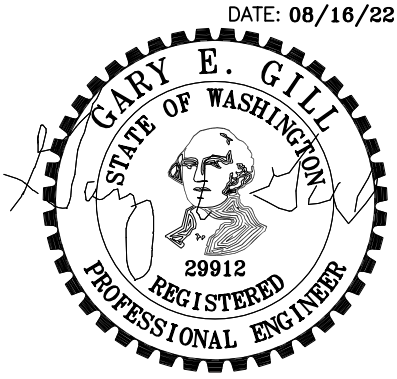
WEST VIEW RESIDENCE

4045 West Mercer Way
Mercer Island, WA 98040

Supplemental Structural
Calculations

DATE: **08/16/22**



EXPIRES: **10/11/23**

Prepared By:
Gary E. Gill, SE
1125 NE 152nd Street
Shoreline, WA 98155
206-992-2728
gill26608@yahoo.com

West View Residence Permit Comments Response Narrative

A geotechnical comment caused a review of the height of the catchment requirement for the west wall of the garage. The height was increased from 7 feet of catchment to 8.5 feet. This caused me to revise the calculations for the garage wall and the battered pipe piles and the permanent shoring that resists the lateral impact of the catchment. I have submitted revised Risa 3D output for the garage wall and mat foundation as well as revised calculations for the wall and mat reinforcing. Another geotechnical comment concerning the amount of excavation required in the area of pile P19-P24 caused me to lower the excavation in front of these piles and revise the calculations for this area of the shoring. This also caused me to revise the shoring for P24, P27 and P28. Another geotechnical comment caused the relocation of temporary piles P12 and P13. The supplemental calculations include revised calculations for the piles and tiebacks that have changed. The other areas that have been commented on and subsequently revised are adequately described in the review comments themselves.

Subsequently, a second chimney was added on the north end of the main residence. Calculations for this change have also been included in this response.

Please let me know if there is any information that I can provide during your review to facilitate your review. I can be reached at 206-992-2728 and welcome an opportunity to assist you in understanding this project and my approach to it. Please don't hesitate to call.

Design Criteria

Address: West View Residence
4045 West Mercer Way
Mercer Island, WA 98040

Seismic (2018 IBC)

Sds := .948 soil factors assuming site class D

Wind (ASCE 7-16)

Wind Speed = 97 mph Exposure D Kzt = 1.0
(exposure and Kzt from Google Earth)

V := 110

Roof Snow (ASCE 7-10)

Pg := 30 psf ws := Pg

Dead Loads

Roof

Ballast
Roofing Metal Roofing
sheathing 5/8" pw
purlins 11 7/8"TJI@24"
beams 5 1/4X12PSL@12'
insul 10" BATT
ceiling 5/8 gyp
Mech/misc

rcob := 0
rf := 1
shtg := 1.9
rpurl := 2.0
rbm := 1.3
rins := 1
rclg := 2.2
rspac := 2.6

wr := rcob + rf + shtg + rpurl + rbm + rins + rspac + rclg
wr = 12 psf

2nd Floor

Flooring hardwood
Sheathing 2 layers 3/4" pw
purlins 11 7/8"TJI@ 16"
beams w10x30 @ 25'
Ceiling 5/8 gyp
Topping 1.5" gypcrete
Misc/Mech

lf := 2
lshtg := 4.3
lpurl := 3
lbm := 2.4
lclg := 2.2
ltpg := 13.8
lmisc := 2.3

w2 := lf + lpurl + lbm + lclg + lshtg + lmisc + ltpg
w2 = 30 psf w2l := 40

1st Floor

Flooring hardwood
Sheathing 2 layers 3/4" pw
purlins 11 7/8"TJI@ 16"
beams w10x30 @ 25'
Ceiling 5/8 gyp
Topping 1.5" gypcrete
Misc/Mech

lf := 2
lshtg := 4.3
lpurl := 3
lbm := 2.4
lclg := 2.2
ltpg := 13.8
lmisc := 2.3

w1 := lf + lpurl + lbm + lclg + lshtg + lmisc + ltpg
w1 = 30 psf w1l := 40

Lateral

Seismic

Main Residence

$AreaURoof := 25.17 \cdot 79$ $WUroof := AreaURoof \cdot (wr + 2)$ $WUroof = 27838$

$Ct := .028$ $x := .8$ $hn := 22$ $Ta := Ct \cdot hn^{x}$ $Ta = 0.3$

$Rlong := 3.5$ $Cslong := \frac{Sds}{Rlong \cdot 1.4}$ $Cslong = 0.19$ above min and below max

$Cslongmax := \frac{Sds}{Rlong \cdot Ta \cdot 1.4}$ $Cslongmax = 0.6$ $Cslongmin := .044 \cdot Sds$ $Cslongmin = 0.042$

$Ct := .02$ $x := .75$ $hn := 22$ $Ta := Ct \cdot hn^{x}$ $Ta = 0.2$

$Rtrans := 6.5$ $Cstrans := \frac{Sds}{Rtrans \cdot 1.4}$ $Cstrans = 0.1$

$Area2ndFloor := 2050$

$Area1stFloor := 2050$

$W2ndFloor := Area2ndFloor \cdot (w2 + 3)$

$W2ndFloor = 67650$

$W1stFloor := Area1stFloor \cdot (w1 + 3)$

$W1stFloor = 67650$

$hr := 33$ $hrxWroof := hr \cdot WUroof$ $hrxWroof = 918654.7$

$h2 := 20.5$ $h2xW2ndFloor := h2 \cdot W2ndFloor$ $h2xW2ndFloor = 1386825$

$h1 := 10.25$ $h1xW1stFloor := h1 \cdot W1stFloor$ $h1xW1stFloor = 693412.5$

$SumhxW := hrxWroof + h2xW2ndFloor + h1xW1stFloor$ $SumhxW = 2998892.2$

$Csr := \frac{hrxWroof}{SumhxW}$ $Csr = 0.3$

$Cs2 := \frac{h2xW2ndFloor}{SumhxW}$ $Cs2 = 0.5$

$Cs1 := \frac{h1xW1stFloor}{SumhxW}$ $Cs1 = 0.2$

$Wtot := WUroof + W2ndFloor + W1stFloor$ $Wtot = 163138$

$Vsrlong := Wtot \cdot Csr \cdot Cslong$ $Vsrlong = 9668.5$

$Vsrtrans := Wtot \cdot Csr \cdot Cstrans$ $Vsrtrans = 5206.1$

$Vs2long := Wtot \cdot Cs2 \cdot Cslong$ $Vs2long = 14595.8$

$Vs2trans := Wtot \cdot Cs2 \cdot Cstrans$ $Vs2trans = 7859.3$

$Vs1long := Wtot \cdot Cs1 \cdot Cslong$ $Vs1long = 7297.9$

$Vs1trans := Wtot \cdot Cs1 \cdot Cstrans$ $Vs1trans = 3929.6$

$Vsrtrans + Vs2trans + Vs1trans = 16995$

$Vsrlong + Vs2long + Vs1long = 31562.2$

Wind

Basic Wind Speed $BWS := 110$ mph Exposure C

$Alpha := 9.5$ $Zg := 900$ $Ht := 33$

$Kd := .85$ $Kz := 2.01 \cdot \left(\frac{Ht}{Zg}\right)^{\frac{2}{Alpha}}$ $Kz = 1$ $Kzt := 1.0$

$q := .00256 \cdot Kd \cdot Kz \cdot Kzt \cdot \frac{BWS^2}{1.4}$ $q = 18.8$

$Vwrlong := 33 \cdot 6 \cdot q$ $Vwrlong = 3731.8$

$Vwrtrans := 78 \cdot 6 \cdot q$ $Vwrtrans = 8820.6$

$Vw2long := 33 \cdot 11.375 \cdot q$ $Vw2trans := 78 \cdot 11.375 \cdot q$

$Vw2long = 7074.9$ $Vw2trans = 16722.4$

$Vw1long := 33 \cdot 10.25 \cdot q$ $Vw1trans := 78 \cdot 10.25 \cdot q$

$Vw1long = 6375.2$ $Vw1trans = 15068.6$

$Vwlong := Vwrlong + Vw2long + Vw1long$

$Vwlong = 17181.8$

$Vwtrans := Vwrtrans + Vw2trans + Vw1trans$

$Vwtrans = 40611.6$

Wind Controls in transverse direction, seismic Controls in longitudinal direction

Shear Walls

2nd Floor to Roof

Shear Wall Redundancy

As long as twice the total shear wall length divided by the story height is greater than or equal to 2, a redundancy factor of 1.0 is allowed.

$H := 11.5$

$L1 := 7.33$ $L1 = 7.3$ $NoBays := \frac{2L1}{H}$ $NoBays = 1.27$ $r1 := 1.3$

$L2 := 2 \cdot 2.66$ $L2 = 5.3$ $NoBays := \frac{2 \cdot L2}{2.5}$ $NoBays = 4.3$ $r2 := 1.0$

$L3 := 7.33$ $L3 = 7.3$ $NoBays := \frac{2 \cdot L3}{H}$ $NoBays = 1.3$ $r3 := 1.3$

Moment Frame A consists of 4 bays therefore rA = 1.0 $rA := 1.0$

$H := 9.5$

$LB := 16.25 + 12$ $LB = 28.3$ $NoBays := \frac{2 \cdot LB}{H}$ $NoBays = 5.9$ $rB := 1.0$

$LC := 8.66 + 3.79$ $LC = 12.4$ $NoBays := \frac{2 \cdot LC}{H}$ $NoBays = 2.6$ $rC := 1.0$

$LD := 8.07 + 12.84$ $LD = 20.9$ $NoBays := \frac{2LD}{H}$ $NoBays = 4.4$ $rD := 1.0$

Shear Wall S1

$L := L1 \quad H := 12.5 \quad r := r1$

$Vs := r \cdot Vsrtrans \cdot \frac{53}{78 \cdot 2}$ $Vs = 2299.4$ $Vw := \frac{Vwrtrans \cdot 53}{78 \cdot 2}$ $Vw = 2996.8$ $V := Vw$

$v := \frac{V}{L}$ $v = 408.8$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2}$ $HD = 4652.3$ **Use: SW2 & HD3**

Shear transfer from roof to shear wall

$vlvl := \frac{V}{L1}$ $vlvl = 408.8$ Use: 10d @ 3" to rim joist in wall.

