

Donald Lum ES Liquefaction Evaluation Structural Calculations

Alameda, California

ZFA Project Number: 17135

Donald Lum ES Liquefaction Evaluation

May 16, 2017

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STRUCTURAL NARRATIVE

Donald Lum Elementary School is a part of Alameda Unified School District located in Alameda, California. There are five buildings on the campus connected by covered walkways. The buildings consist of wood and steel framing with wood and masonry vertical elements.

Miller Pacific Engineering Group performed soil testing at the site and subsequent liquefaction analysis. They found a high risk of liquefaction at the site with potential differential settlement between 3 to 7 inches across a given building footprint.

To evaluate the effects of liquefaction at the site we analyzed perimeter and interior footings for a 25 foot diameter loss of bearing at each building.

The existing footings were not designed for this loss of bearing at the foundations and our analysis indicates the footings do not have sufficient capacity to sustain the loss of bearing.

USGS Design Maps Summary Report

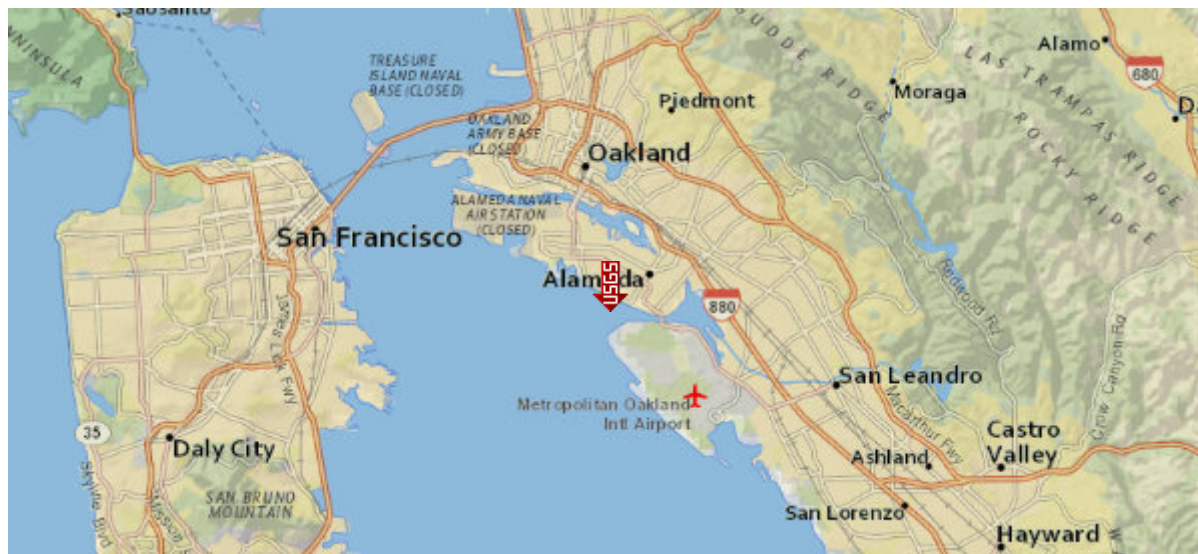
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Report Title Donald Lum ES
Tue May 16, 2017 00:58:54 UTC

Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-2N
(which utilizes USGS hazard data available in 2008)

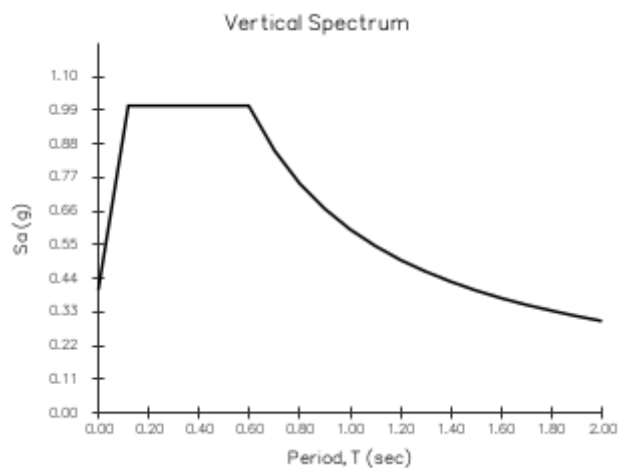
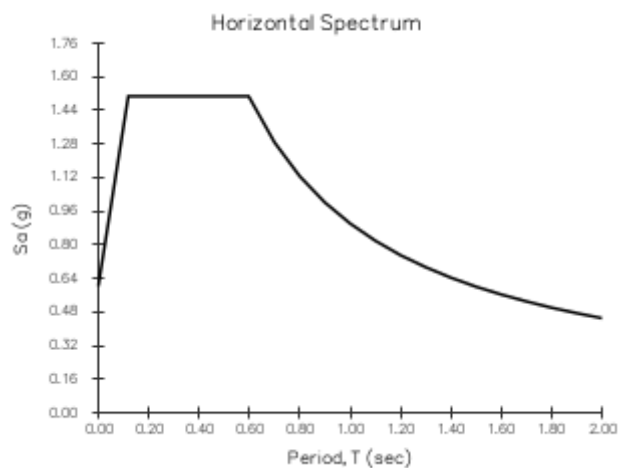
Site Coordinates 37.76169°N, 122.26024°W

Site Soil Classification Site Class D – “Stiff Soil”



USGS-Provided Output

$S_{S,BSE-2N}$	1.507 g	$S_{XS,BSE-2N}$	1.507 g
$S_{1,BSE-2N}$	0.600 g	$S_{X1,BSE-2N}$	0.901 g



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USGS Design Maps Summary Report

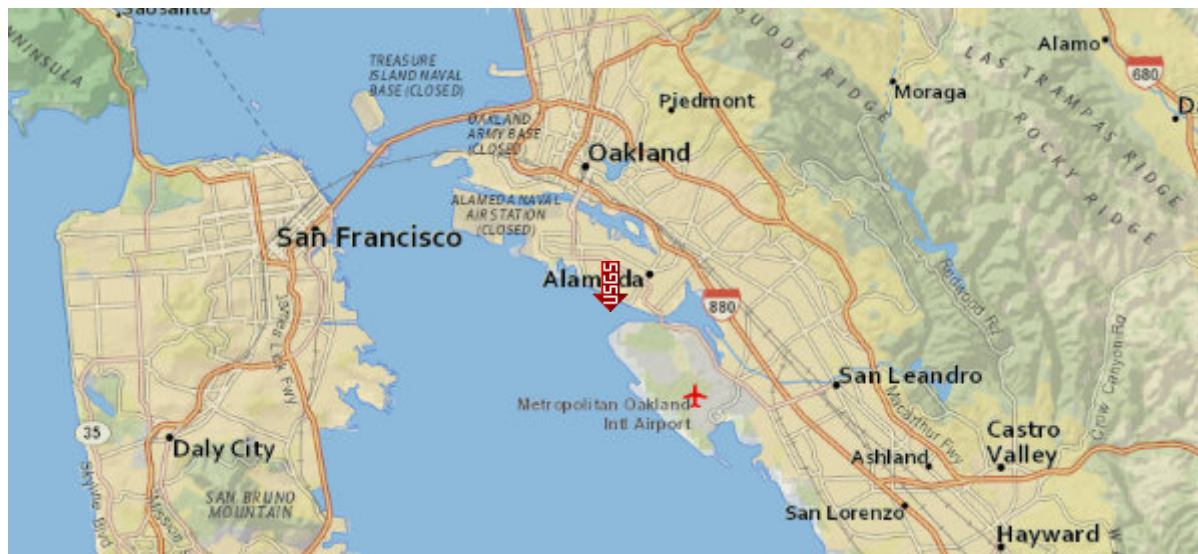
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Report Title Donald Lum ES
Tue May 16, 2017 00:59:22 UTC

