1. BUILDING LOADS AS REQUIRED BY CODE:

Loads are in accordance to:	2012	IBC
Modified by:	Massachusetts Building Code	(CMR780)
Snow	Lowell	MA
Wind	Lowell	MA
Seismic	Lowell	MA
Construction Live Load:	20	psf
Uniform Live Load:	100	psf

2.1 BUILDING VERTICAL LOADS:

	Roof		1st Floor	
2.1. Dead Load (D)	26.0	psf	128	psf
2.2. Live Load (L)		psf	100	psf
2.3. Roof Live Load (Lr)	20.0	psf		psf
2.4. Snow Load (S)	31.5	psf		psf
2.5. Rain Load (R)		psf		psf
2.6. Seismic Load (E)		psf		psf
2.7. Wind Load (W)	-23.0	psf		psf
Total / Service Load:	54.5	psf	228	psf

2.2 LOAD COMBINATIONS PER LRFD SPECIFICATIONS:

	Roof		1st Floor	
1. 1.4D	36.4	psf	179.2	psf
2. 1.2D + 1.6L + .5(Lr or S or R)	47.0	psf	313.6	psf
3. 1.2D + 1.6(Lr or S or R) + (L or .5W)	70.1	psf	253.6	psf
4. 1.2D + 1.0W + L + .5(Lr or S or R)	24.0	psf	153.6	psf
5. 1.2D + 1.0E + L + .2S	37.5	psf	253.6	psf
6. 0.9D + 1.0W	0.4	psf	115.2	psf
7. 0.9D + 1.0E	23.4	psf	115.2	psf
Controlling Load:	70.1	psf	313.6	psf

3.1 BUILDING LATERAL LOAD ON LONGITUDINAL DIRECTION: BRACED-FRAME

	Roof		1st Floor	
2.1. Dead Load (D)		psf		psf
2.2. Live Load (L)		psf		psf
2.3. Roof Live Load (Lr)		psf		psf
2.4. Snow Load (S)		psf		psf
2.5. Rain Load (R)		psf		psf
2.6. Seismic Load (E)	20.8	psf	20.4	psf
2.7. Wind Load (W)	6.4	psf	12.9	psf
Total / Service Load:	27.2	psf	33.3	psf

3.2 LOAD COMBINATIONS PER LRFD SPECIFICATIONS:

	Roof		1st Floor	
1. 1.4D	0.0	psf	0.0	psf
2. 1.2D + 1.6L + .5(Lr or S or R)	0.0	psf	0.0	psf
3. 1.2D + 1.6(Lr or S or R) + (L or .5W)	3.2	psf	6.4	psf
4. 1.2D + 1.0W + L + .5(Lr or S or R)	6.4	psf	12.9	psf
5. 1.2D + 1.0E + L + .2S	20.8	psf	20.4	psf
6. 0.9D + 1.0W	6.4	psf	12.9	psf
7. 0.9D + 1.0E	20.8	psf	20.4	psf
Controlling Load:	20.8	psf	20.4	psf

4.1 BUILDING LATERAL LOAD ON TRANSVERSE DIRECTION: MOMENT-FRAME

	Roof		1st Floor	
2.1. Dead Load (D)		psf		psf
2.2. Live Load (L)		psf		psf
2.3. Roof Live Load (Lr)		psf		psf
2.4. Snow Load (S)		psf		psf
2.5. Rain Load (R)		psf		psf
2.6. Seismic Load (E)	17.6	psf	17.0	psf
2.7. Wind Load (W)	9.8	psf	19.6	psf
Total / Service Load:	27.3	psf	36.6	psf

4.2 LOAD COMBINATIONS PER LRFD SPECIFICATIONS:

	Roof		1st Floor	
1. 1.4D	0.0	psf	0.0	psf
2. 1.2D + 1.6L + .5(Lr or S or R)	0.0	psf	0.0	psf
3. 1.2D + 1.6(Lr or S or R) + (L or .5W)	4.9	psf	9.8	psf
4. 1.2D + 1.0W + L + .5(Lr or S or R)	9.8	psf	19.6	psf
5. 1.2D + 1.0E + L + .2S	17.6	psf	17.0	psf
6. 0.9D + 1.0W	9.8	psf	19.6	psf
7. 0.9D + 1.0E	17.6	psf	17.0	psf
Controlling Load:	17.6	psf	19.6	psf