$vpsl := \frac{V}{17.5}$ $vpsl = 171.2$ Use: 10d @ 4" to PSL beam.

Shear Wall S2

$L := L2 \quad H := 2 \quad r := r2$

$Vs := r \cdot Vsrtrans \cdot (.5) \quad Vs = 2603.1 \quad Vw := \frac{Vwrtrans}{2} \quad Vw = 4410.3 \quad V := Vw$

$v := \frac{V}{L} \quad v = 829 \quad Lreq := \frac{v}{770} \cdot \frac{L}{2} \quad Lreq = 2.9$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2} \quad HD = 1604.8$ **Use: SW5 & HD1**

Shear Wall S3

$L := L3 \quad H := 12.5 \quad r := r3$

$Vs := r \cdot Vsrtrans \cdot \frac{25}{78 \cdot 2} \quad Vs = 1084.6 \quad Vw := \frac{Vwrtrans \cdot 25}{78 \cdot 2} \quad Vw = 1413.6 \quad V := Vw$

$v := \frac{V}{L} \quad v = 192.8$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2} \quad HD = 1952.5$ **Use: SW1 & HD1**

Shear transfer from roof to shear wall

$vlvl := \frac{V}{L3} \quad vlvl = 192.8$ Use: 10d @ 3" to rim joist in wall.

$vpsl := \frac{V}{17.5} \quad vpsl = 80.8$ Use: 10d @ 4" to PSL beam.

Moment Frame MA

$H := 12.5 \quad r := rA$

$Vs := r \cdot Vsrlong \cdot \frac{17.5}{33 \cdot 2} \quad Vs = 2563.6 \quad Vw := \frac{Vwrlong \cdot 17.5}{33 \cdot 2} \quad Vw = 989.5 \quad V := Vs$

See Risa Model for design of moment frame

Shear Wall SB

$L := LB \quad H := 11 \quad r := r1$

$Vs := r \cdot Vsrlong \cdot .5 \quad Vs = 6284.5 \quad Vw := \frac{Vwrlong}{2} \quad Vw = 1865.9 \quad V := Vs$

$v := \frac{V}{L} \quad v = 222.5$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2} \quad HD = 893.3$ **Use: SW1 & HD1**

Shear Wall SC

$L := LC \quad H := 8 \qquad r := r1$

$Vs := r \cdot Vsrlong \cdot .25 \qquad Vs = 3142.3 \qquad Vw := \frac{Vwrlong}{4} \qquad Vw = 933 \qquad V := Vs$

$v := \frac{V}{L} \qquad v = 252.4$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2} \qquad HD = 1521.1$ **Use: SW1 & HD1**

Shear Wall SD

$L := LD \quad H := 8 \qquad r := r1$

$Vs := r \cdot Vsrlong \cdot .5 \qquad Vs = 6284.5 \qquad Vw := \frac{Vwrlong}{2} \qquad Vw = 1865.9 \qquad V := Vs$

$v := \frac{V}{L} \qquad v = 300.6$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2} \qquad HD = 1568$ **Use: SW1 & HD2**

1st Floor to 2nd Floor

Shear Wall Redundancy

As long as twice the total shear wall length divided by the story height is greater than or equal to 2, a redundancy factor of 1.0 is allowed.

$H := 9.5$

$L1 := 13.14 \qquad L1 = 13.1 \qquad NoBays := \frac{2L1}{H} \qquad NoBays = 2.77 \qquad r1 := 1.0$

$L13 := 7.5 \qquad L13 = 7.5 \qquad NoBays := \frac{2L13}{H} \qquad NoBays = 1.58 \qquad r13 := 1.3$

$L17 := 7.5 \qquad L17 = 7.5 \qquad NoBays := \frac{2L17}{H} \qquad NoBays = 1.58 \qquad r17 := 1.3$

$L2 := 8 \qquad L2 = 8 \qquad NoBays := \frac{2 \cdot L2}{H} \qquad NoBays = 1.7 \qquad r2 := 1.3$

$L3 := 13 \qquad L3 = 13 \qquad NoBays := \frac{2 \cdot L3}{H} \qquad NoBays = 2.7 \qquad r3 := 1.0$

Moment Frame A consists of 4 bays therefore rA = 1.0 $rA := 1.0$

$H := 9.5$

$LA7 := 16.75 \qquad LA7 = 16.8 \qquad NoBays := \frac{2 \cdot LA7}{H} \qquad NoBays = 3.5 \qquad rA7 := 1.0$

$LB := 22.5 + 16.25 + 4.93 + 12.5$ $LB = 56.2$ $NoBays := \frac{2 \cdot LB}{H}$ $NoBays = 11.8$ $rB := 1.0$

$LC := 7.5 + 35.5$ $LC = 43$ $NoBays := \frac{2 \cdot LC}{H}$ $NoBays = 9.1$ $rC := 1.0$

$LD := 24$ $LD = 24$ $NoBays := \frac{2LD}{H}$ $NoBays = 5.1$ $rD := 1.0$

Shear Wall S1

$L := L1 \quad H := 9.5 \quad r := r1$

$Vs := r \cdot (Vsrtrans + Vs2trans) \cdot \frac{8}{2 \cdot 78}$ $Vs = 670$

$Vw := \frac{(Vwrtrans + Vw2trans) \cdot 8}{78 \cdot 2}$ $Vw = 1309.9$ $V := Vw$

$v := \frac{V}{L}$ $v = 99.7$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2}$ $HD = 322.9$ **Use: SW2 & HD3**

Shear Wall S1.3

$L := L13 \quad H := 9.5 \quad r := r13$

$Vs := r \cdot (Vsrtrans + Vs2trans) \cdot \frac{8 + 18.5}{2 \cdot 78}$ $Vs = 2885.3$

$Vw := \frac{(Vwrtrans + Vw2trans) \cdot (8 + 18.5)}{78 \cdot 2}$ $Vw = 4339$ $V := Vw$

$v := \frac{V}{L}$ $v = 578.5$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2}$ $HD = 5139.9$ **Use: SW3 & HD4**

Shear Wall S1.7

$L := L17 \quad H := 9.5 \quad r := r17$

$Vs := r \cdot (Vsrtrans + Vs2trans) \cdot \frac{12 + 18.5}{2 \cdot 78}$ $Vs = 3320.8$

$Vw := \frac{(Vwrtrans + Vw2trans) \cdot (12 + 18.5)}{78 \cdot 2}$ $Vw = 4994$ $V := Vw$

$v := \frac{V}{L}$ $v = 665.9$

$HD := v \cdot H - H \cdot 10 \cdot \frac{L}{2}$ $HD = 5969.5$ **Use: SW3 & HD4**

CHIMNEY SHEAR WALL OFFSETS

2ND FLOOR SI

$V_2 = 8351 - 2997 = 5354$

$v_1 = 5354/7.33 = 730$ PLF

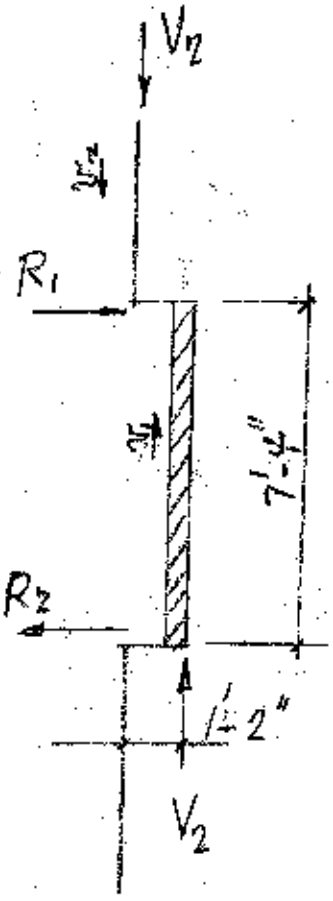
USE: BLOCKED DIAPHRAGM
W/ 10d @ 4"

$v_{ALL} = 1780/2 = 890$ PLF ok

$v_2 = 5354/18.66 = 287$ PLF

USE: UNBLOCKED DIAPHRAGM
W/ 10d @ 4" oc

$R_1 = R_2 = 5354(1.17)/7.33 = 855^{\#}$



BLOCK 3 JST SPACES @
STRAP W/ CS16 W/ 20-.148"Ø x 2½"
NAILS EA END

1ST FLOOR

$V_1 = 5354$ $v_1 = 287$ PLF UNBLOCKED DIAPH ok

DIAPHRAGM CONNECTS DIRECTLY TO CONC WALLS
& SW CONNECTS DIRECTLY TO CONC WALL SO NO
DIAPH TRANSFER REQ'D AT THIS LEVEL.