Building Code Reference Document ASCE 41-13 Retrofit Standard, BSE-1N
(which utilizes USGS hazard data available in 2008)

Site Coordinates 37.76169°N, 122.26024°W

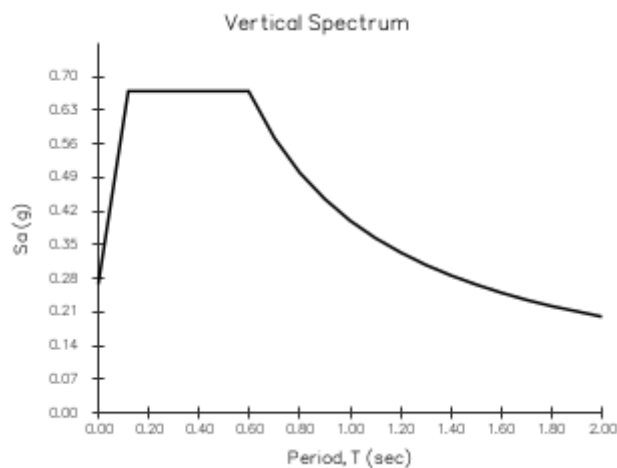
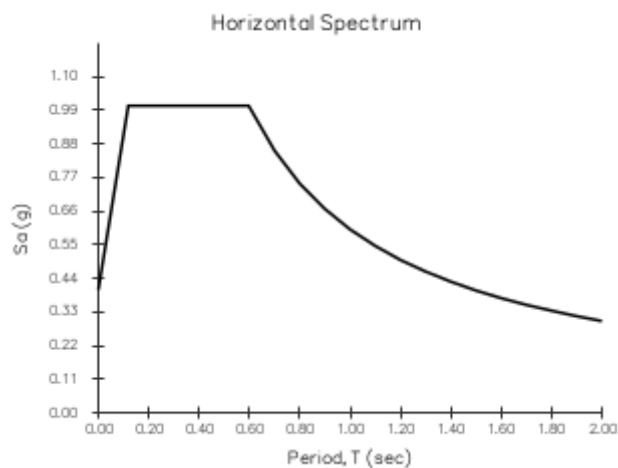
Site Soil Classification Site Class D – “Stiff Soil”



USGS-Provided Output

$S_{XS,BSE-1N}$ 1.005 g

$S_{X1,BSE-1N}$ 0.600 g



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$$Q_6 = 1.1 (Q_D + Q_L)$$

$$Q_L = 25\% \text{ UNREDUCED ASCE 7 LIVE LOAD}$$

$$= 0.25 * 50 \text{ PSF}$$

$$= 12.5 \text{ PSF}$$

(2016 IBC TABLE 1607A.1

FOOTNOTE P)

- ASSUME FIXED-FIXED FOR FOUNDATION SPANNING.

- SIMPLIFY SLAB LOAD TO TRIANGULAR RATHER THAN SEMI-CIRCLE

1959 CLASSROOM 1 & 2

VERTICAL LOADS

EXTERIOR WALL - CMU

$$HT = 9.75 \text{ FT}$$

$$WT = 80 \text{ PSF} = 780 \text{ PLF}$$

EXTERIOR WALL - STOREFRONT

$$HT = 9 \text{ FT}$$

$$WT = 10 \text{ PSF} = 90 \text{ PLF}$$

ROOF WEIGHT

$$19 \text{ PSF}$$

$$TRIB = 4.5 + \frac{11}{2} = 10 \text{ FT}$$

$$= 17 \times 10 = 170 \text{ PLF}$$

FOUNDATION - EXTERIOR WALL

2'-8" DEEP 1'-6" WIDE

SLAB

4" #4 @ 18" oc EA WAY

SLAB TRIBUTARY IS

$$\frac{25 \text{ FT}}{2} = 12.5 \text{ FT INTERIOR}$$

10 FT EXTERIOR

(1) #6 T & B #4 @ 12" oc VERT

$$WT = \frac{10}{12} * \frac{32}{12} * 150 \text{ PLF}$$

$$= 600 \text{ PLF}$$

$$WT = \frac{4}{12} * 150 \text{ PLF}$$

$$= 50 \text{ PSF}$$

LATERAL LOADS

TOTAL SEISMIC WEIGHT

$$= 215 \text{ K}$$

TOTAL ROOF AREA

$$= 8,587 \text{ SF}$$

TRIBUTARY ROOF AREA

$$= 727 \text{ SF} + \frac{1}{2} * 2819 \text{ SF}$$

$$= 2137 \text{ SF}$$

TRIBUTARY SEISMIC WEIGHT

$$= \frac{2137}{8587} * 215 \text{ K}$$

$$= 53.5 \text{ K}$$

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157 CLASSROOM 1 & 2 - CONT'D

$$\begin{aligned} \text{BSE-2 } Q_{up} &= 1.5 W \\ &= 1.5 * 45 \text{ K} \\ &= 68 \text{ K} \end{aligned}$$

$$\begin{aligned} \text{BSE-2 } M_{OT} &= V * l_t \\ &= 68 \text{ K} * 9.75 \text{ FT} \\ &= 661 \text{ K-FT} \end{aligned}$$

$$\frac{M}{S} = \frac{661 \text{ K-FT}}{1.5 * (12')^2} * 1.5 \text{ FT} = 28 \text{ K-LF}$$

$$\text{BSE-2 } \frac{Q_{up}}{S} = \frac{28.5}{2} = 14.3 \text{ K-LF}$$

CHECK FOOTING W/O BLOCK WALL, AT 6.5 FT & 18.5 FT

$$\begin{aligned} \text{BSE-2 } Q_{up} &= \frac{-68 \text{ K-FT}}{34 \text{ K-FT}} @ 6.5 \text{ FT} & \frac{198 \text{ K-FT}}{198 \text{ K-FT}} @ 18.5 \text{ FT} \\ & & \text{(SEE RISA)} \end{aligned}$$

