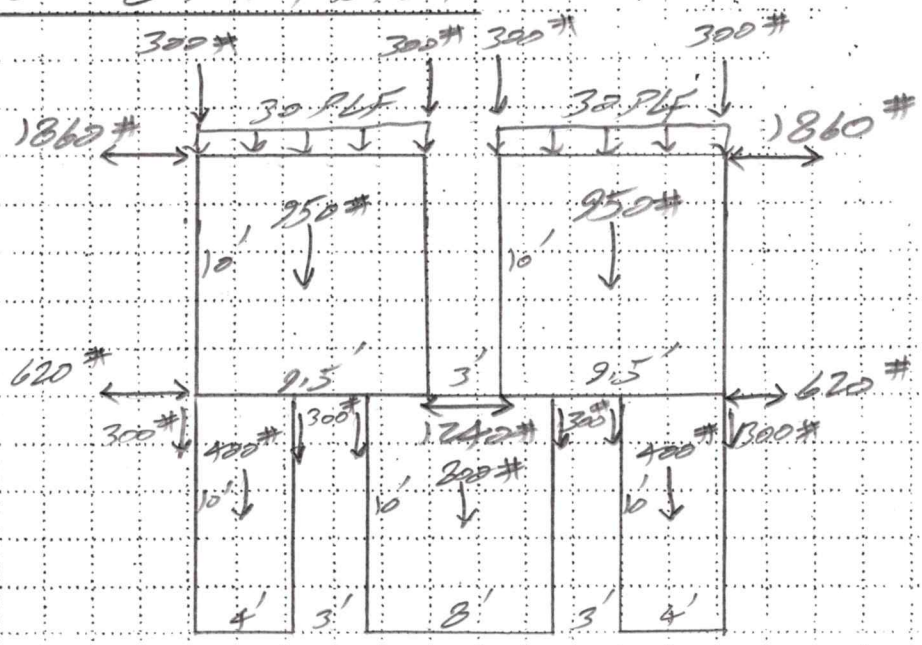
$M_{NET} = 3,909\ \#'$

$T = 1,042\ \#$

USE: STHD10RS

KIA CO	Project/Subject: 5000 WEST MERCER WAY, MERCER ISLAND, WA.	By: A.G.	Sheet No.: L-9/14
		Date: 11-21	Job No.: 171-2101

HOLDOWN @ R4 & L12:



UPPER LEVEL:

$M_{@T_1} = 18,600$ #'

$M_{@2} = 8,736$ #'

$0.6M_{@2} = 5,230$ #'

$M_{NET} = 13,370$ #'

$T_1 = 1,445$ #

USE: (2)-CS16

LOWER LEVEL:

4'-WALL	8'-WALL
$M_{@T_1} = 6,200$ #'	$M_{@T_1} = 12,400$ #'
$M_{@2} = 2,000$ #'	$M_{@2} = 5,600$ #'
$0.6M_{@2} = 1,200$ #'	$0.6M_{@2} = 3,360$ #'
$M_{NET} = 5,000$ #'	$M_{NET} = 9,040$ #
$T_2 = 1,429$ #	$T_2 = 1,205$ #
$T_1 + T_2 = 2,874$ #	$T_1 + T_2 = 2,650$ #
USE: STHD14	USE: STHD14

KIA CO

Project/Subject: MORAN RESIDENCE, MERCER ISLAND, WA

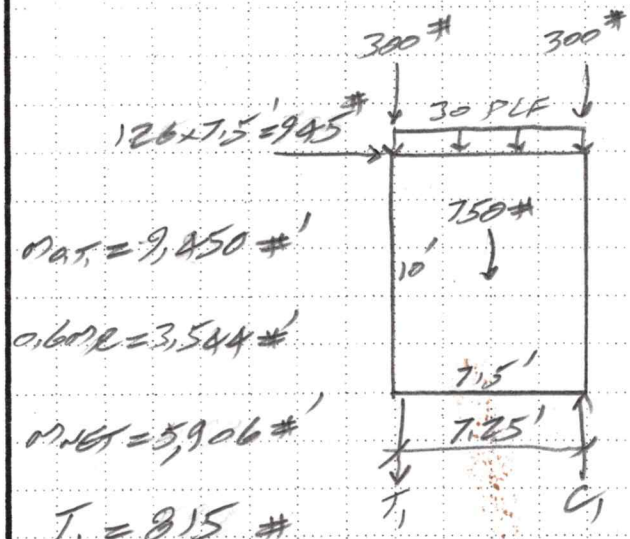
By: A.G.