Reference: ASCE 7-10
Section *Eq/Fig/Table/Notes*

DEAD LOAD

3

Floor:	Roof					2nd				
	Item	Quantity *(Area)*	Units	Unit Weight *(ksf or klf)*	Weight *(kip)*	Item	Quantity *(Area)*	Units	Unit Weight *(ksf or klf)*	Weight *(kip)*
	Metal Deck	7776	*sf*	0.014	109	Concrete Slab	7776	*sf*	0.075	583
	EPDM Membrane	7776	*sf*	0.001	8	Metal Deck 18 g.a	7776	*sf*	0.014	109
	Insulation	7776	*sf*	0.006	47	Cladding	7776	*sf*	0.01	78
	Mechanical Equipment	7776	*sf*	0.005	39	Partitions	7776	*sf*	0.01	78
						Mechanical Equipment	7776	*sf*	0.007	54
						Steel Structure	7776	*sf*	0.012	93
Subtotal	*202*			0.026	202	*995*			0.128	995
Cummulative	*202*				202	*1198*				**1198**

***Unit Weights per ASCE 7-10**

Reference: ASCE 7-10
Section *Eq/Fig/Table/Notes*

SNOW LOAD

7

Exposure Factor	C_e =	0.90		Table	7-2
Thermal Factor	C_t =	1.00		Table	7-3
Importance Factor	I_s =	1.00		Table	1.5-2
Ground Snow Load	ρ_g =	50.00	psf	Figure	7-1
Flat Roof Snow Load	ρ_f =	31.50	psf	Eq	7.3-1

Reference: ASCE 7-10

	Section	*Eq/Fig/Table/Notes*
SEISMIC LOAD	12	

Number of Floors: 2

Floor:	**Roof**					**2nd**				
	Item	**Quantity** *(Area)*	**Units**	**Unit Weight** *(ksf or klf)*	**Weight** *(kip)*	**Item**	**Quantity** *(Area)*	**Units**	**Unit Weight** *(ksf or klf)*	**Weight** *(kip)*
						Concrete Slab	7776	*sf*	0.075	583
	Metal Deck	7776	*sf*	0.014	109	**Metal Deck**	7776	*sf*	0.014	109
	EPDM Membrane	7776	*sf*	0.001	8	**Cladding**	7776	*sf*	0.01	78
	Insulation	7776	*sf*	0.006	47	**Partitions**	7776	*sf*	0.01	78
	Mechanical Equipment	7776	*sf*	0.005	39	**Mechanical Equipment**	7776	*sf*	0.007	54
	Snow	7776	*sf*	0.0315	245	**Steel Structure**	7776	*sf*	0.012	93
Subtotal	*447*				**447**	*995*				**995**
Cummulative	*447*				**447**	*1442*				**1442**
Mass (kip*s^2/ft)					107					58

WIND LOAD ANALYSIS

				Reference: Section	ASCE 7-10 *Eq/Fig/Table/Notes*	
1. BUILDING INFORMATION RELATED TO WIND LOAD ANALYSIS				26/27/28		
Mean roof height	H_{roof} =	30	ft	*Height of heighest level of structure*		
Floor-Floor Height	h_n =	15	ft			
Building Length	L =	112	ft			
Building Width	W =	76	ft			
Number of Braces/Level		2				
Number of Moment Frames/ Level		2				
2. WIND EXPOSURE, ROUGHNESS AND OCCUPANCY CATEGORY				26.4		
Occupancy Category:		B			Table	1-1
Ground Surface Roughness:		B				26.7.2
Exposure Category:		C				26.7.2
3. ENVIRONMENTAL CHARACTERISTICS AND FACTORS				26.5		
Wind Speed	V =	120	mph	26.5	Figure	26.5-1A
Zone A	P_{s30} =	22.8	psf		Figure	28.6-1
Zone C	P_{s30} =	15.1	psf		Figure	28.6-1
	a_1 =	7.6	ft	*.1*W*		
	a_2 =	12	ft	*.4*H_{roof}*		
	a =	7.6	ft	*Min Value*		
	2.a =	15.2	ft			
Weighted Average for P_{s30}:						
Longitudinal		16.1	psf			
Transverse		16.6	psf			
4. DESIGN WIND PRESSURE				26.8		
Adjustment Factor	λ =	1.4			Figure	28.6-1
	K_{zt} =	1		*26.8*		
Design wind pressure,	$P_{s\text{-longitudinal}}$ =	22.6	kip			
Design wind pressure,	$P_{s\text{-transverse}}$ =	23.3	kip			
5. LOAD APPLIED TO EACH LEVEL				26.8		
Roof	$F_{u\text{-longitudinal}}$ =	12.9	kip		Figure	28.6-1
	$F_{u\text{-transverse}}$ =	19.6	kip	*26.8*		