(F) FOOTING CAPACITY

$$\begin{aligned} d &= 32" - 3" - \frac{1}{2} * \frac{6}{8}" \\ &= 28.625" \end{aligned}$$

$$f_{yt} = 33 \text{ KSI (ASSUMED)}$$

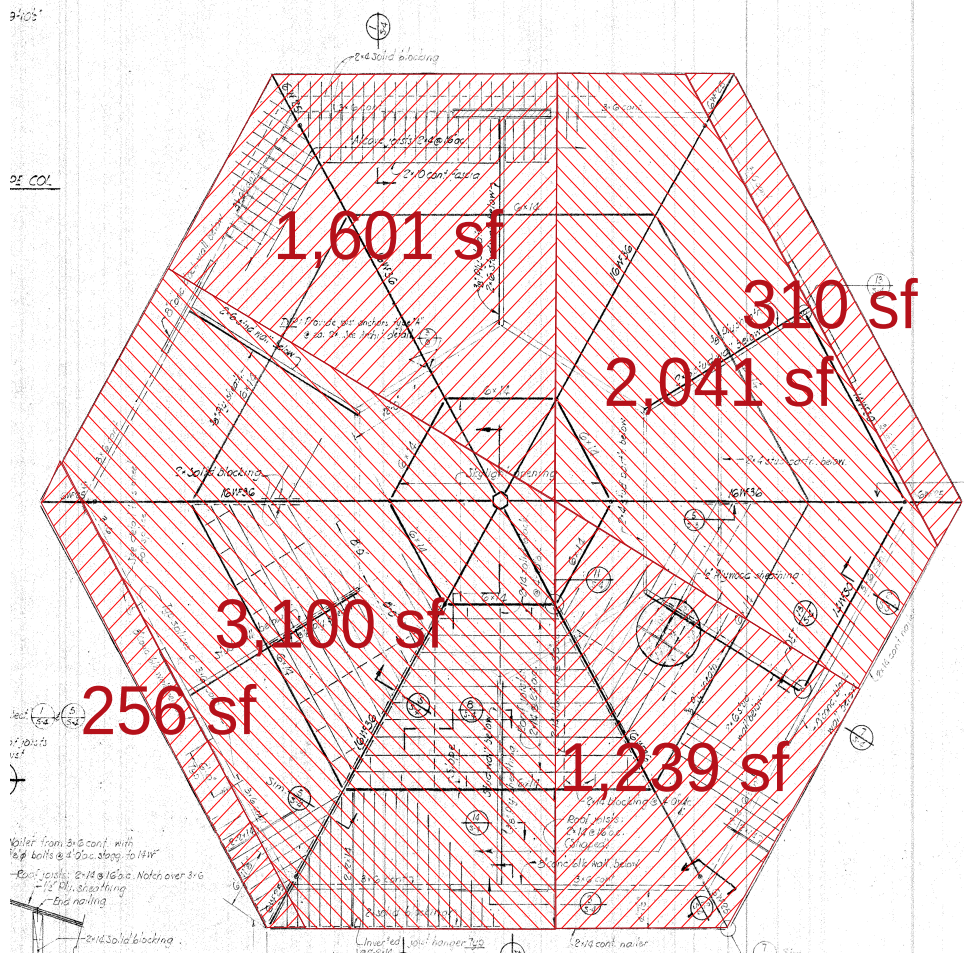
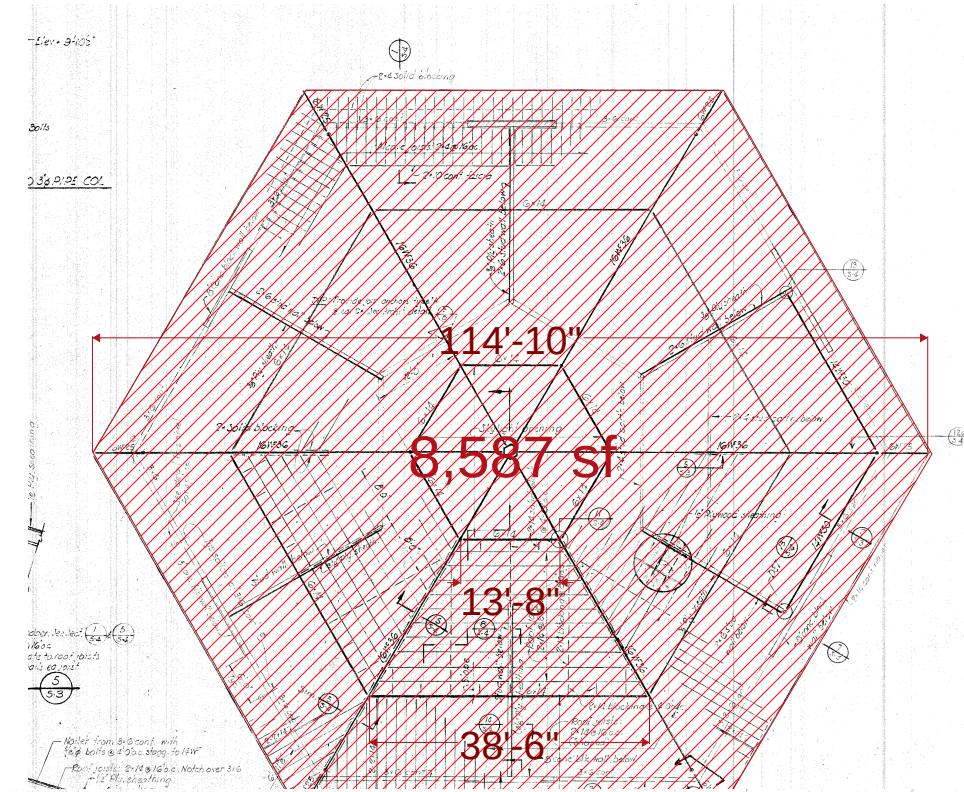
$$f'_c = 2000 \text{ PSI (SA)}$$

$$\begin{aligned} a &= \frac{A_s f_y}{0.85 f'_c b} \\ &= \frac{(1) * 0.44 \text{ IN}^2 * 33 \text{ KSI}}{0.85 * 2 \text{ KSI} * 18 \text{ IN}} = 0.47 \end{aligned}$$

$$\begin{aligned} Q_u &= A_s f_y (1 - a/2) \\ &= 0.44 * 33 * (28.625 - \frac{0.47}{2}) \\ &= 34.3 \text{ K-FT} \end{aligned}$$

$$\text{BSE-2 } \frac{Q_{up}}{Q_u} = \frac{198}{34} = \underline{\underline{5.8}}$$

1959 Classroom



Site Criteria

Latitude =	37.76169
Longitude =	-122.26024

Site Class =	D	[per Geotechnical Report]
F _a =	1	
F _v =	1.5	

BSE2 Response Spectra (2% in 50 year period)

S _S =	1.51	USGS Seismic Design Maps	F _a =	1.00
S ₁ =	0.60	USGS Seismic Design Maps	F _v =	1.50
S _{XS} =	1.51	[F _a * S _S]		
S _{X1} =	0.90	[F _v * S ₁]		

BSE1 Response Spectra (10% in 50 year period)

S _S =	1.005	USGS Seismic Design Maps	F _a =	1.10
S ₁ =	0.4	USGS Seismic Design Maps	F _v =	1.50
S _{XS} =	1.00	[F _a * S _S]		
S _{X1} =	0.60	[F _v * S ₁]		

Building Period (Method 2 - Empirical)

T =	[C _t * h _n ^β]	
T =	0.17 sec	
C _t =	0.02	
h _n =	17.0 ft	[mean building height]
β =	0.75	

Horizontal Response Acceleration

	<u>BSE2</u>	<u>BSE1</u>	
T _s =	0.60	0.60	[S _{X1} / S _{XS}]
T ₀ =	0.12	0.12	[0.2 * T _S]
B ₁ =		1.00	[4 / {5.6 - ln(100 * 0.05)}]
S _a =	1.50	1.00	[S _{XS} / B ₁]