SW01

CHIMNEY SHEAR WALL OFFSETS

2ND FLOOR S3

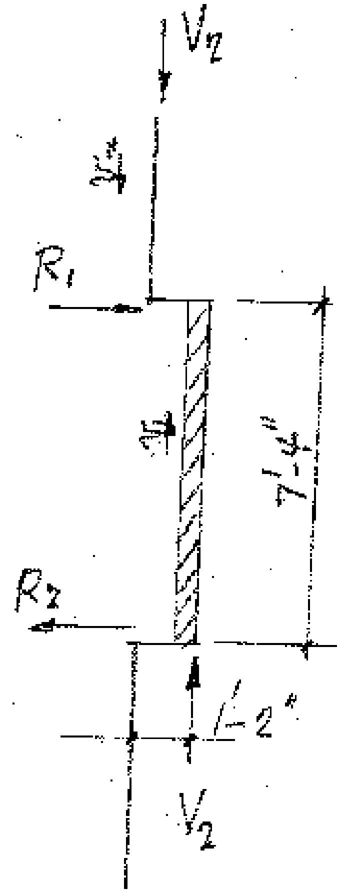
$V_2 = 6386 - 1414 = 4972$

$v_1 = 4972/7.33 = 678$ PLF

USE: BLOCKED DIAPHRAGM
W/ 10d @ 4"

$v_{all} = 1780/2 = 890$ PLF ok

$v_2 = 4972/18.66 = 266$ PLF



USE: UNBLOCKED DIAPHRAGM
W/ 10d @ 4" oc

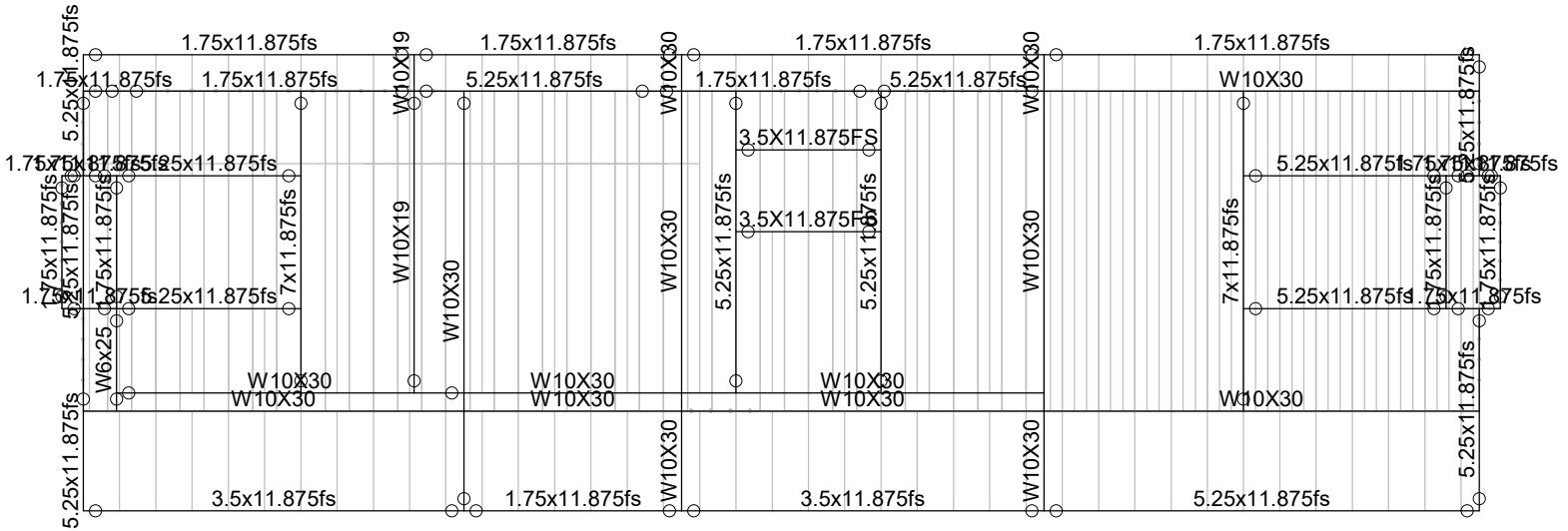
$R_1 = R_2 = 4972(1.17)/7.33 = 794^{\#}$

BLOCK 3 JST SPACES &
STRAP W/ CS16 W/ 20 - .148" ⌀ x 2½"
NAILS EA END

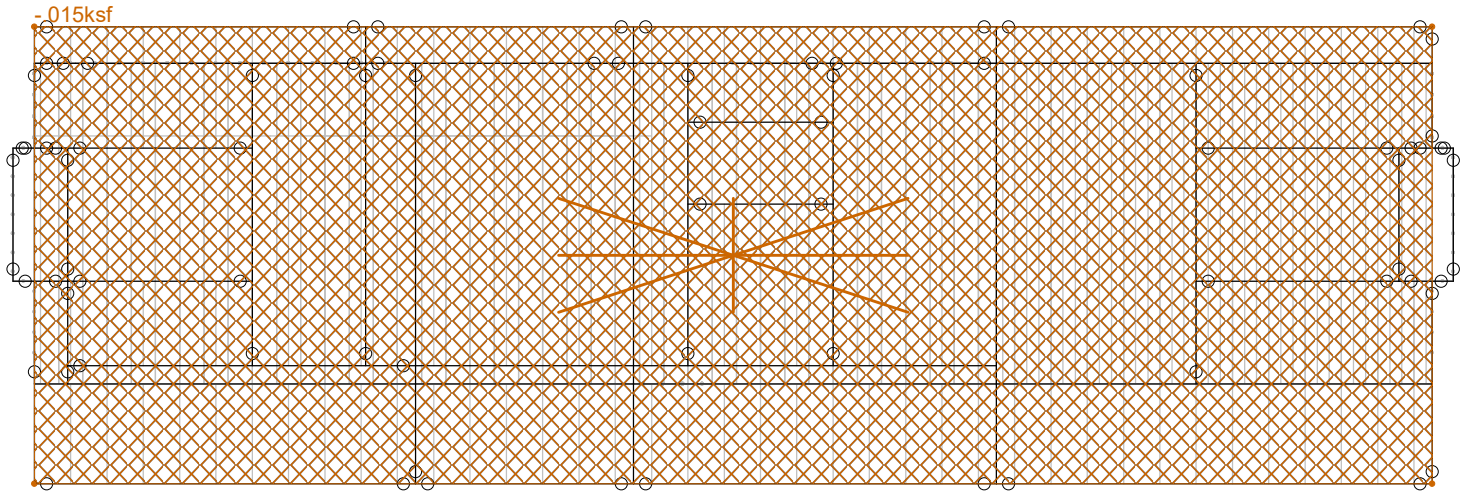
1ST FLOOR

$V_1 = 4972$ $v_2 = 266$ PLF UNBLOCKED DIAPH ok

DIAPHRAGM CONNECTS DIRECTLY TO CONC WALLS
& SW CONNECTS DIRECTLY TO CONC WALL SO NO
DIAPH TRANSFER REQ'D AT THIS LEVEL

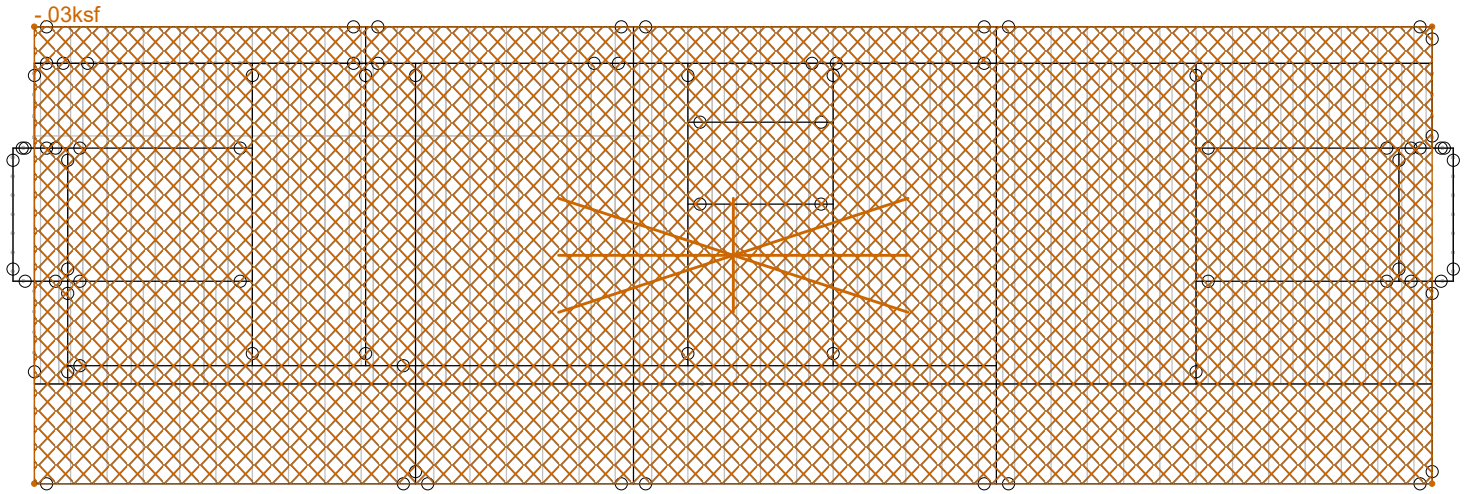


	Roof Member Sizes	Main Residence - 1
		Aug 16, 2022 at 4:59 PM
		mist model 2-26-22.r3d



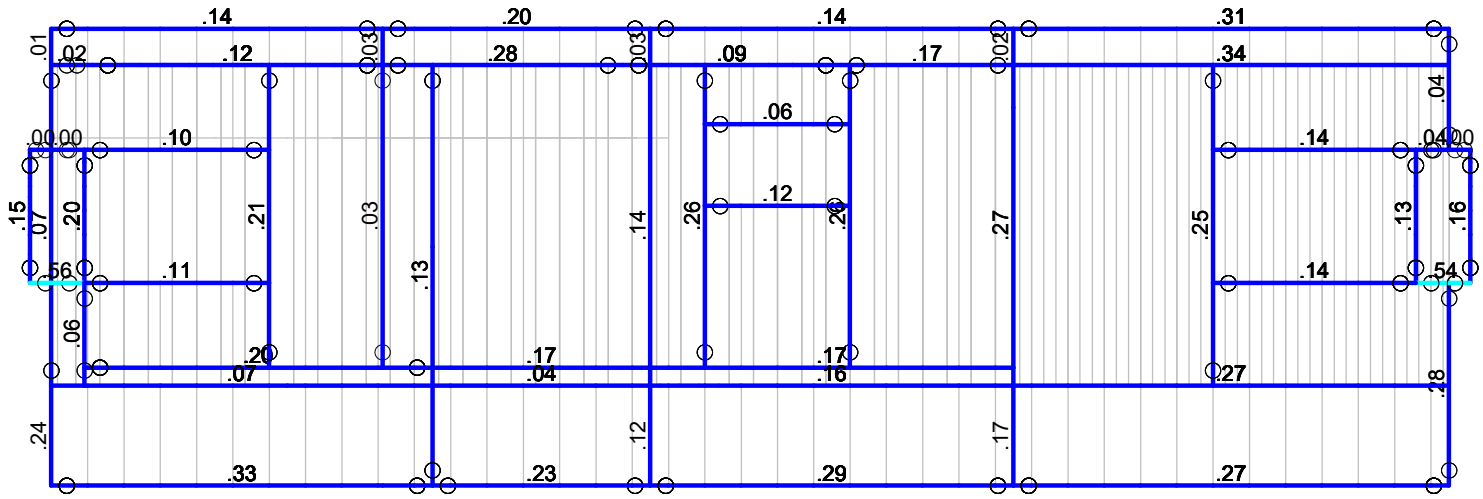
Loads: BLC 1, dead

	Roof Dead Load	Main Residence - 2
		Aug 16, 2022 at 5:00 PM
		mist model 2-26-22.r3d