Level 1	$F_{u\text{-longitudinal}} =$	25.8	kip
	$F_{u\text{-transverse}} =$	39.1	kip

6. LATERAL LOAD APPLIED TO BRACED AND MOMENT FRAME

		Roof	Level 1	
Braced Frame	(Longitudinal)	6.44	12.88	kip
Moment Frame	(Transverse)	9.78	19.57	kip

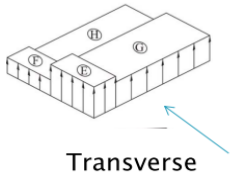
7. VERTICAL UPLIFT PRESSURES ON ROOF

Zone E	P_{s30}	-27.4	psf	Figure 28.6-1
Zone F	P_{s30}	-15.6	psf	Figure 28.6-1
Zone G	P_{s30}	-19.1	psf	Figure 28.6-1
Zone H	P_{s30}	-12.1	psf	Figure 28.6-1

Design wind pressure Zone E,	P_s	-38.36	psf
Design wind pressure Zone F,	P_s	-21.84	psf
Design wind pressure Zone G,	P_s	-26.74	psf
Design wind pressure Zone H,	P_s	-16.94	psf

7. UPLIFT PRESSURE (TRANSVERSE LOADING)

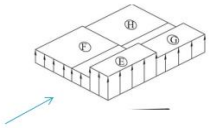
Area, Zone E	577.6	ft^2
Area, Zone F	577.6	ft^2
Area, Zone G	3678.4	ft^2
Area, Zone H	3678.4	ft^2
Total Roof Area	8512	ft^2



Weighted Uplift Pressure from Transverse Wind Load -22.96 psf

8. UPLIFT PRESSURE (LONGITUDINAL LOADING)

Area, Zone E	851.2	ft^2
Area, Zone F	851.2	ft^2
Area, Zone G	3404.8	ft^2
Area, Zone H	3404.8	ft^2
Total Roof Area	8512	ft^2



Longitudinal

Weighted Uplift Pressure from Longitudinal Wind Load	-23.49	psf

9. MAXIMUM UPLIFT PRESSURE

Controlling Uplift Pressure	-23.49	psf	Largest Absolute Value

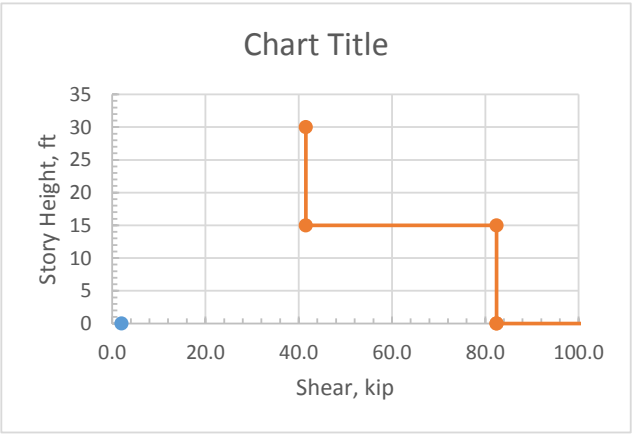
ASSUMPTIONS:

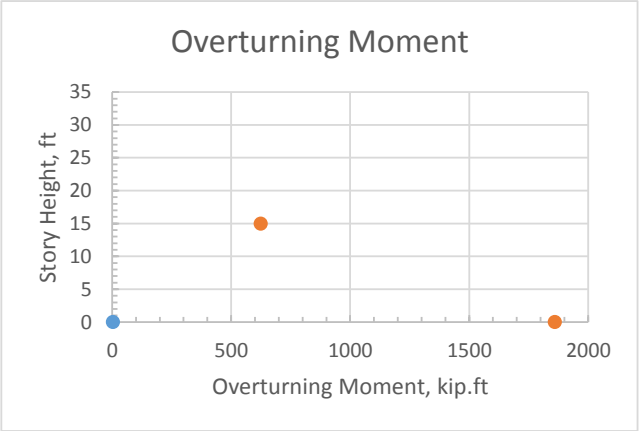
Building Frame System: Eccentrically braced steel frame

			Reference: Section	ASCE	7-10 *Eq/Fig/Table/Notes*
1. SEISMIC GROUD MOTION VALUES			11.4		
Seismic Site Class:	C		11.4.2	Soil Properties / Ch. 20	
Maximum Considered Earthquake Spectral Response:					
S_s =	0.250		11.4.1	Fig	22-1 / 22-4
S_1 =	0.077		11.4.1	Fig	22-1 / 22-4
Adjusted MCE Spectral Response:					
F_a =	1.200		11.4.3	Table	11.4-1
F_v =	1.700		11.4.3	Table	11.4-2
$S_{MS} = F_a S_s$ =	0.300		11.4.3	Eq	11.4-1
$S_{M1} = F_v S_1$ =	0.131		11.4.3	Eq	11.4-2
Design Spectral Response Acceleration Parameters:					
$S_{DS} = 2/3\ S_{MS}$ =	0.2		11.4.4	Eq	11.4-3
$S_{D1} = 2/3\ S_{M1}$ =	0.087		11.4.4	Eq	11.4-4
Design Response Spectrum:					
$T_O = 0.2\ S_{D1}/S_{DS}$ =	0.087	s	11.4.5		
$T_S = S_{D1}/S_{DS}$ =	0.436	s	11.4.5		
Long Period Transition T_L=	6	s	11.4.5	Fig	22-15
T =	0.54	s	Fundamental Period of Structure		
S_a = if $T < T_O$: $S_{DS}(0.4+0.6T/T_O)$ =			11.4.5	Eq	11.4-5
if $T_O < T < T_S$: S_{DS} =			11.4.5		
if $T_S < T < T_L$: S_{D1}/T =	0.162		11.4.5	Eq	11.4-6
if $T > T_L$: $S_{D1}*T_L/T^2$=			11.4.5	Eq	11.4-7
2. IMPORTANCE FACTOR AND OCCUPANCY CATEGORY			11.5		
Occupancy Category:	II			Table	1-1
Importance Factor:	1			Table	11.5-1
3. SEISMIC DESIGN CATEGORY			11.6		
SDC based on short period:	B			Table	11.6-1
SDS based on 1-s period:	B			Table	11.6-2
SDC =	**B**		*Maximum from values above*		
4. EQUIVALENT LATERAL FORCE PROCEDURE			12.8		
R =	3.25		12.8.1	Table	12.2-1
Ω_O =	2		12.8.1	Table	12.2-1
C_D =	3.25		12.8.1	Table	12.2-1

Approximate Fundamental Period, T_a:				12.8.2.1		
	C_t =	0.03		*Dependent on structure*	Table	12.8-2
	x =	0.75			Table	12.8-2
	h_n =	30	ft	*Height of heighest level of structure*		
	$T_a = C_t h_n^{\ x}$ =	0.385	s	12.8.2.1	Eq	12.8-7
Seismic Response Coefficient:				12.8.1.1		
	$C_{Scalc} = S_{DS}/(R/I)$ =	0.062			Eq	12.8-2
	C_{Smax} = if $T <= T_L : S_{D1}/(T*(R/I)$ =	0.050			Eq	12.8-3
	if $T > T_L : S_{D1}*T_L/(T^2*(R/I)$ =				Eq	12.8-4
	C_{Smin} =	0.01		*Revised Sup. 2*	Eq	12.8-5/12.8-6
	C_S =	0.050				
Seismic Base Shear:				12.8.1		
Seismic Weight	W =	1652	kip	12.7.2		Table Below
Seismic Base Shear	V =	82.4	kip	12.8.1	Eq	12.8-1
Vertical Distribution of Seismic Forces:				12.8.3		
Lateral force per level		$F_x = C_{vx}V$			Eq	12.8-11
		$C_{vx} = (w_x h_x^{\ k})/(\Sigma\ w_i h_i^{\ k})$		*Vertical Distribution Factor*		
	k =	0.94		12.8.3		
Horizontal Distribution of Seismic Forces:				12.8.4		
	$V_x = \Sigma\ F_i$ =				Eq	12.8-13