HIGH Level of Seismicity

Pseudo Lateral Force

$$V = \frac{\underline{BSE2}}{C_1 C_2 C_m S_a W}$$

$$V = \frac{1.50 * W}{1.00 * W}$$

 with $C_1 = C_2 = C_m = 1.0$

$$DCR_{max} = Q_{UD}/Q_{CE} = 2.50 \quad (\text{see following calculations})$$

$$C_m = 1.0 \quad [1.0 \text{ for 1-2 stories}]$$

$$a = 60 \quad [\text{per Site Class}]$$

$$R = [DCR_{max} * C_m / 1.5 \geq 1.0]$$

$$R = 1.67$$

$$C_1 = [1 + (R - 1) / (a * T^2)] \quad (T_{min} = 0.2)$$

$$C_2 = [1 + \{(R - 1) / T\}^2 / 800]$$

$$C_1 = 1.28$$

$$C_2 = 1.02$$

$$V' = \frac{\underline{BSE2'}}{C_1 C_2 C_m S_a W}$$

$$V' = \frac{1.96 * W}{1.31 * W}$$

 with C_1, C_2, C_m as calculated above

Roof Area = **8587 sf** (Includes Overhang)

Diaphragm: Roof Slope: **3.25:12**

Slope Factor:

1.04

Roof Materials	PSF
Built up roofing	6.0
1/2" Plywood	1.5
2x14 Wood Rafters @ 24"oc	3.0
W16x36	1.4
6x14	0.7
M/E/P	1.5
Ceiling	1.5
Insulation	1.0
Misc.	2.4

Total **19.0**

x Roof Area =

Diaphragm Wt

53 kips
13 kips
27 kips
13 kips
6 kips
13 kips
13 kips
9 kips
21 kips
169 kips

Sum =

1) Diaphragm weights include the diaphragm and half of the height of out-of-plane walls.

2) Seismic wall weights include half height of wall.

Ext Walls

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
1	8" CMU Wall	80	12	9.8	9 kips	5 kips
	Window	10	38	9.0	3 kips	2 kips
				Sum =	13 kips	6 kips
Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
2	8" CMU Wall	80	12	9.8	9 kips	5 kips
	Door/Partition	10	38	9.0	3 kips	2 kips
				Sum =	13 kips	6 kips
Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
3	8" CMU Wall	80	12	9.8	9 kips	5 kips
	Door	10	38	9.0	3 kips	2 kips
				Sum =	13 kips	6 kips
Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
4	8" CMU Wall	80	12	9.8	9 kips	5 kips
	Window	10	38	9.0	3 kips	2 kips
				Sum =	13 kips	6 kips
Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
5	8" CMU Wall	80	12	9.8	9 kips	5 kips
	Window	10	38	9.0	3 kips	2 kips
				Sum =	13 kips	6 kips
Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
6	8" CMU Wall	80	12	9.8	9 kips	5 kips
	Window	10	38	9.0	3 kips	2 kips
				Sum =	13 kips	6 kips

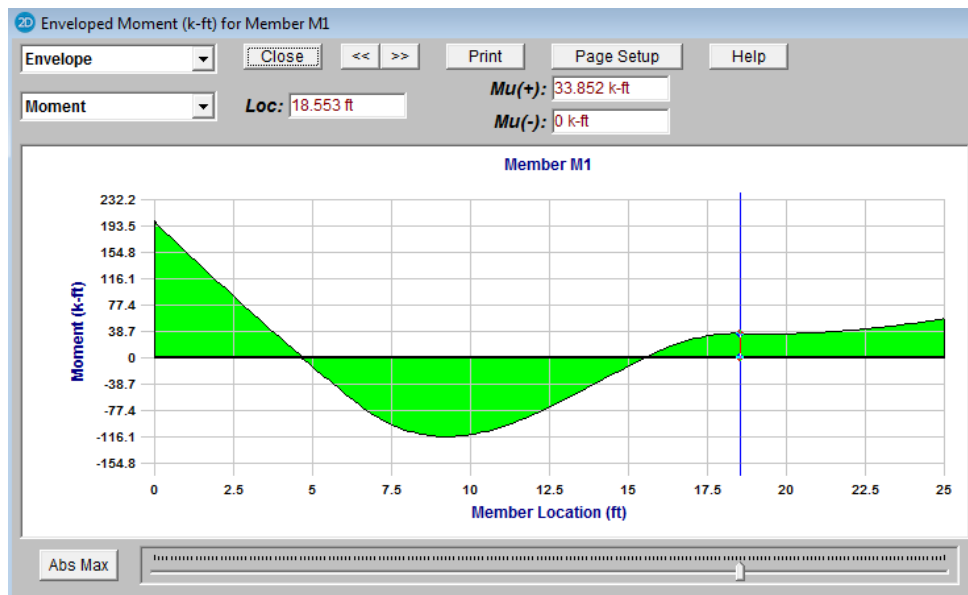
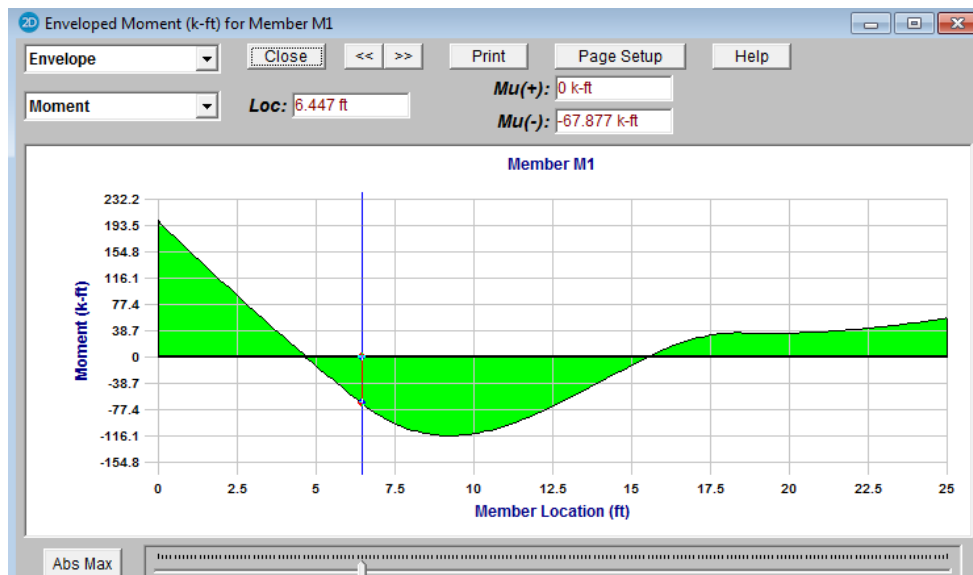
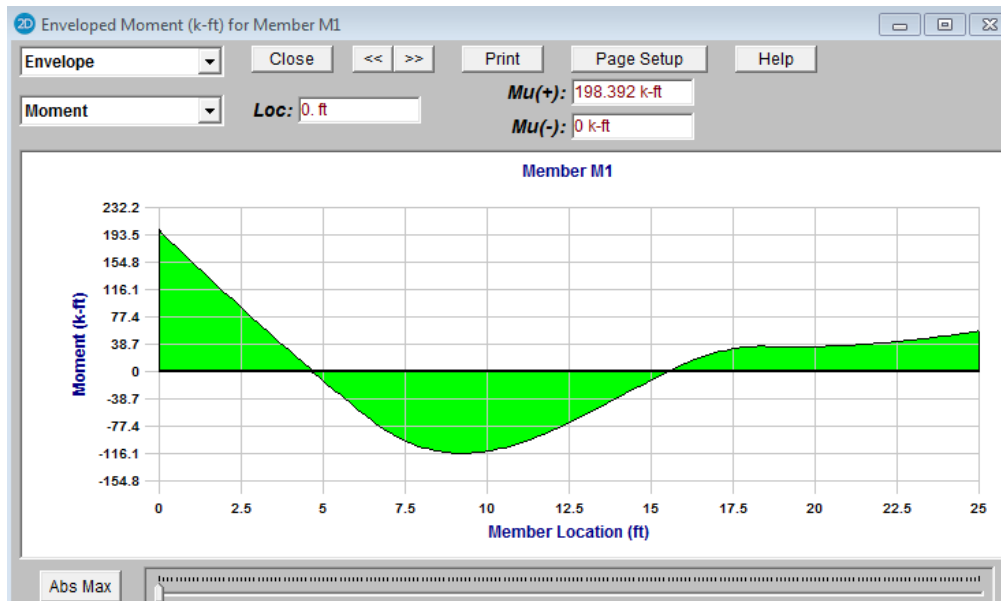
Int Walls