Sheet No.: L-10/14

Date: 11-21

Job No.: 171-1901

HOLDOWN @ C5 & C13:



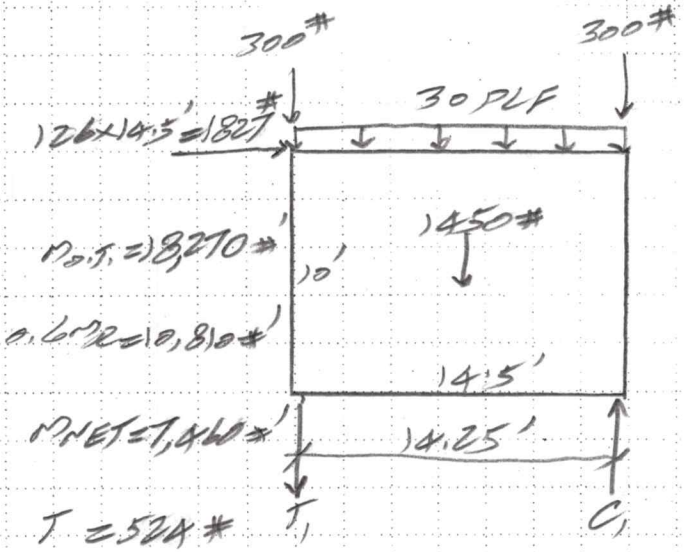
$M_{O.T.} = 9,450\ \#'$

$0.6MR = 3,544\ \#'$

$M_{NET} = 5,906\ \#'$

$T_1 = 815\ \#$

USE: CS16



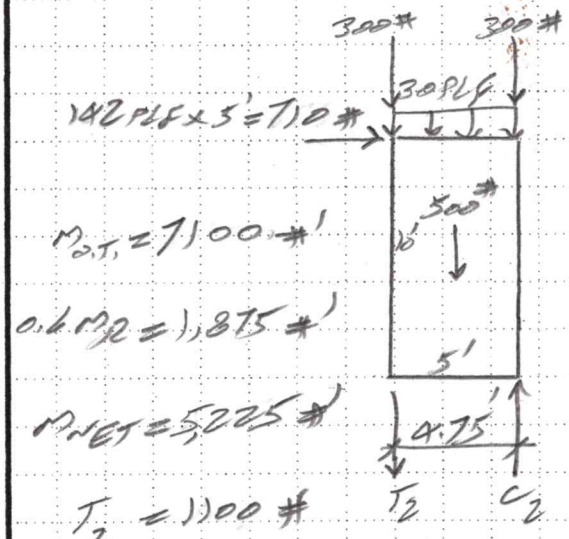
$M_{O.T.} = 18,270\ \#'$

$0.6MR = 10,810\ \#'$

$M_{NET} = 7,460\ \#'$

$T = 524\ \#$

USE: CS16



$M_{O.T.} = 7100\ \#'$

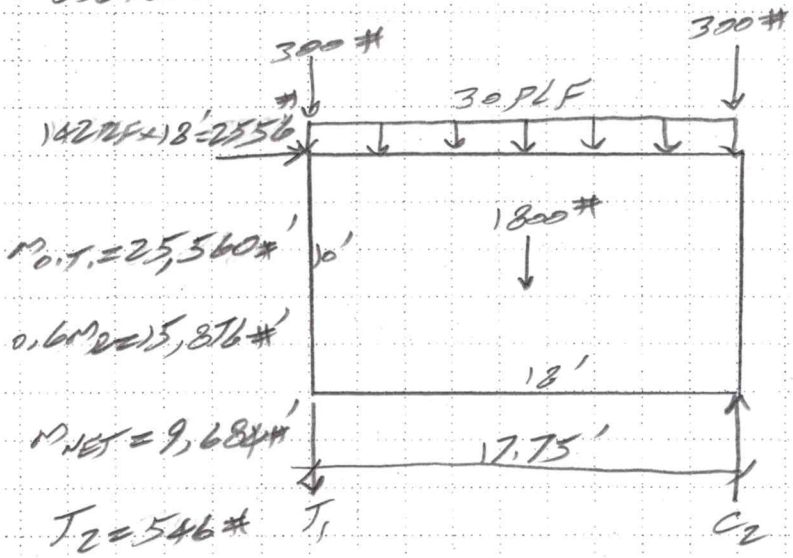
$0.6MR = 1,875\ \#'$

$M_{NET} = 5225\ \#'$

$T_2 = 1100\ \#$

$T_1 + T_2 = 1,915\ \# < 2,175\ \#$

USE: STHD10 RS



$M_{O.T.} = 25,560\ \#'$

$0.6MR = 15,876\ \#'$

$M_{NET} = 9,684\ \#'$

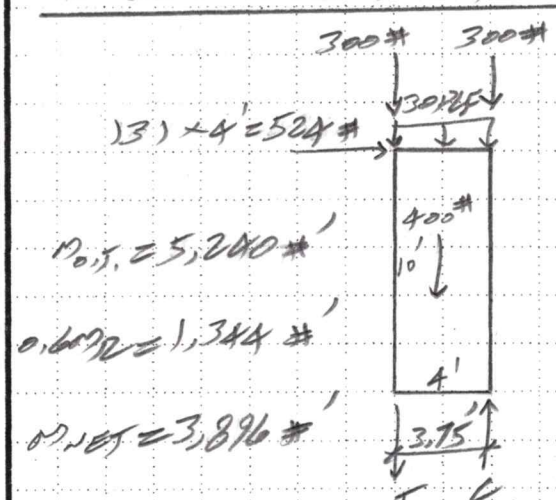
$T_2 = 546\ \#$

$T_1 + T_2 = 1,070\ \# < 2,175\ \#$

USE: STHD10 RS

KIA CO	Project/Subject: 5000 W MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-11/14
		Date: 11-21	Job No.: 171-2101

HOLDOWN @ R6 & R14:



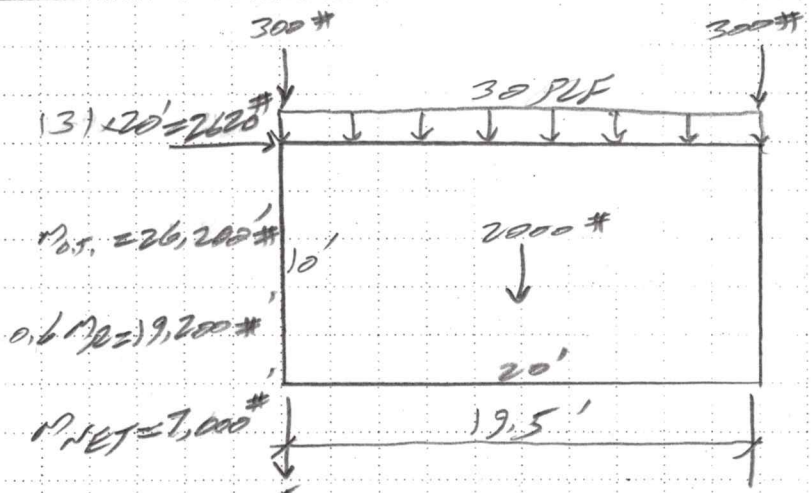
$M_{O.T.} = 5,240\ \#'$

$0.6M_R = 1,344\ \#'$

$M_{NET} = 3,896\ \#'$

$T_1 = 1039\ \#$

USE: CS16



$M_{O.T.} = 26,200\ \#'$

$0.6M_R = 19,200\ \#'$

$M_{NET} = 7,000\ \#'$

$T_1 = 359\ \#$

USE: CS16

$M_{O.T.} = 9,760\ \#'$

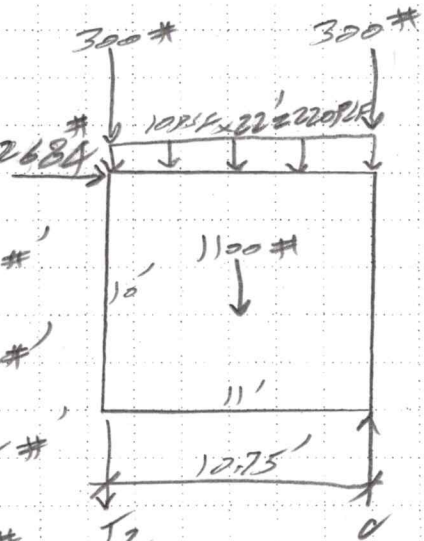
$0.6M_R = 1,536\ \#'$

$M_{NET} = 8,224\ \#'$

$T_2 = 2,193\ \#$

$T_1 + T_2 = 3,232\ \# < 3,500\ \#$

USE: STHD14



$M_{O.T.} = 26,840\ \#'$

$0.6M_R = 13,596\ \#'$

$M_{NET} = 13,244\ \#'$

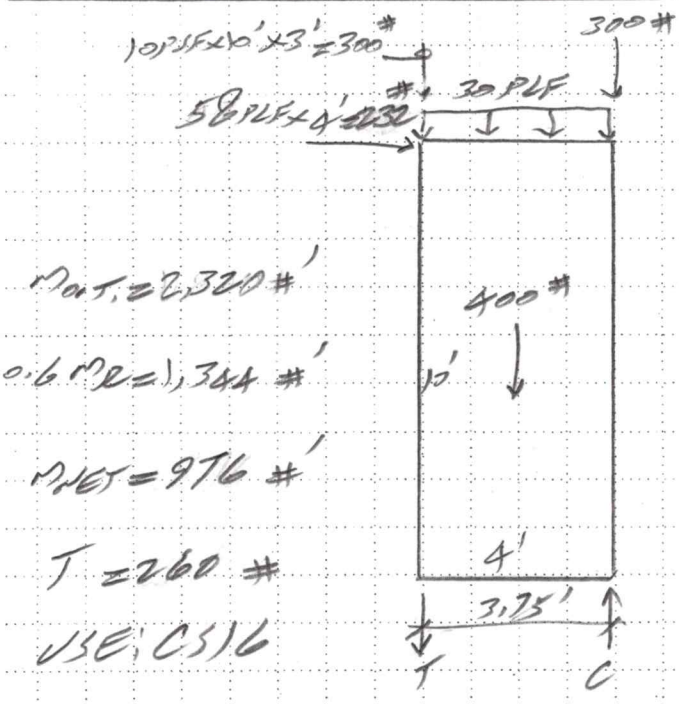
$T_2 = 1232\ \#$

$T_1 + T_2 = 1,591\ \# < 2175\ \#$

USE: STHD10

KIA CO	Project/Subject: 5000 W. MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-12/14
		Date: 11-21	Job No.: 171-2101

HOLDOWN @ L7 & L15:



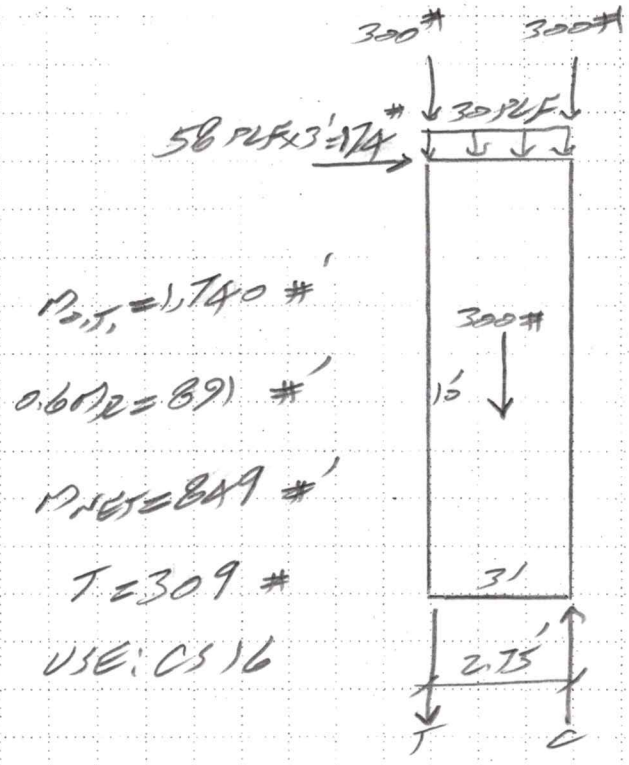
$M_{O.T.} = 2{,}320\ \#'$

$0.6M_E = 1{,}344\ \#'$

$M_{NET} = 976\ \#'$

$T = 260\ \#$

USE: CS16



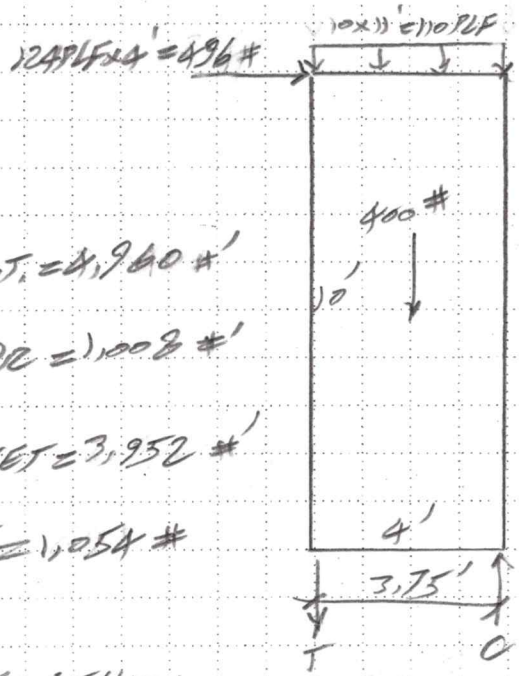
$M_{O.T.} = 1{,}740\ \#'$

$0.6M_E = 891\ \#'$

$M_{NET} = 849\ \#'$

$T = 309\ \#$

USE: CS16



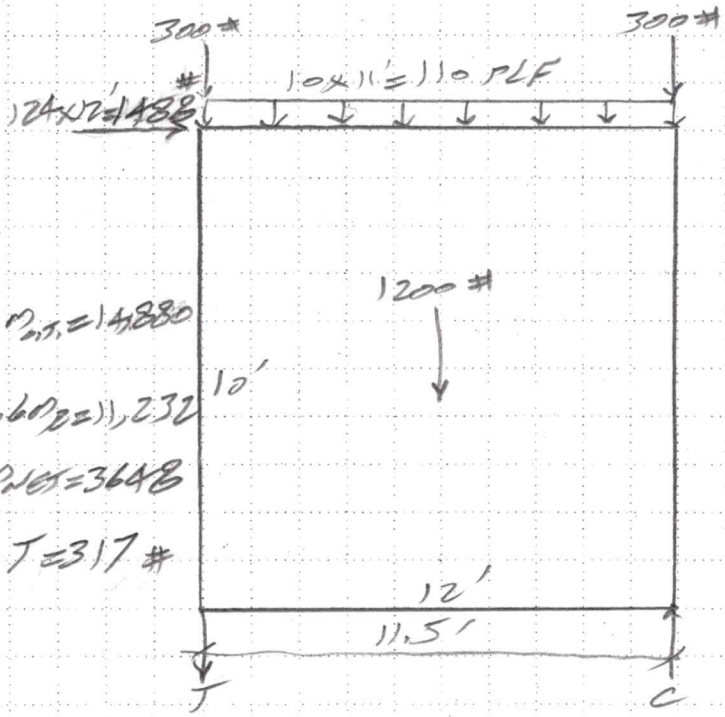
$M_{O.T.} = 4{,}960\ \#'$

$0.6M_E = 1{,}008\ \#'$

$M_{NET} = 3{,}952\ \#'$

$T = 1{,}054\ \#$

USE: STHD10



$M_{O.T.} = 14{,}880$

$0.6M_E = 11{,}232$

$M_{NET} = 3648$

$T = 317\ \#$

USE: STHD10

KIA CO	Project/Subject: 5000 WEST MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-13/14
		Date: 11-21	Job No.: 171-2101

HOLDOWN @ R9:

$V_q = 2,160$ lbs

$M_{O.T.} = 21,600$ #'

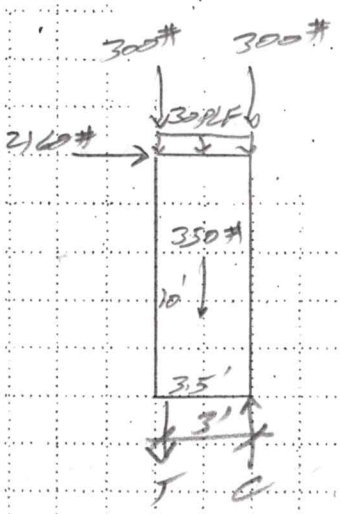
$M_R = 1,846$ #'

$0.6M_R = 1,108$ #'

$M_{NET} = 20,492$ #'