Floor	Height (ft)	Weight (kip)	$w_x h_x^{\ k}$	C_{vx}	F_x (kip)	V_x (kip)	Overturning Moment (kip.ft)	Total Height (ft)
Roof	15	572	14090	0.504	41.5	41.5		30
						41.5		15
2nd	15	1081	13867	0.496	40.9	82.4	623	15
						82.4		0
Podium	0	0	0	0	0	82.4	1859	0
SUM	30	1652	27957	1	82.4	123.9		0





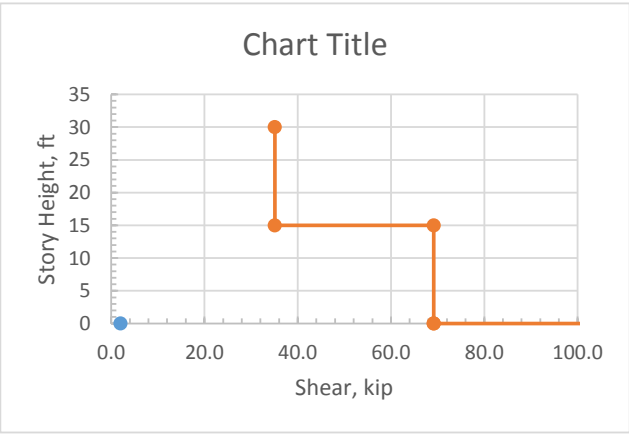
ASSUMPTIONS:

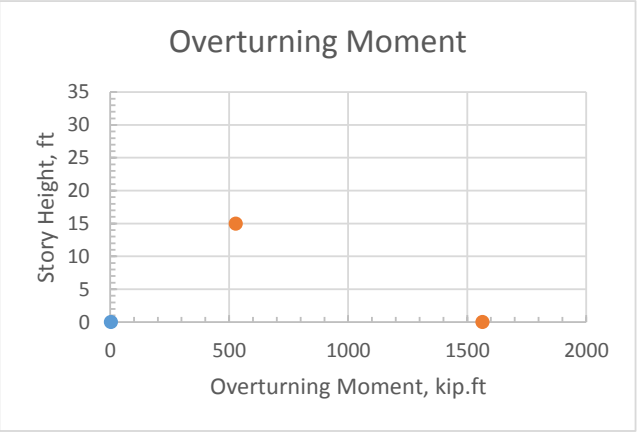
Building Frame System: Steel moment-resisting frame