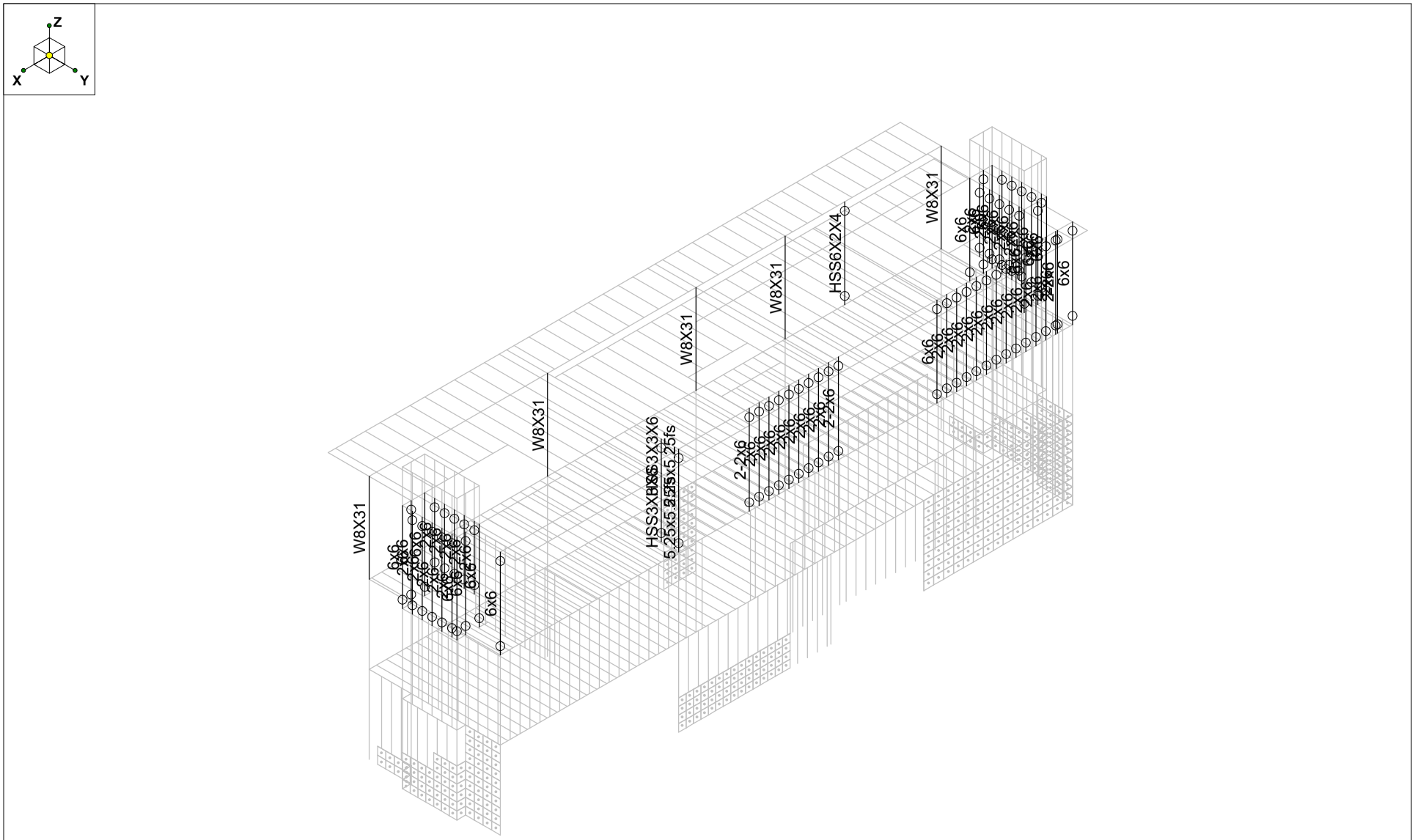
Loads: BLC 2, snow

	Roof Snow Load	Main Residence - 3
		Aug 16, 2022 at 5:01 PM
		mist model 2-26-22.r3d

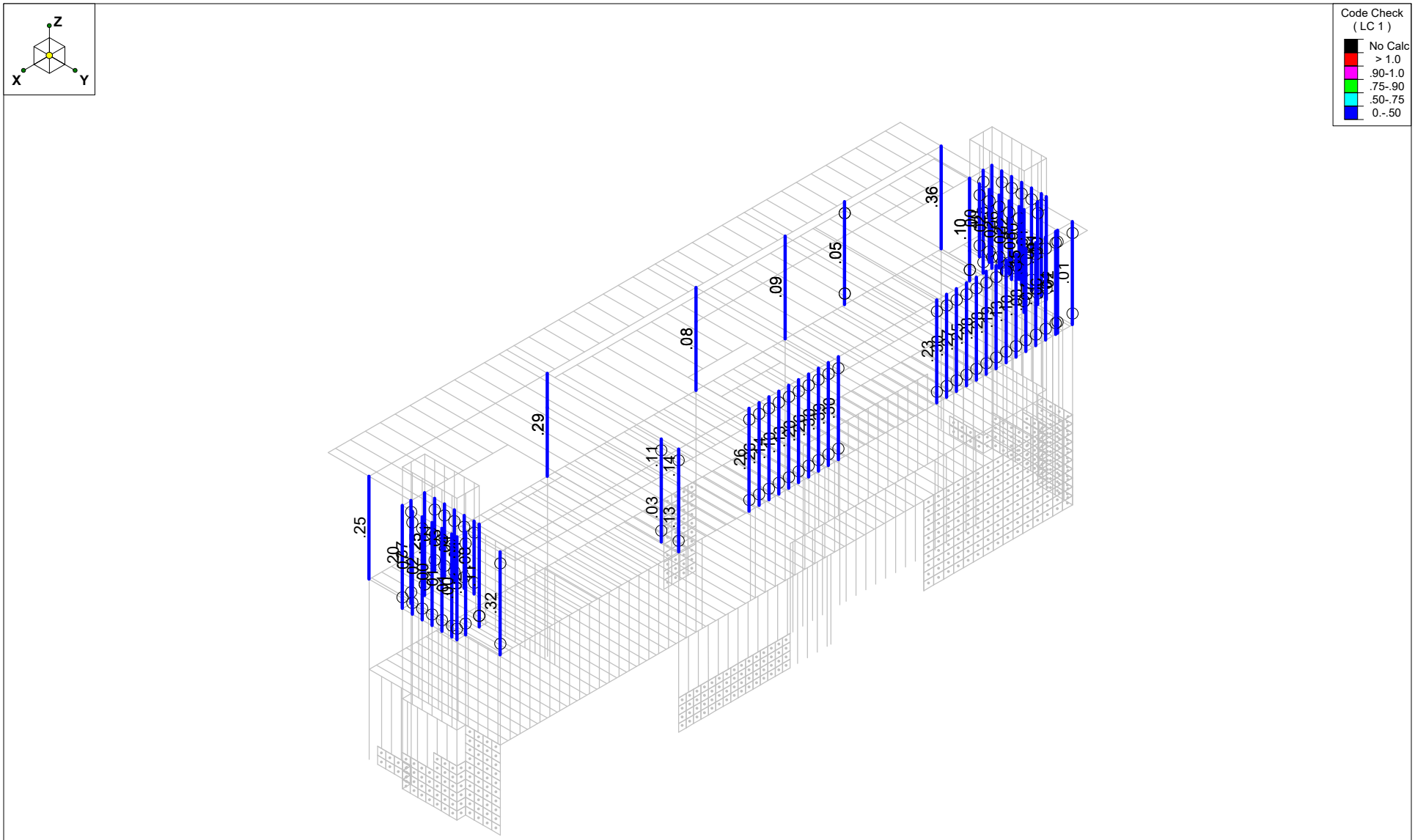


Member Code Checks Displayed
Results for LC 1, d+sn

	Roof Member Stress Check	Main Residence - 4
		Aug 16, 2022 at 5:03 PM
		mist model 2-26-22.r3d