Line	Elements	PSF	x	Length (ft)or Quantity	x	Height (ft)	=	Wall Weight	Diaphragm Wall Wt
1	Wood Framed Wall	15		24		13.0		5 kips	2 kips
						Sum =		5 kips	2 kips
2	Wood Framed Wall	15		24		13.0		5 kips	2 kips
						Sum =		5 kips	2 kips
3	Wood Framed Wall	15		24		13.0		5 kips	2 kips
						Sum =		5 kips	2 kips
4	Wood Framed Wall	15		24		13.0		5 kips	2 kips
						Sum =		5 kips	2 kips
5	Wood Framed Wall	15		24		13.0		5 kips	2 kips
						Sum =		5 kips	2 kips
6	Wood Framed Wall	15		24		13.0		5 kips	2 kips
						Sum =		5 kips	2 kips

Weight Summary:**Diaphragm Weights**

Diaphragm Weight = 215 kips

1959 Classroom



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1959 MULTI-USE

VERTICAL LOADS

EXTERIOR WALL - CMU

$$WT = 80 \text{ PSF}$$

$$HT = 8.67 \text{ FT}$$

$$WT = 694 \text{ PLF}$$

EXTERIOR WALL - STORE FRONT

$$WT = 10 \text{ PSF}$$

$$HT = 9 \text{ FT}$$

$$WT = 90 \text{ PLF}$$

ROOF WEIGHT

$$WT = 18 \text{ PSF}$$

$$TRIB = 15 \text{ FT}$$

$$WT = 270 \text{ PLF}$$

FOUNDATION

2'-8" DEEP 1'-6" WIDE

(1) #6 T & B #4 @ 12" VERT

$$WT = \frac{32}{12} \times \frac{18}{12} \times 150$$

$$= 600 \text{ PLF}$$

SLAB

4" #4 @ 18" OC EW

$$WT = \frac{4}{12} \times 150$$

$$= 50 \text{ PSF}$$

$$\text{MAX } WT = 50 \text{ PSF} \times 25 \text{ FT}$$

$$= 1250 \text{ PLF}$$

$$\text{MAX } LL = 12.5 \text{ PSF} \times 25 \text{ FT}$$

$$= 313 \text{ PLF}$$

MODEL SLAB & LIVE LOAD AS

TRIANGULAR DISTRIBUTION W/ 25

FT TRIB FROM PEAK TO PEAK IN

EITHER SIDE AT MIDDLE OF FEN

LATERAL LOADS

$$\text{TOTAL SEISMIC } WT = 306 \text{ K}$$

$$\text{TOTAL ROOF AREA} = 12095 \text{ SF}$$

$$\text{TRIBUTARY ROOF AREA} = 163 \text{ SF} + \frac{1}{2} \times 3358 \text{ SF} + \frac{1}{2} \times \frac{1}{2} \times 4619 \text{ SF}$$

$$= 2997 \text{ SF}$$

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1759 MULTI-USE CONT'D

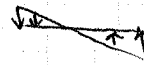
$$\begin{aligned} \text{TRIBUTARY SEISMIC WT} &= \frac{2997}{17095} * 3062 \\ &= 76 \text{ K} \end{aligned}$$

$$\begin{aligned} \text{BSE-2 } Q_{uf} &= 1.5W \\ &= 1.5 * 76 \\ &= 114 \text{ K} \end{aligned}$$

$$\begin{aligned} \text{BSE-2 } M_{ot} &= V * h \\ &= 114 \text{ K} * 8.67 \text{ FT} \\ &= 986 \text{ K-FT} \end{aligned}$$

$$\frac{M}{S} = \frac{986}{1.5 * \frac{(13)^2}{6} + 1.5} = 35 \text{ KLF}$$

$$\text{BSE-2 } \frac{Q_{uf}}{3} = \frac{35}{2} = 17.5 \text{ KLF} \quad \text{FROM START OF FOOTING TO 13 FT}$$



FROM PREVIOUS, (E) FOOTING CAPACITY:

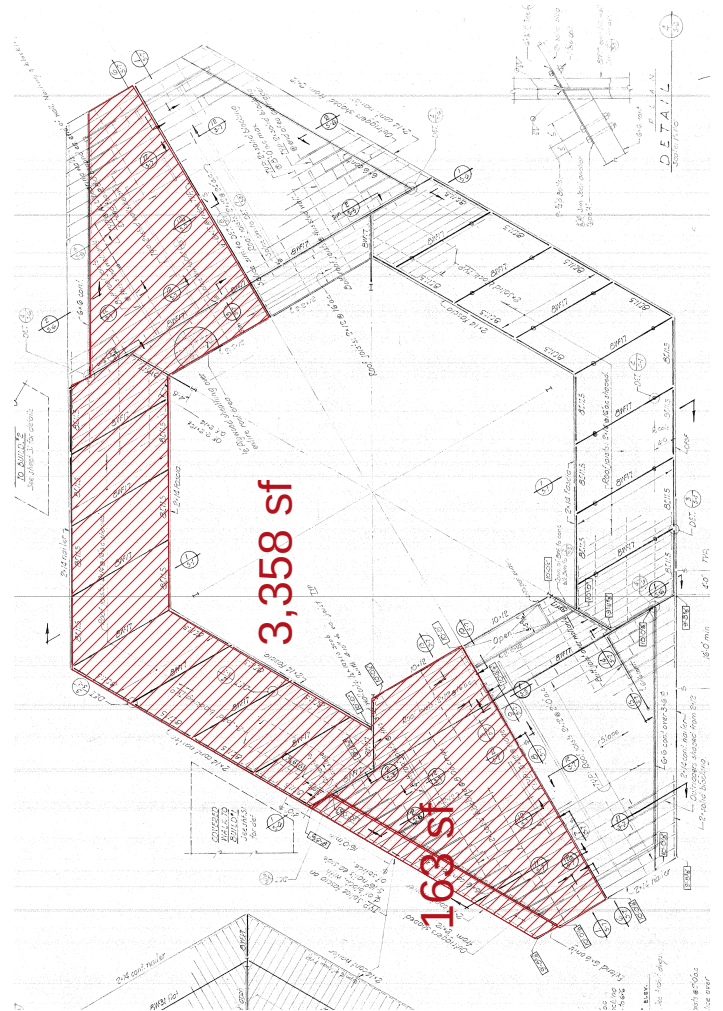
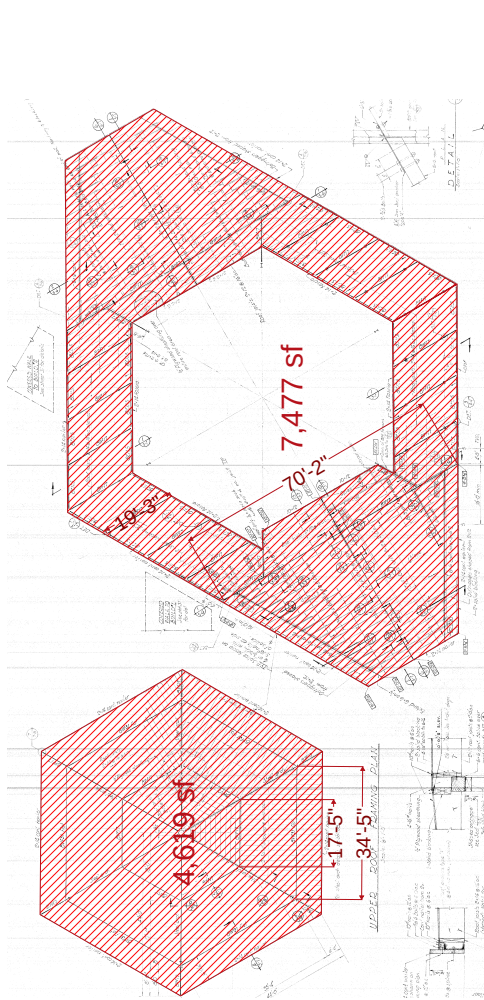
$$Q_{ul} = 34.3 \text{ K-FT}$$