$T = 6,831$ # < 9,230 #

HDE8 W/ 4×6 DF POST



KIA CO	Project/Subject: 5000 W MERCER WAY, MERCER ISLAND, WA	By: A.G.	Sheet No.: L-4/14
		Date: 18-21	Job No.: 171-2101

FOUNDATION DESIGN:

① TYP. EXT. CONT. FTG

ROOF TL = 40 PSF × 10' = 400 PLF

UPPER FLR = 55 PSF × 14'/2 = 385

MAIN FLR = 55 PSF × 14'/2 = 385

FOUND. WALL = 150 × 8"/12 × 6' = 600

FTG = 150 × 8"/12 × 1.5' = 150

TL = 1920 PLF < 1500 PSF × 1.5 = 2250 PLF

② TYP. INT. CONT. FTG

ROOF TL = 40 PSF × 18' = 720 PLF

UPPER FLR = 55 PSF × 19'/2 = 522

MAIN FLR = 55 × 17'/2 = 468

FOUND. WALL = 150 × 8"/12 × 4' = 400

FTG = 150 × 8"/12 × 1.5' = 150

2260 PLF

USE; 2'-0" WIDE CONT. FTG

1500 × 2 = 3000 PLF > 2260 PLF

O.K.

KIA CO	Project/Subject: MORAN RESID. MERCER ISLAND, WA	By: A.G.	Sheet No.: F-1/3
		Date: 11-21	Job No.: 171-1901

(3) TYP. INT. PAD FTG —

UPPER FLR = 55 PSF × 18'/2 × 8' = 3960 #

LOWER FLR = 55 PSF × 18'/2 × 8' = 3960 #

FTG DL = 150 × 10"/12 × 2.5' × 2.5' = 780 #

TL = 8700 #

SOIL BRG = 1500 PSF

Areq'd = 8700/1500 = 5.8 ft²

2'-6" × 2'-6" × 10"
W/ (3) - #4 E.W.

(4) TYP. EXT. FTG @ CATCHMENT WALL —

ROOF TL = 40 PSF × 10' = 400 PLF

UPPER FLR = 55 PSF × 14'/2 = 385

MAIN FLR = 55 PSF × 14'/2 = 385

FOUND. WALL = 150 × 1' × 6' = 900

FTG = 150 × 10"/12 × 2' = 250

TL = 2320 PLF

USE: 2'-0" WIDE CONT. FTG

KIA CO	Project/Subject: MORAN RESID. MERCER ISLAND, WA	By: A.G.	Sheet No.: F-2/3
		Date: 11-21	Job No.: 171-1901

⑤ INT. PAD FTG BELOW DENTFOYER:

$P_{TL} = 5.94K \times 2 = 11.88K$

↑ FROM MFB-4

$Area\,\#d = 11.88/1.5 = 7.92\,SFT$

3'-0" x 3'-0" x 12"

W/(4)-#4 E.W.

KIA CO	Project/Subject: MORAD RESID. MERCER ISLAND, WA.	By: A.G.	Sheet No.: F-3/3
		Date: 11-21	Job No.: 171-1901

Project Title: Moran Residence
Engineer: KIA CO
Project ID: 171-2101
Project Descr:

Cantilevered Retaining Wall

File: 171-2101.ec6

Lic. # : KW-06009143
Kia CO

DESCRIPTION: 4' Building Ret. wall, without building load and Seismic

Calculations per ACI 318-14, TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	3.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft
Vertical component of active Lateral soil pressure options:		
NOT USED for Soil Pressure.		
NOT USED for Sliding Resistance.		
NOT USED for Overturning Resistance.		

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	45.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure	=	200.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Design Summary

Wall Stability Ratios

Overturning	=	3.43 OK
Sliding	=	2.59 OK
Total Bearing Load	=	1,078 lbs
...resultant ecc.	=	3.12 in
Soil Pressure @ Toe	=	700 psf OK
Soil Pressure @ Heel	=	162 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	841 psf
ACI Factored @ Heel	=	195 psf
Footing Shear @ Toe	=	0.9 psi OK
Footing Shear @ Heel	=	4.6 psi OK
Allowable	=	82.2 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	300.0 lbs
less 100% Passive Force	= -	400.0 lbs
less 100% Friction Force	= -	370.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	8.00
Rebar Size	=	# 5
Rebar Spacing	in =	16.00
Rebar Placed at	=	User Spec
Design Data		
fb/FB + fa/Fa	=	**0.057**
Total Force @ Section	lbs =	300.0
Moment....Actual	ft-l =	316.0
Moment.....Allowable	ft-l =	5,515.2
Shear.....Actual	psi =	4.5
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.50
Lap splice if above	in =	12.00
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00
Concrete Data		
f'c	psi =	3,000.0
Fy	psi =	