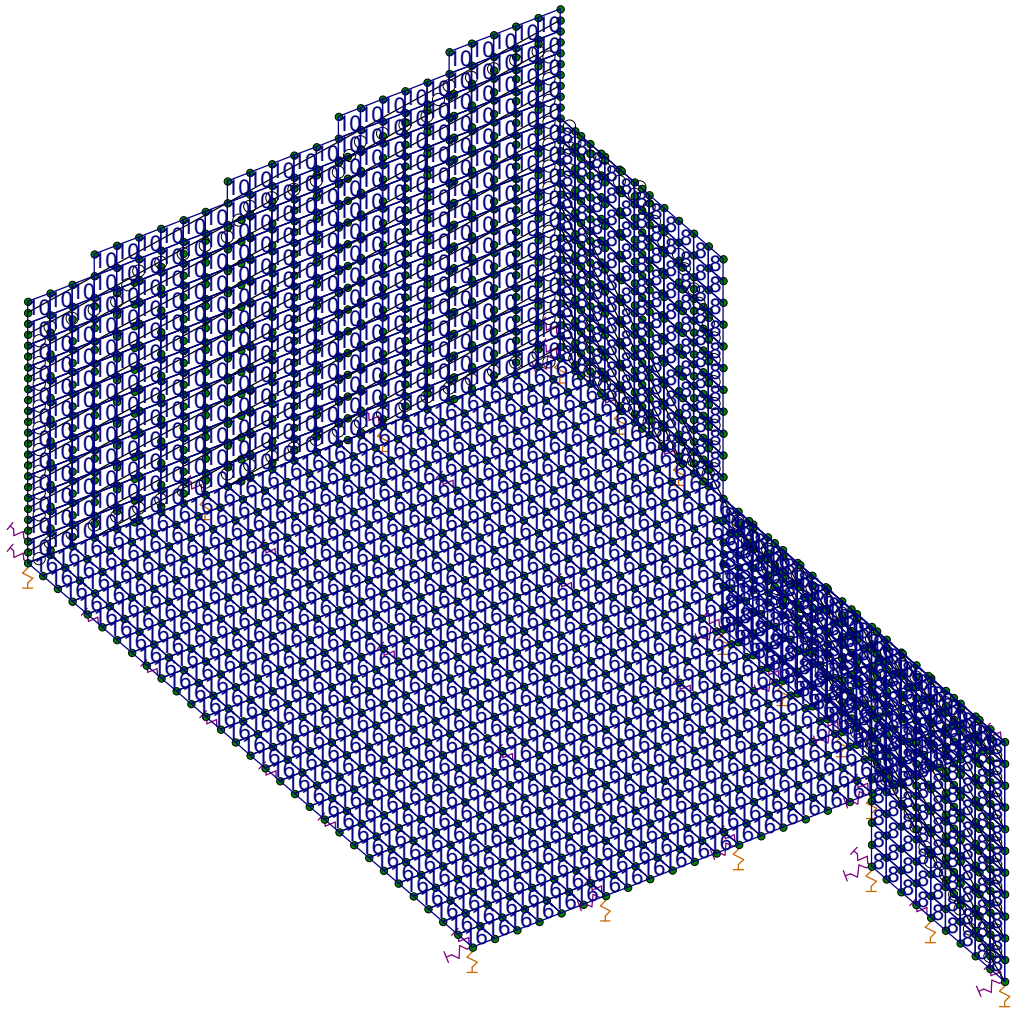


	2nd Floor to Roof Member Sizes	Main Residence - 5
		Aug 16, 2022 at 5:05 PM
		mist model 2-26-22.r3d

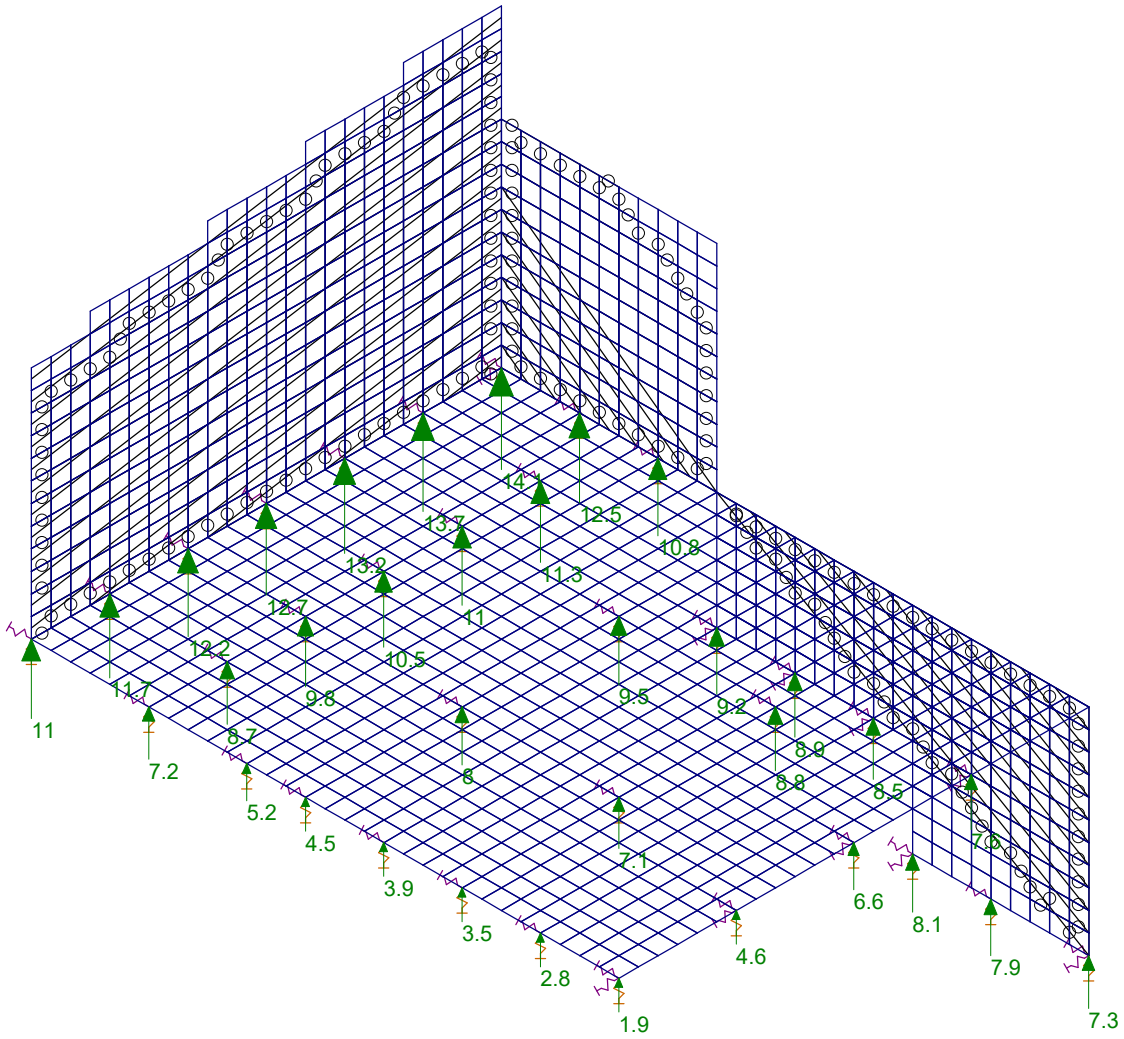


Member Code Checks Displayed
Results for LC 1, d+sn

	2nd Floor to Roof Vertical Member Stress Check	Main Residence - 6
		Aug 16, 2022 at 5:06 PM
		mist model 2-26-22.r3d

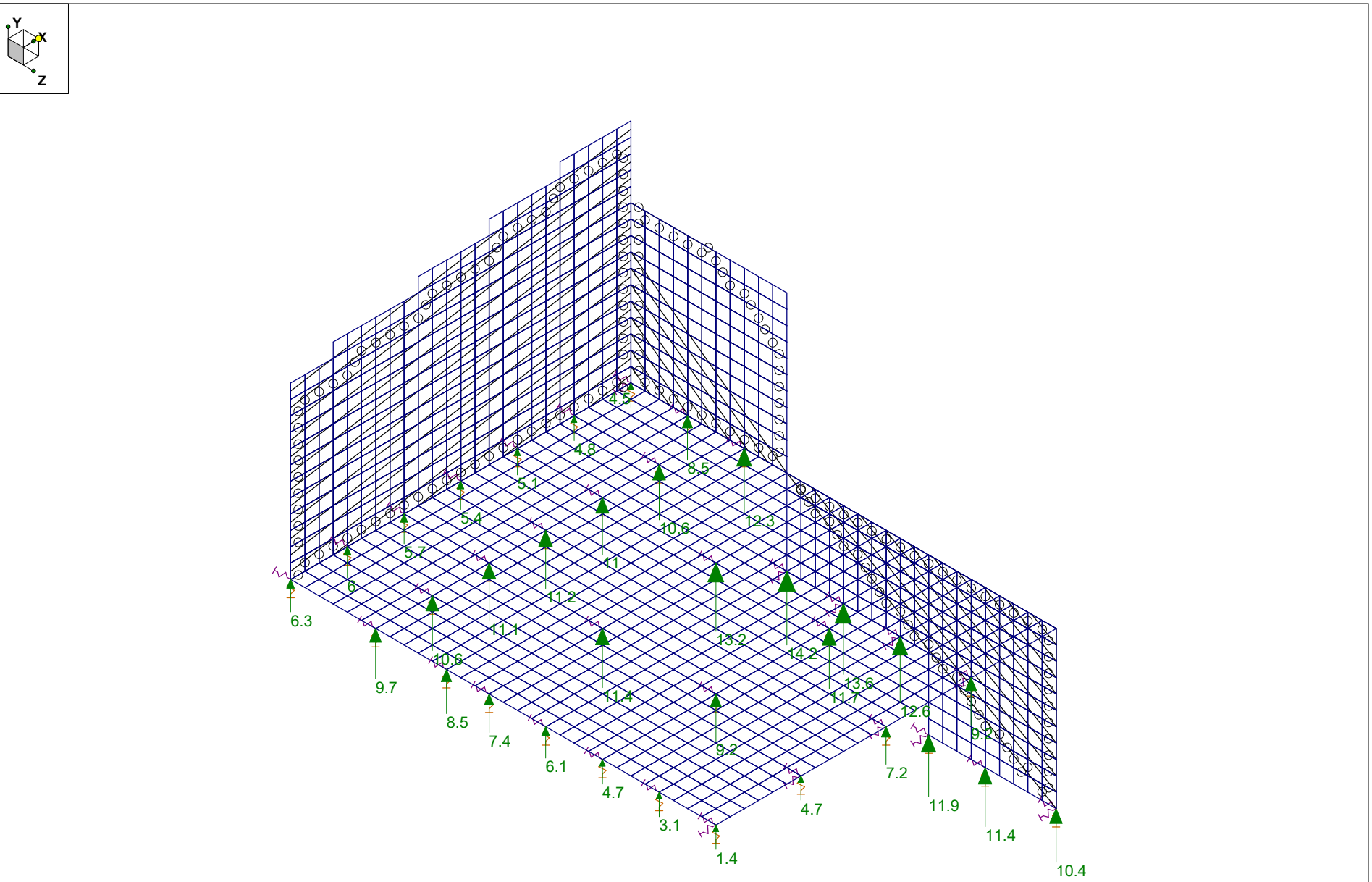


		GArage Walls and Mat Foundatio 1
		July 8, 2022 at 11:18 AM
	Concrete Thicknesses	garage retaining walls 6-16-22_backup.r3d