			Reference: Section	ASCE	7-10 Eq/Fig/Table/Notes
1. SEISMIC GROUD MOTION VALUES			11.4		
Seismic Site Class:	C		11.4.2	Soil Properties / Ch. 20	
Maximum Considered Earthquake Spectral Response:					
S_s =	0.250		11.4.1	Fig	22-1 / 22-4
S_1 =	0.077		11.4.1	Fig	22-1 / 22-4
Adjusted MCE Spectral Response:					
F_a =	1.200		11.4.3	Table	11.4-1
F_v =	1.700		11.4.3	Table	11.4-2
$S_{MS} = F_a S_s$ =	0.3		11.4.3	Eq	11.4-1
$S_{M1} = F_v S_1$ =	0.131		11.4.3	Eq	11.4-2
Design Spectral Response Acceleration Parameters:					
$S_{DS} = 2/3\ S_{MS}$ =	0.2		11.4.4	Eq	11.4-3
$S_{D1} = 2/3\ S_{M1}$ =	0.087		11.4.4	Eq	11.4-4
Design Response Spectrum:					
$T_O = 0.2\ S_{D1}/S_{DS}$ =	0.087	s	11.4.5		
$T_S = S_{D1}/S_{DS}$ =	0.436	s	11.4.5		
Long Period Transition T_L=	6	s	11.4.5	Fig	22-15
T =	0.60	s	*Fundamental Period of Structure*		
S_a = if $T < T_O$: $S_{DS}(0.4+0.6T/T_O)$ =			11.4.5	Eq	11.4-5
if $T_O < T < T_S$: S_{DS} =			11.4.5		
if $T_S < T < T_L$: S_{D1}/T =	0.147		11.4.5	Eq	11.4-6
if $T > T_L$: $S_{D1}*T_L/T^2$=			11.4.5	Eq	11.4-7
2. IMPORTANCE FACTOR AND OCCUPANCY CATEGORY			11.5		
Occupancy Category:	II			Table	1-1
Importance Factor:	1			Table	11.5-1
3. SEISMIC DESIGN CATEGORY			11.6		
SDC based on short period:	B			Table	11.6-1
SDS based on 1-s period:	B			Table	11.6-2
SDC =	**B**		*Maximum from values above*		
4. EQUIVALENT LATERAL FORCE PROCEDURE			12.8		
R =	3.5		12.8.1	Table	12.2-1
Ω_O =	3		12.8.1	Table	12.2-1
C_D =	3		12.8.1	Table	12.2-1

Approximate Fundamental Period, T_a:				12.8.2.1		
	C_t =	0.028		*Dependent on structure*	Table	12.8-2
	x =	0.8			Table	12.8-2
	h_n =	30	ft	*Height of heighest level of structure*		
	$T_a = C_t h_n^x$ =	0.425	s	12.8.2.1	Eq	12.8-7
Seismic Response Coefficient:				12.8.1.1		
	$C_{Scalc} = S_{DS}/(R/I)$ =	0.057			Eq	12.8-2
	C_{Smax} = if $T <= T_L : S_{D1}/(T*(R/I))$ =	0.042			Eq	12.8-3
	if $T > T_L : S_{D1}*T_L/(T^2*(R/I))$ =				Eq	12.8-4
	C_{Smin} =	0.01		*Revised Sup. 2*	Eq	12.8-5/12.8-6
	C_S =	0.042		*Beware of mins and max*		
Seismic Base Shear:				12.8.1		
Seismic Weight	W =	1652	kip	12.7.2		Table Below
Seismic Base Shear	V =	69.2	kip	12.8.1	Eq	12.8-1
Vertical Distribution of Seismic Forces:				12.8.3		
Lateral force per level	$F_x = C_{vx}V$				Eq	12.8-11
	$C_{vx} = (w_x h_x^k)/(\Sigma\, w_i h_i^k)$			*Vertical Distribution Factor*		
	k =	0.96		12.8.3		
Horizontal Distribution of Seismic Forces:				12.8.4		
	$V_x = \Sigma\, F_i$ =				Eq	12.8-13

Floor	Height (ft)	Weight (kip)	$w_x h_x^k$	C_{vx}	F_x (kip)	V_x (kip)	Overturning Moment (kip.ft)	Total Height (ft)
Roof	15	572	15105	0.508	35.1	35.1		30
						35.1		15
2nd	15	1081	14656	0.492	34.1	69.2	527	15
						69.2		0
Podium	0	0	0	0	0	69.2	1564	0
SUM	30	1652	29761	1	69.2	104.3		0





1. MOMENT FRAME INFORMATION

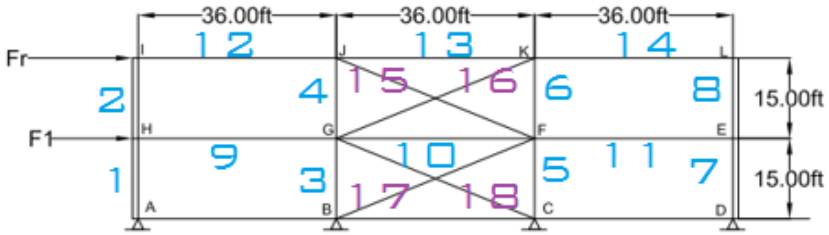


Figure 1 - Braced-Frame Member Reference

Diagonal, D	39	ft	
Story Height, H	15	ft	
Bay Width, W	36	ft	
F_r	9.78	kip	6.44
F_1	19.57	kip	0.00