FROM RISA,

$$\begin{aligned} \text{BSE-2 } Q_{uf} &= 259 \text{ K-FT} \quad \text{AT 26 FT} \\ &= 186 \text{ K-FT} \quad \text{AT 13 FT} \end{aligned}$$

$$\underline{\underline{\text{BSE-2 } \frac{Q_{uf}}{Q_{ul}} = \frac{259}{34.3} = 7.6}}}$$

1959 Multi-Use



Roof Area = **12095 sf** (Includes Overhang)

Diaphragm: Roof Slope: **3.25:12**

Slope Factor:

1.04

Roof Materials	PSF
Built up roofing	6.0
1/2" Plywood	1.5
2x12 Wood Rafters @ 24"oc	2.6
Steel Beams	1.4
M/E/P	1.5
Ceiling	1.5
Insulation	1.0
Misc.	2.5

Total **18.0**

x Roof Area =

Diaphragm Wt

75 kips
19 kips
33 kips
17 kips
19 kips
19 kips
13 kips
31 kips
225 kips

Sum =

1) Diaphragm weights include the diaphragm and half of the height of out-of-plane walls.

2) Seismic wall weights include half height of wall.

Ext Walls

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
1	8" CMU Wall	80	19	8.7	13 kips	7 kips
	Window	10	0	9.0	kips	kips
				Sum =	13 kips	7 kips

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
2	8" CMU Wall	80	13	8.7	9 kips	5 kips
	Window	10	28	9.0	3 kips	1 kips
				Sum =	12 kips	6 kips

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
3	8" CMU Wall	80	0	8.7	kips	kips
	Window	10	40	9.0	4 kips	2 kips
				Sum =	4 kips	2 kips

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
4	8" CMU Wall	80	25	8.7	17 kips	9 kips
	Window	10	0	9.0	kips	kips
				Sum =	17 kips	9 kips

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
5	8" CMU Wall	80	0	8.7	kips	kips
	Window	10	40	9.0	4 kips	2 kips
				Sum =	4 kips	2 kips

Line	Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	<u>Diaphragm Wall Wt</u>
6	8" CMU Wall	80	24	8.7	17 kips	8 kips
	Window	10	16	9.0	1 kips	1 kips
				Sum =	18 kips	9 kips