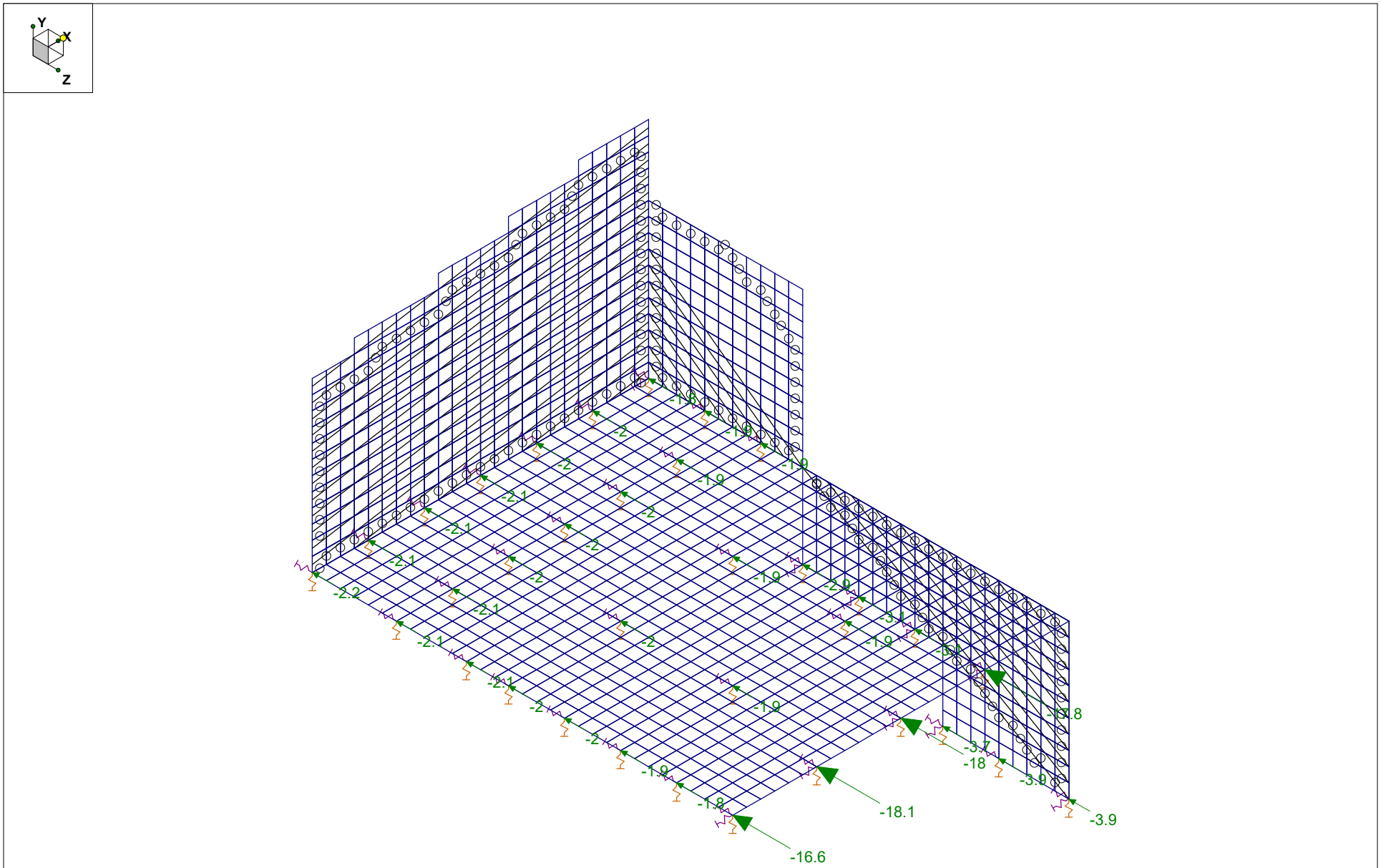
Results for LC 2, self wt + ecp + seis
Y-direction Reaction Units are k and k-ft

	Vertical Reactions Self Weight + ECP + Seismic	Garage Walls and Mat Found - 3
		July 8, 2022 at 3:20 PM
		garage retaining walls 6-16-22.r3d



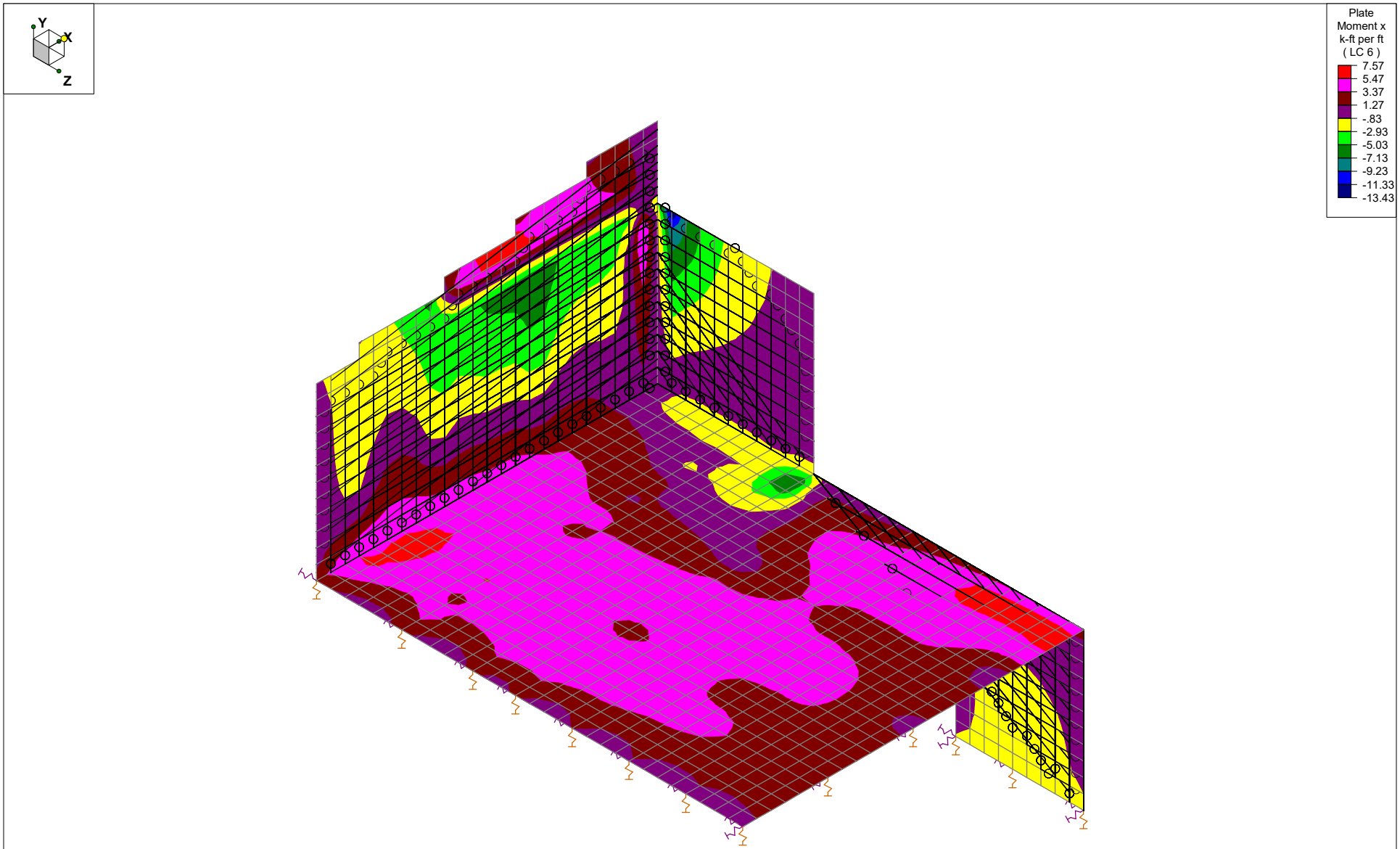
Results for LC 3, self wt + ecp + cont
Y-direction Reaction Units are k and k-ft

		Garage Walls and Mat Found - 4
		July 8, 2022 at 3:23 PM
	Vertical REactions Self Weight + ECP + Catchment	garage retaining walls 6-16-22.r3d



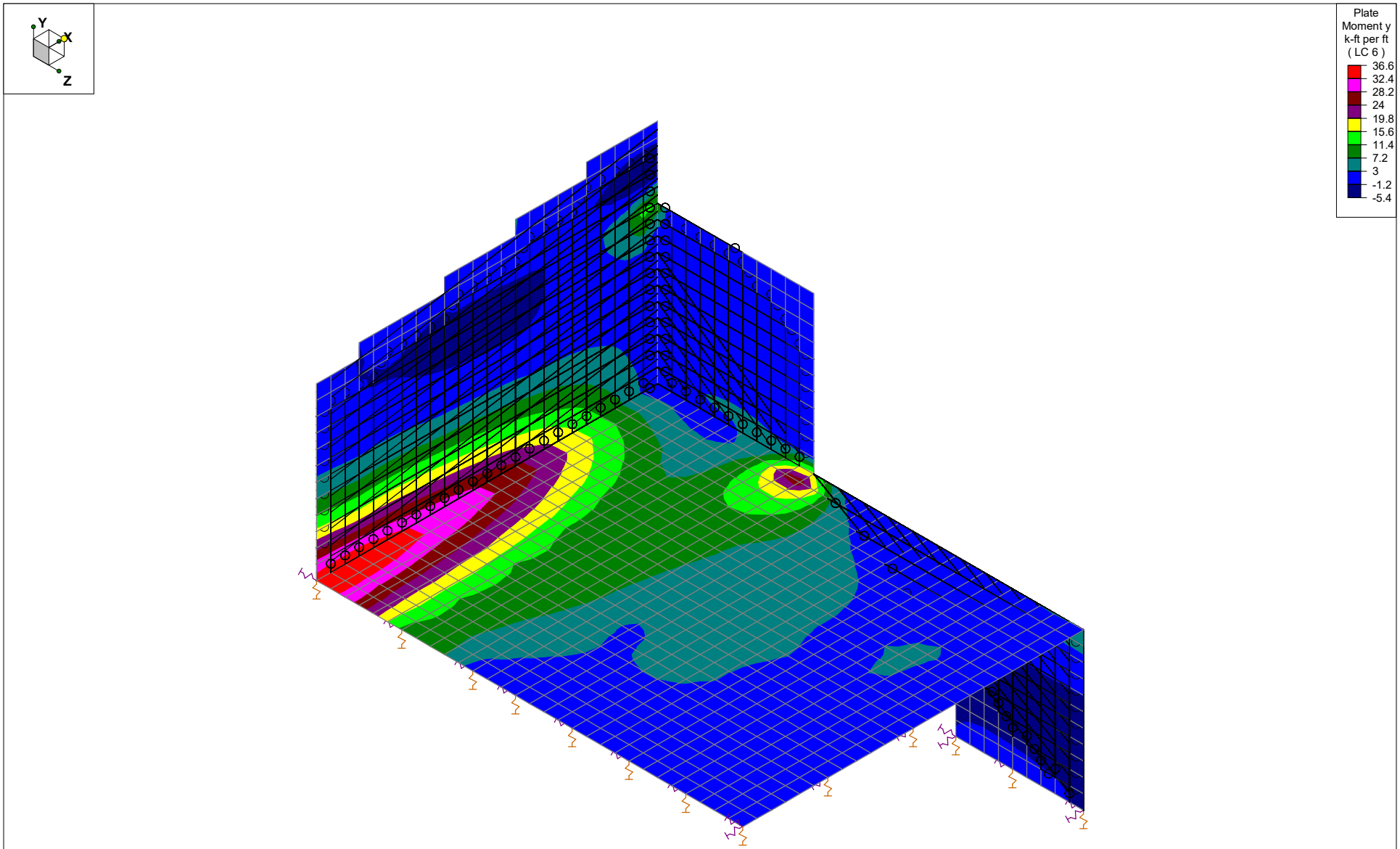
Results for LC 3, self wt + ecp + cont
Z-direction Reaction Units are k and k-ft