2.1 MEMBER FORCES DISTRIBUTION

Find Reactions

Cy=		kip	up	
By=	0.00	kip	down	
Cx=	-14.68	kip	west	
Bx=	-14.68	kip	west	

Joint B

(Fr+F1)/2	V_1	14.68	kip		
	F_{BFy}	-6.12	kip		
Brace Force	F_{BF}	15.90	kip	T	
Vertical Force	F_{BG}	-6.1152	kip	T	

Joint C

V_1	14.68	kip		
F_{GCy}	-6.12	kip		C
F_{GC}	15.90	kip		C
F_{FC}	-6.12	kip		C

To solve system:

Moment Equation	15	F_{GF}	27.69	F_{GK}	-36	F_{GJ}	=	-72.06	513.69
Forces in X	-1	F_{GF}	-0.923	F_{GK}	0	F_{GJ}	=	-4.8	-4.89
Forces in Y	0	F_{GF}	-0.385	F_{GK}	1	F_{GJ}	=	4	-12

Inverse Matrix

61.533	922	2215.2
-66.666	-1000	-2400.0
-25.666	-385	-923.0

Solution

F_{GF}	1.13
F_{GK}	3.95
F_{GJ}	5.49

Joint G

Brace Force	F_{GK}	3.95	kip	C
Horizontal Force	F_{GF}	1.13	kip	C
Vertical Force	F_{GJ}	5.49	kip	T

Joint F

F_{FJ}	14.67	kip	C
F_{GF}	1.13	kip	C
F_{FK}	1.52	kip	T

Joint J

Joint K

Brace Force	F_{JF}	14.7	kip	C	F_{GK}	4.0	kip	C
Horizontal Force	**F_{JK}**	3.6	kip	T	F_{KJ}	3.6	kip	T
Vertical Force	F_{JG}	5.49	kip	T	F_{KF}	1.5	kip	T

3. RESULTS

	Member (#)	Frame (type)	Floor (Units)	Function	Force (kip)	T/C	Moment (kip.ft)
GF	10	Braced	First	Beam	14.67	C	
JK	13	Braced	Roof	Beam	3.65	T	
JF	15	Braced	Roof	Brace	14.67	C	
GK	16	Braced	Roof	Brace	3.95	C	
BF	17	Braced	First	Brace	15.90	T	
GC	18	Braced	First	Brace	15.90	C	
BG	3	Braced	First	Column	-6.12	T	
JG	4	Braced	Roof	Column	5.49	T	
CF	5	Braced	First	Column	-6.12	C	
KF	6	Braced	Roof	Column	1.52	T	

1. MOMENT FRAME INFORMATION

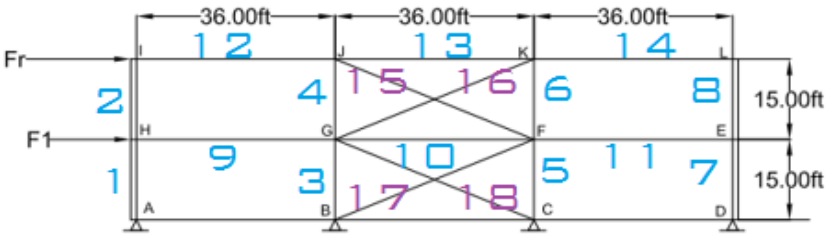


Figure 1 - Braced-Frame Member Reference

Diagonal, D	39	ft
Story Height, H	15	ft
Bay Width, W	36	ft
F_r	20.77	kip
F_1	20.44	kip

2.1 MEMBER FORCES DISTRIBUTION

Find Reactions

Cy=		kip	up
By=	0	kip	down
Cx=	-20.603	kip	west
Bx=	-20.603	kip	west

Joint B

(Fr+F1)/2	V_1	20.60	kip	
	F_{BFy}	-8.58	kip	
Brace Force	F_{BF}	22.32	kip	T
Vertical Force	F_{BG}	-8.58	kip	T