RTW-1/6

Project Title: Moran Residence
Engineer: KIA CO
Project ID: 171-2101
Project Descr:

Cantilevered Retaining Wall

File: 171-2101.ec6

Lic. # : KW-06009143
Kia CO

DESCRIPTION: 4' Building Ret. wall, without building load and Seismic

Footing Dimensions & Strengths

Toe Width	=	0.92 ft
Heel Width	=	1.58
Total Footing Width	=	2.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 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	=	841	195 psf
Mu' : Upward	=	320	0 ft-lb
Mu' : Downward	=	131	242 ft-lb
Mu: Design	=	189	242 ft-lb
Actual 1-Way Shear	=	0.93	4.63 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 16.00 in
Heel Reinforcing = # 5 @ 16.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	360.0	1.33	480.0
Surcharge over Heel	=			
Toe Active Pressure	=	-60.0	0.67	-40.0
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=			
Total	=	300.0	**O.T.M.** =	440.0

Resisting/Overturning Ratio = **3.43**
Vertical Loads used for Soil Pressure = 1,078.3 lbs

		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Soil Over Heel	=	302.5	2.04	617.6
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Stem	=			
* Axial Live Load on Stem	=			
Soil Over Toe	=	100.8	0.46	46.2
Surcharge Over Toe	=			
Stem Weight(s)	=	300.0	1.25	375.0
Earth @ Stem Transitions	=			
Footing Weight	=	375.0	1.25	468.8
Key Weight	=			
Vert. Component	=			
Total =		1,078.3 lbs	**R.M. =**	1,507.6

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

RJW-2/6

Project Title: Moran Residence
Engineer: KIA CO
Project ID: 171-2101
Project Descr:

Cantilevered Retaining Wall

File: 171-2101.ec6

Lic. # : KW-06009143
Kia CO

DESCRIPTION: 6' Building Ret. wall, without building load and Seismic

Calculations per ACI 318-14, TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Vertical component of active Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	45.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure	=	200.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Design Summary

Wall Stability Ratios

Overturning	=	2.94 OK
Sliding	=	1.50 OK
Total Bearing Load	=	2,079 lbs
...resultant ecc.	=	4.80 in
Soil Pressure @ Toe	=	910 psf OK
Soil Pressure @ Heel	=	200 psf OK
Allowable	=	1,500 psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,092 psf
ACI Factored @ Heel	=	240 psf
Footing Shear @ Toe	=	5.2 psi OK
Footing Shear @ Heel	=	11.4 psi OK
Allowable	=	82.2 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	750.0 lbs
less 100% Passive Force	= -	400.0 lbs
less 100% Friction Force	= -	720.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	8.00
Rebar Size	=	# 5
Rebar Spacing	in =	12.00
Rebar Placed at	=	User Spec

Design Data

fb/FB + fa/Fa	=	**0.206**
Total Force @ Section	lbs =	876.0
Moment....Actual	ft-l =	1,492.0
Moment.....Allowable	ft-l =	7,247.3
Shear.....Actual	psi =	13.3
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.50
Lap splice if above	in =	12.00
Lap splice if below	in =	6.00
Hook embed into footing	in =	6.00

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	

2Tw-3/6

Project Title: Moran Residence
Engineer: KIA CO
Project ID: 171-2101
Project Descr:

Cantilevered Retaining Wall

File: 171-2101.ec6

Lic. # : KW-06009143
Kia CO

DESCRIPTION: 6' Building Ret. wall, without building load and Seismic

Footing Dimensions & Strengths

Toe Width	=	1.54 ft
Heel Width	=	2.21
Total Footing Width	=	3.75
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	5.17 ft