		Garage Walls and Mat Found - 5
		July 8, 2022 at 3:24 PM
	Horizontal Reactions Self Weight + ECP + Catchment	garage retaining walls 6-16-22.r3d



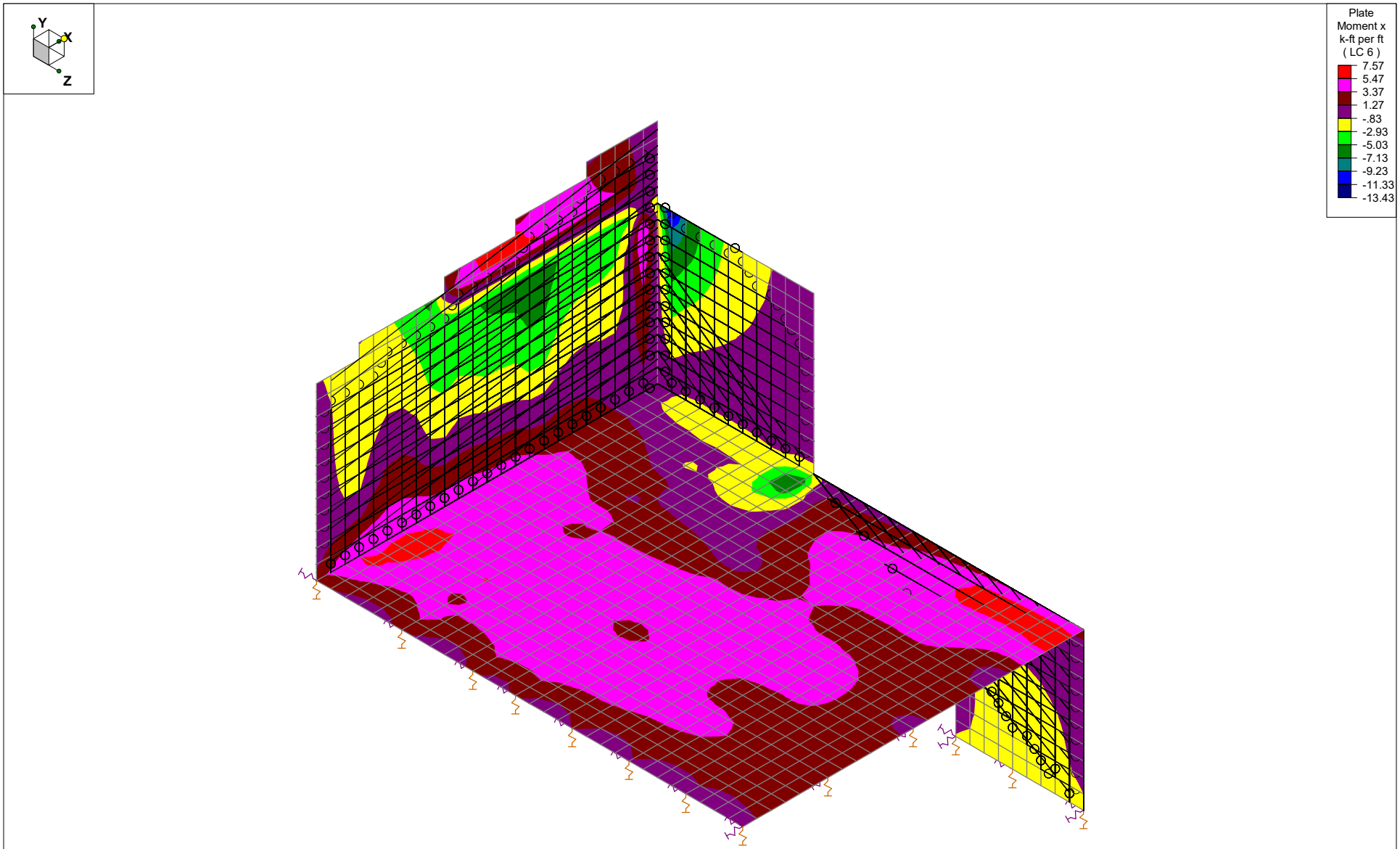
Results for LC 6, 1.4sw+1.4ecp+1.4cont

		Garage Walls and Mat Found - 6
		July 8, 2022 at 3:27 PM
	Factored Mx	garage retaining walls 6-16-22.r3d



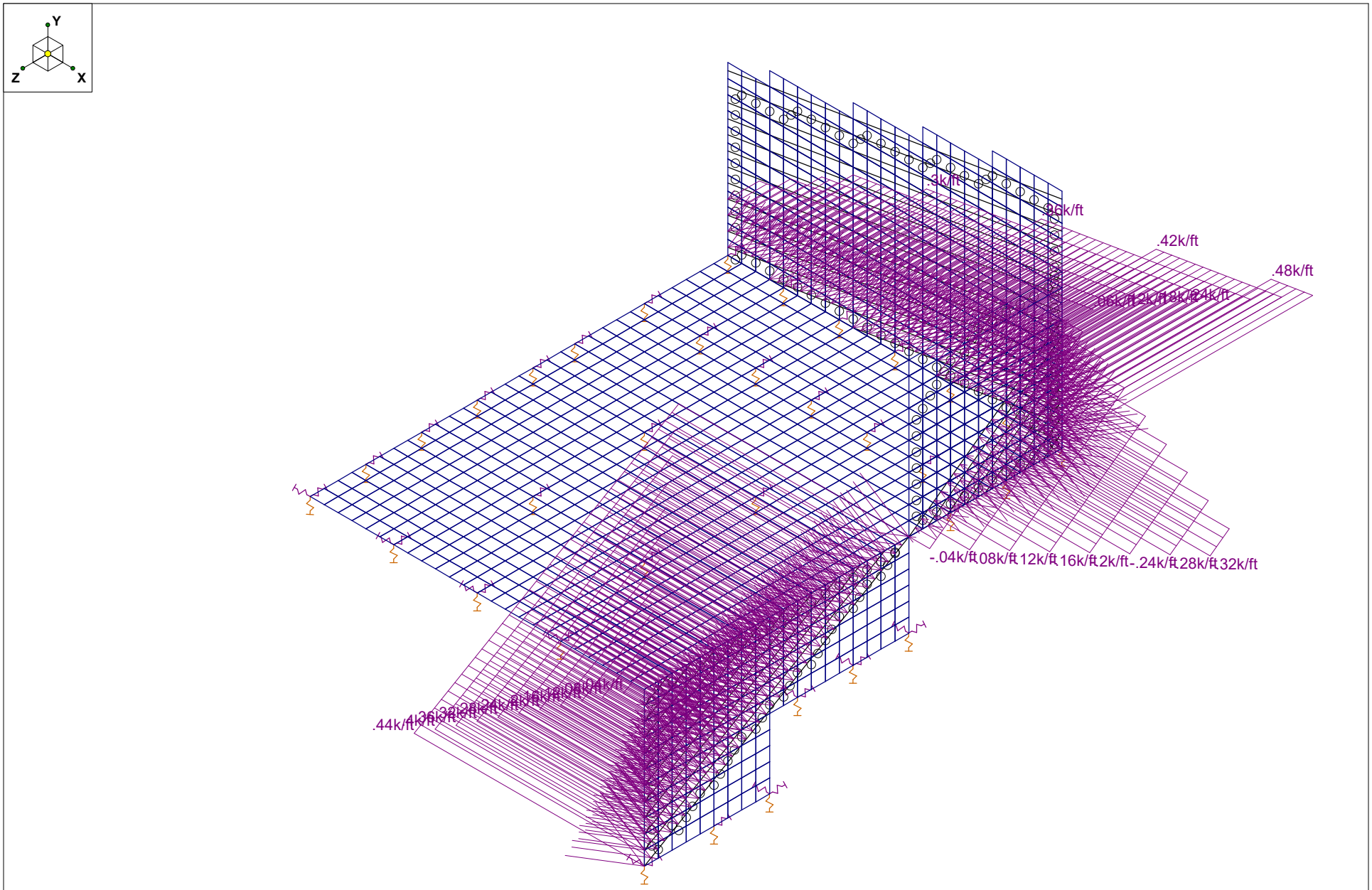
Results for LC 6, 1.4sw+1.4ecp+1.4cont

		Garage Walls and Mat Found - 7
		July 8, 2022 at 3:28 PM
	Factored My	garage retaining walls 6-16-22.r3d