Int Walls

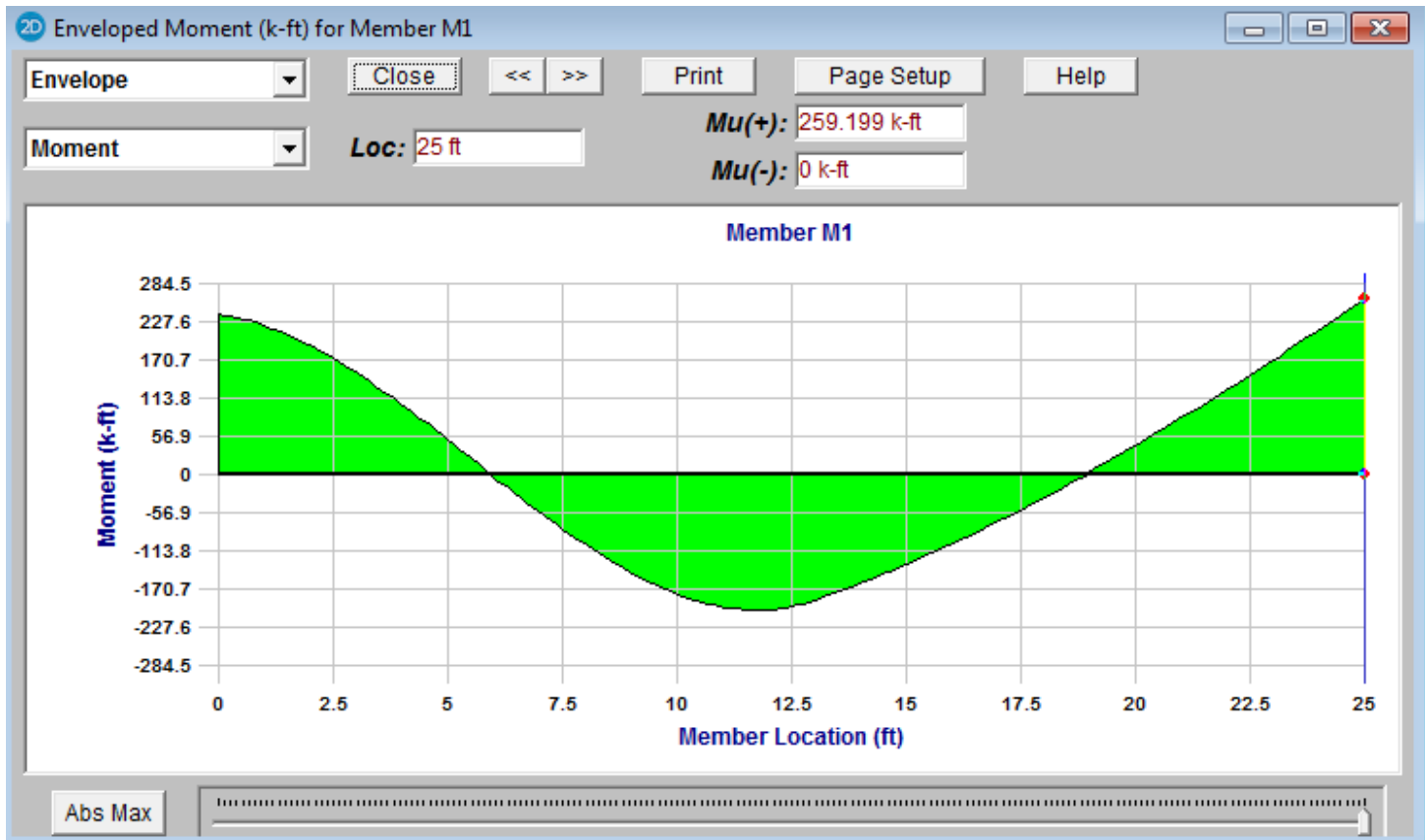
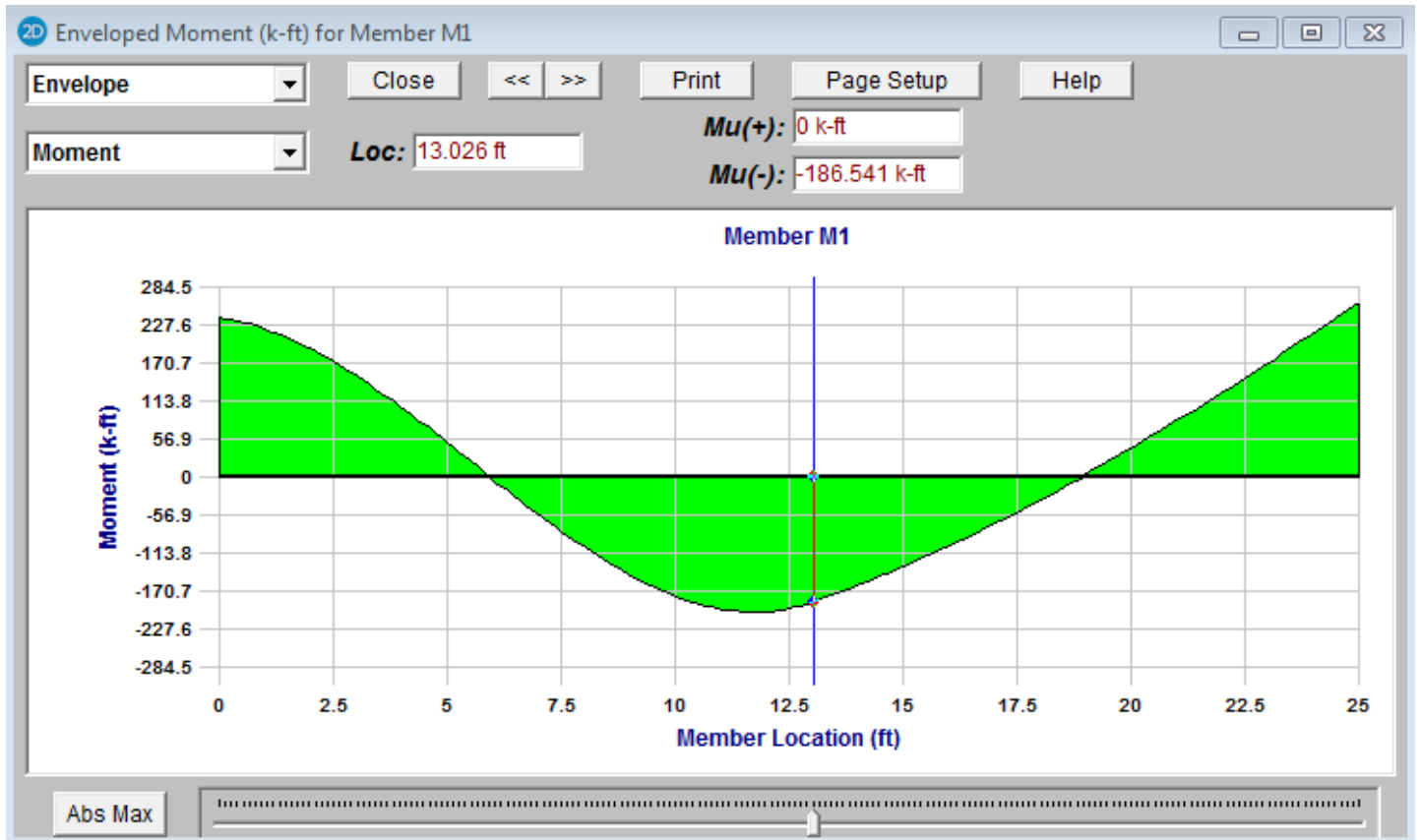
Line	Elements	PSF	x	Length (ft)or Quantity	x	Height (ft)	=	Wall Weight	Diaphragm Wall Wt
1	Wood Framed Wall	15		50		9.0		7 kips	3 kips
						Sum =		7 kips	3 kips
2	8" CMU Wall	80		12		9.0		9 kips	4 kips
						Sum =		9 kips	4 kips
3	Wood Framed Wall	15		210		12.0		38 kips	19 kips
						Sum =		38 kips	19 kips
4	8" CMU Wall	80		49		9.0		35 kips	18 kips
						Sum =		35 kips	18 kips
5	Wood Framed Wall	15		50		9.0		7 kips	3 kips
						Sum =		7 kips	3 kips

Weight Summary:

Diaphragm Weights

Diaphragm Weight = **306 kips**

1959 Multi-Use



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NEW FOOTING

24" DEEP

36" WIDE

(5) # 8 T & B # 3 @ 12" oc

$$a = \frac{A_s f_y}{0.85 f'_c b}$$

$$= \frac{5 * 0.71 * 60}{0.85 * 3 * 36}$$

$$= 2.58$$

$$Q_u = A_s f_y \left(d - \frac{a}{2} \right)$$

$$d = 24" - 3" - 3 \left(\frac{8}{8} \right) - \frac{1}{2} * \frac{8}{8} "$$

$$= 5 * 0.71 * 60 \left(20.125 - \frac{2.58}{2} \right)$$

$$= 20.125 "$$

$$= 372 \text{ K-FT}$$

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1774 CLASSROOM

VERTICAL LOADS

INTERIOR WALL - WOOD

$$WT = 12 \text{ PSF}$$

$$HT = 11.5 \text{ FT}$$

$$WT = 138 \text{ PLF}$$

ROOF WEIGHT

$$WT = 16 \text{ PSF}$$

$$TRIB = \frac{1}{2}(24 + 28)$$

$$= 26 \text{ FT}$$

$$WT = 416 \text{ PLF}$$

FOUNDATION

$$2'-0" \times 2'-0"$$

W/ (2) #5 T & B & #3 @ 16" c

$$WT = 2 \times 2 \times 150$$

$$= 600 \text{ PLF}$$

SLAB

$$5" \text{ W/ } \#3 @ 16" \text{ c}$$

$$WT = 5/12' \times 150 \text{ PCF}$$

$$= 63 \text{ PSF}$$

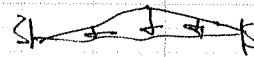
$$\text{MAX } WT = 63 \text{ PSF} \times 25 \text{ FT}$$