f'c = 3,000 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	=	1,092	240 psf
Mu' : Upward	=	1,158	0 ft-lb
Mu' : Downward	=	371	998 ft-lb
Mu: Design	=	787	998 ft-lb
Actual 1-Way Shear	=	5.23	11.36 psi
Allow 1-Way Shear	=	82.16	82.16 psi
Toe Reinforcing	=	# 5 @ 12.00 in	
Heel Reinforcing	=	# 5 @ 12.00 in	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	810.0	2.00	1,620.0	Soil Over Heel	= 847.6	2.98	2,524.5
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Toe Active Pressure	=	-60.0	0.67	-40.0	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	= 169.5	0.77	130.6
					Surcharge Over Toe	=		
					Stem Weight(s)	= 500.0	1.87	937.2
					Earth @ Stem Transitions	=		
					Footing Weight	= 562.3	1.87	1,054.1
					Key Weight	=	5.17	
					Vert. Component	=		
Total	=	750.0	**O.T.M.** =	1,580.0	**Total =**	2,079.5 lbs	**R.M. =**	4,646.5

Resisting/Overturning Ratio = **2.94**
Vertical Loads used for Soil Pressure = 2,079.5 lbs

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

RTW-4/6

Project Title: Moran Residence
Engineer: KIA CO
Project ID: 171-2101
Project Descr:

Cantilevered Retaining Wall

File: 171-2101.ec6

Lic. # : KW-06009143
Kia CO

DESCRIPTION: 8' Building Ret. wall, without building load and Seismic

Calculations per ACI 318-14, TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	6.83 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Vertical component of active Lateral soil pressure options:
NOT USED for Soil Pressure.
NOT USED for Sliding Resistance.
NOT USED for Overturning Resistance.

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	45.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure	=	200.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

Design Summary

Wall Stability Ratios

Overturning	=	3.74 OK
Sliding	=	1.38 Ratio < 1.5!
Total Bearing Load	=	4,065 lbs
...resultant ecc.	=	3.87 in
Soil Pressure @ Toe	=	945 psf OK
Soil Pressure @ Heel	=	469 psf OK
Allowable	=	1,500 psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,134 psf
ACI Factored @ Heel	=	563 psf
Footing Shear @ Toe	=	7.4 psi OK
Footing Shear @ Heel	=	22.8 psi OK
Allowable	=	82.2 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	1,368.4 lbs
less 100% Passive Force	= -	469.4 lbs
less 100% Friction Force	= -	1,420.9 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	160.2 lbs NG

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	in =	8.00
Rebar Size	=	# 5
Rebar Spacing	in =	12.00
Rebar Placed at	=	User Spec

Design Data

fb/FB + fa/Fa	=	**0.526**
Total Force @ Section	lbs =	1,655.4
Moment....Actual	ft-l =	3,815.3
Moment.....Allowable	ft-l =	7,247.3
Shear.....Actual	psi =	25.1
Shear.....Allowable	psi =	82.2
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.50
Lap splice if above	in =	12.00
Lap splice if below	in =	9.59
Hook embed into footing	in =	9.59

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	

RT-5/6

Project Title: Moran Residence
Engineer: KIA CO
Project ID: 171-2101
Project Descr:

Cantilevered Retaining Wall

File: 171-2101.ec6

Lic. # : KW-06009143
Kia CO

DESCRIPTION: 8' Building Ret. wall, without building load and Seismic

Footing Dimensions & Strengths

Toe Width	=	2.25 ft
Heel Width	=	3.50
Total Footing Width	=	5.75
Footing Thickness	=	14.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	5.17 ft

f'c = 3,000 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	=	1,134	563 psf
Mu' : Upward	=	2,682	0 ft-lb
Mu' : Downward	=	866	0 ft-lb
Mu: Design	=	1,817	3,815 ft-lb
Actual 1-Way Shear	=	7.42	22.82 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-lb		.....RESISTING..... Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	1,438.8	2.67	3,835.2	Soil Over Heel	= 2,128.7	4.33	9,224.3
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Toe Active Pressure	=	-70.4	0.72	-50.9	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	= 247.5	1.13	278.4
					Surcharge Over Toe	=		
					Stem Weight(s)	= 683.0	2.58	1,764.4
					Earth @ Stem Transitions	=		
					Footing Weight	= 1,006.3	2.88	2,893.0
					Key Weight	=	5.17	
					Vert. Component	=		
Total	=	1,368.4	**O.T.M.** =	3,784.3	**Total =**	4,065.4 lbs	**R.M. =**	14,160.1

Resisting/Overturning Ratio = **3.74**
Vertical Loads used for Soil Pressure = 4,065.4 lbs

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

RTW-6/6