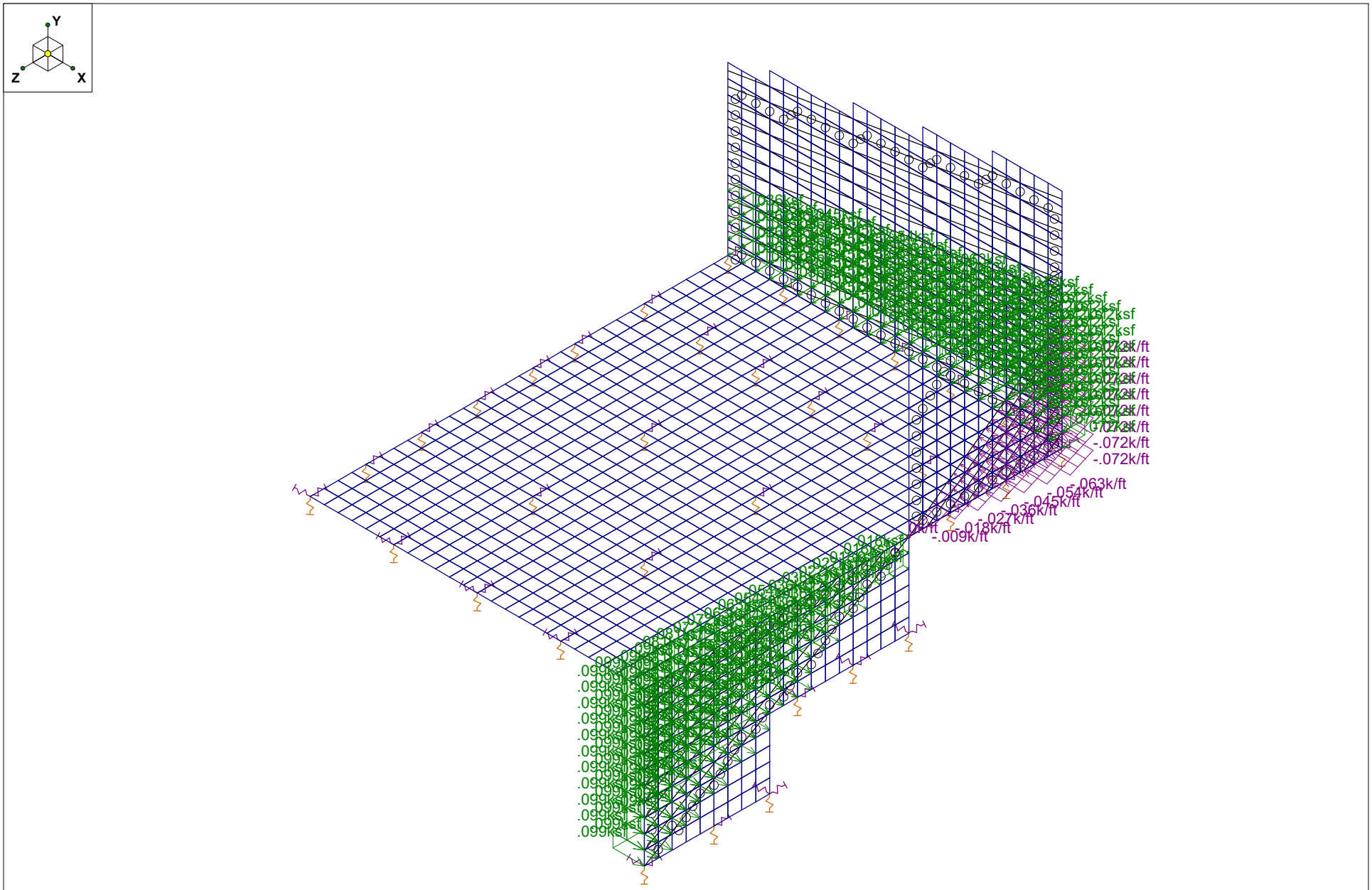
Results for LC 6, 1.4sw+1.4ecp+1.4cont

		Garage Walls and Mat Found - 8
		July 8, 2022 at 5:16 PM
	Factored Mx	garage retaining walls 6-16-22.r3d



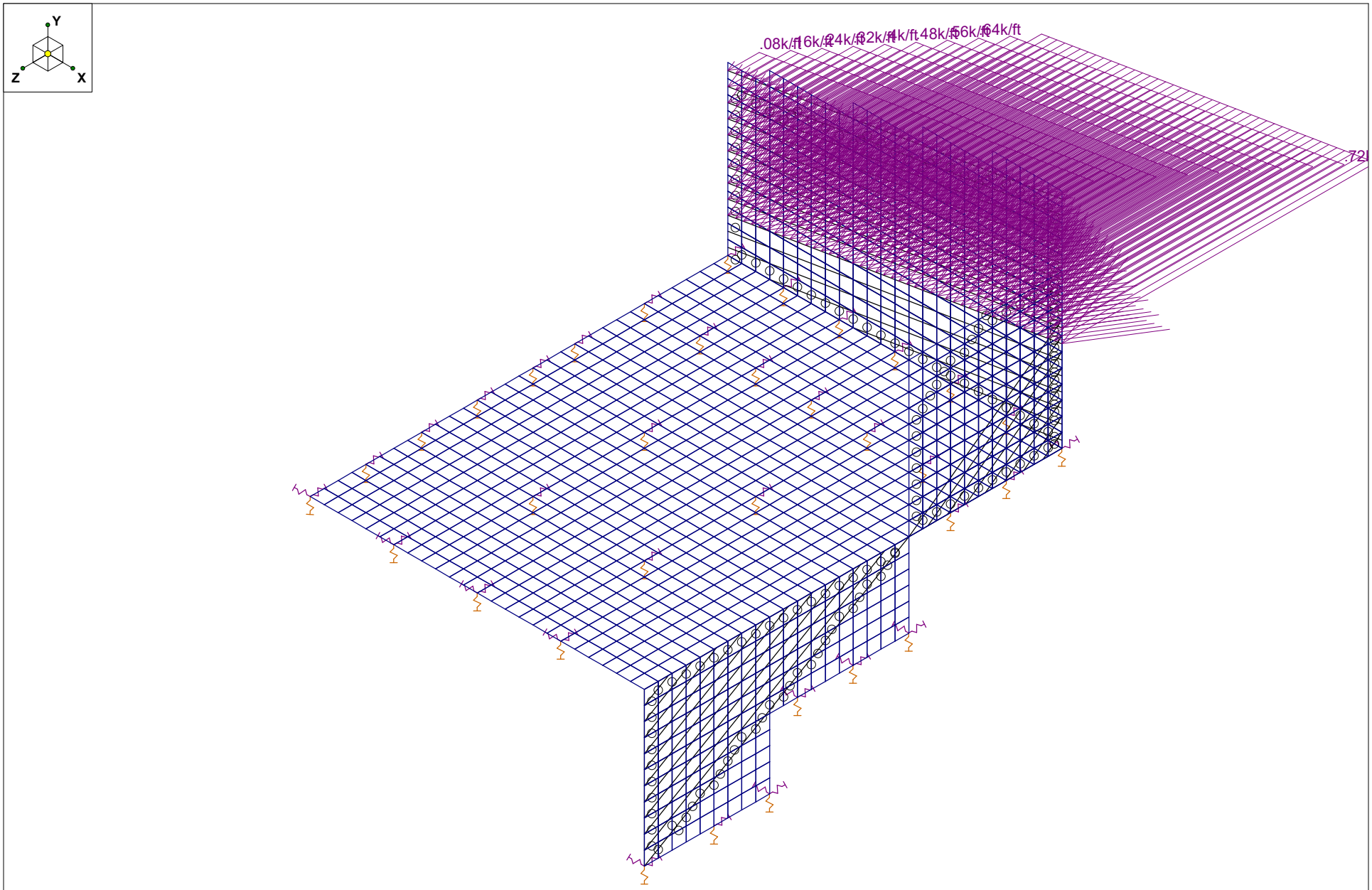
Loads: BLC 1, ECP

	ECP Loads	Garage Walls and Mat Found - 9
		July 8, 2022 at 5:18 PM
		garage retaining walls 6-16-22.r3d



Loads: BLC 2, Seismic

	Seismic Loads	Garage Walls and Mat Found - 10
		July 8, 2022 at 5:19 PM
		garage retaining walls 6-16-22.r3d



Loads: BLC 3, Containment

	Catchment Loads	Garage Walls and Mat Found - 11
		July 8, 2022 at 5:19 PM
		garage retaining walls 6-16-22.r3d

Concrete Walls

East Wall

$Mux := 36.6$ $Muy := 13.34$

Vertical Reinforcing

$d := 8.5$ $A := .6$ $Spac := 6$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 2.824$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 38.276$ **OK** Use: **#7v @ 6" ext & #4v @12" int**

Horizontal Reinforcing

$d := 8$ $A := .44$ $Spac := 12$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 1.035$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 14.815$ **OK** Use: **#6h @ 12" ea face**

South Wall

$Mux := 11.1$ $Muy := 9.53$

Vertical Reinforcing

$d := 6$ $A := .44$ $Spac := 10$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 1.242$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 12.78$ **OK** Use: **#6v @ 10" ea face**

Horizontal Reinforcing

$d := 6$ $A := .31$ $Spac := 9$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 0.973$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 10.256$ **OK** Use: **#5h @ 9" ea face**

Mat Footing

First 6 feet from East wall

$Muns := 26.1$ $Muew := 5.5$

E-W Reinforcing

$d := 12$ $A := .44$ $Spac := 10$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 1.242$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 27.036$ **OK** Use: **#6h @ 10" t&b EW**

N-S Reinforcing

$d := 12$ $A := .2$ $Spac := 12$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 0.471$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 10.588$ **OK** Use: **#4h @ 12" t&b NS**

Beyond first 6 feet from West wall

$Muns := 17.1$ $Muew := 5.5$

E-W Reinforcing

$d := 12$ $A := .31$ $Spac := 10$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 0.875$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 19.355$ **OK** Use: **#5h @ 10" t&b EW**

N-S Reinforcing

$d := 12$ $A := .2$ $Spac := 12$ $As := A \cdot \frac{12}{Spac}$

$a := \frac{As \cdot 60}{12 \cdot .85 \cdot 2.5}$ $a = 0.471$

$PhiMc := As \cdot 60 \cdot .9 \cdot \frac{\left(d - \frac{a}{2}\right)}{12}$ $PhiMc = 10.588$ **OK** Use: **#4h @ 12" t&b NS**