$$= 1575 \text{ PLF}$$

$$\text{MAX } LL = 313 \text{ PLF (SEE PREV)}$$

MODEL SLAB LOAD

AS TRIANGULAR LOAD



LATERAL LOADS

$$\text{TOTAL SEISMIC } WT = 154 \text{ K}$$

$$\text{TOTAL ROOF AREA} = 7254 \text{ SF}$$

$$\begin{aligned} \text{TRIBUTARY ROOF AREA} &= \frac{1}{2}(1068 + 1797) \\ &= 1444 \text{ SF} \end{aligned}$$

$$\begin{aligned} \text{TRIBUTARY SEISMIC WEIGHT} &= \frac{1444}{7254} \times 154 \\ &= 30.6 \text{ K} \end{aligned}$$

$$\begin{aligned} \text{SE-2 } Q_w &= 1.5W \\ &= 46 \text{ K} \end{aligned}$$

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1714 CLASSROOM CONT'D

$$\begin{aligned} \text{BSE-2 } Q_{na} &= V * L \\ &= 46 \text{ K} * 11.5 \text{ FT} \\ &= 529 \text{ K-FT} \end{aligned}$$

$$\frac{M}{S} = \frac{529 \text{ K-FT}}{2 * \frac{25'}{6}} * 2$$

$$= 5.1 \text{ KLF}$$

$$\text{BSE-2 } \frac{Q_{na}}{S} = \frac{5.1 \text{ KLF}}{2} = 2.5 \text{ KLF}$$

FOOTING CAPACITY

$$f'_{cu} = 2500 \text{ PSI}$$

$$f_y = 40 \text{ KSI}$$

(PER SHEET S8 OR16 1714 DWG)

$$a = \frac{A_s f_y}{0.85 f'_{cu} L}$$

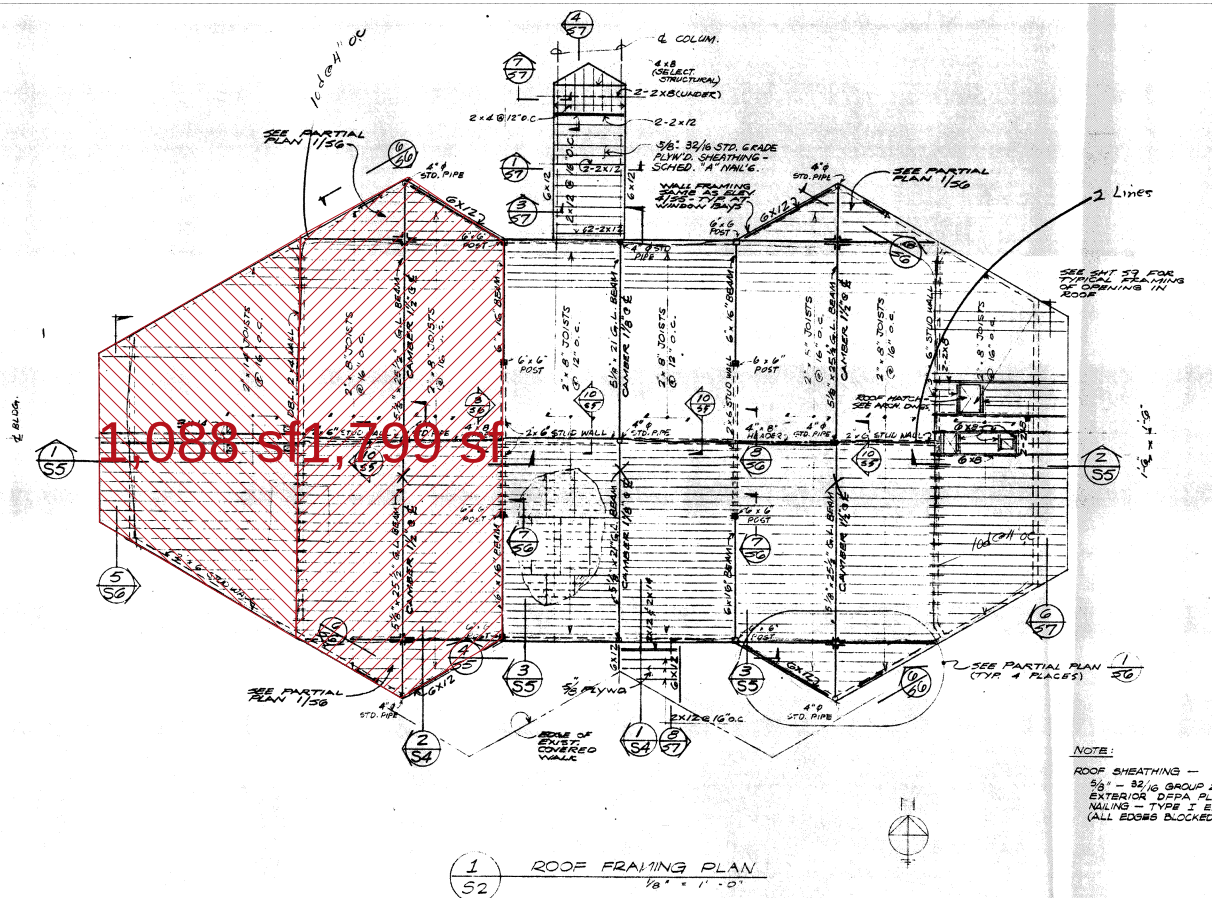
$$\begin{aligned} &= \frac{2 * 0.31 * 40}{0.85 * 2.5 * 24} \\ &= 0.49 \end{aligned}$$

$$\begin{aligned} d &= 24 - 3 - 3/8 - 1/2 * \frac{5}{8} \\ &= 20.3125 \end{aligned}$$

$$\begin{aligned} Q_{cu} &= A_s f_y (d - a/2) \\ &= 0.31 * 2 * 40 * (20.3125 - \frac{0.49}{2}) \\ &= 412 \text{ K-FT} \end{aligned}$$

$$\text{MAX MOMENT} = 159 \text{ K-FT}$$

$$\text{BSE-2 } \frac{Q_{na}}{Q_{cu}} = \frac{159}{412} = \underline{\underline{3.8}}$$



Roof Area = **7254 sf** (Includes Overhang)

 Diaphragm: Roof Slope: **3.25:12**

 Slope Factor: **1.04**

Roof Materials	PSF
Built up roofing	6.0
5/8" Plywood	1.5
2x8 Wood Rafters @ 16"oc	1.6
GLB	0.6
M/E/P	1.5
Ceiling	1.5
Insulation	1.0
Misc.	2.3

 Total **16.0**

x Roof Area =

Diaphragm Wt

45 kips

11 kips

12 kips

5 kips

11 kips

11 kips

8 kips

17 kips

Sum =

120 kips

1) Diaphragm weights include the diaphragm and half of the height of out-of-plane walls.

2) Seismic wall weights include half height of wall.

Ext Walls

Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	Diaphragm Wall Wt
Wood Wall	15	315	10.0	47 kips	24 kips
Window	10	35	10.0	4 kips	2 kips
			Sum =	51 kips	25 kips

Int Walls

Elements	PSF	x Length (ft) or Quantity	x Height (ft)	= Wall Weight	Diaphragm Wall Wt
Wood Framed Wall	12	126	11.5	17 kips	9 kips
			Sum =	17 kips	9 kips

Weight Summary:

Diaphragm Weights

 Diaphragm Weight = **154 kips**

1974 Classroom