Joint C

	V_1	20.60	kip	
	F_{GCy}	-8.58	kip	C
	F_{GC}	22.32	kip	C
	F_{FC}	-8.58	kip	C

To solve system:

Moment Equation	15	F_{GF}	27.69	F_{GK}	-36	F_{GJ}	=	29.1	615.63
Forces in X	-1	F_{GF}	-0.923	F_{GK}	0	F_{GJ}	=	-6.25	0.16
Forces in Y	0	F_{GF}	-0.385	F_{GK}	1	F_{GJ}	=	1.796	-17.17

Inverse Matrix

61.533	922	2215.2
-66.666	-1000	-2400.0
-25.666	-385	-923.0

Solution

F_{GF}	6.61
F_{GK}	-0.38
F_{GJ}	1.66

Joint G

Brace Force	F_{GK}	-0.38	kip	C
Horizontal Force	F_{GF}	6.61	kip	C
Vertical Force	F_{GJ}	1.66	kip	T

Joint F

	F_{FJ}	15.16	kip	C
	F_{GF}	6.61	kip	C
	F_{FK}	-0.15	kip	T

Joint J

Joint K

Brace Force	F_{JF}	15.2	kip	C	F_{GK}	-0.4	kip	C
Horizontal Force	**F_{JK}**	-0.4	kip	T	F_{KJ}	-0.4	kip	T
Vertical Force	F_{JG}	1.66	kip	T	F_{KF}	-0.1	kip	T

3. RESULTS

	Member	Frame	Floor	Function	Force	T/C	Moment
	(#)	*(type)*	*(Units)*		*(kip)*		*(kip.ft)*
GF	10	Braced	First	Beam	15.16	C	
JK	13	Braced	Roof	Beam	-0.35	T	
JF	15	Braced	Roof	Brace	15.16	C	
GK	16	Braced	Roof	Brace	-0.38	C	
BF	17	Braced	First	Brace	22.32	T	
GC	18	Braced	First	Brace	22.32	C	
BG	3	Braced	First	Column	-8.58	T	
JG	4	Braced	Roof	Column	1.66	T	
CF	5	Braced	First	Column	-8.58	C	
KF	6	Braced	Roof	Column	-0.15	T	

1. MOMENT FRAME INFORMATION

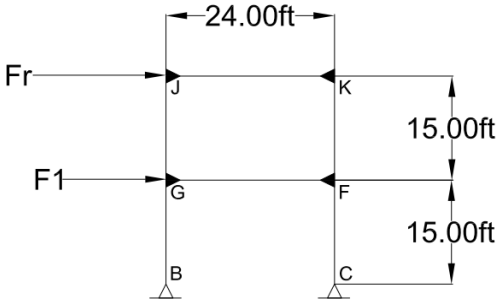


Figure 1 - Moment Frame

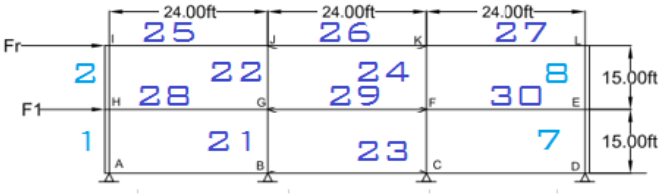


Figure 2 - Member Reference

Story Height, H =	15	ft
Bay Width, W =	24	ft
$F_{r=}$	9.78	kip
$F_{1=}$	19.57	kip

2.1 MEMBER FORCES DISTRIBUTION

Compute Shear Forces

$\sum F_x=0$

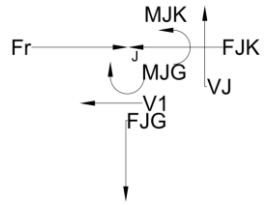
$F_{r=}$	9.78	kips
# of shear forces	2	
$V_{1=}$	4.89	kips

Compute moments at top of columns

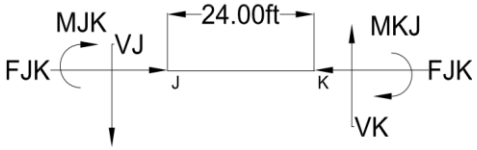
$M_{JG=}$	36.69	kip*ft
$M_{KF=}$	36.69	kip*ft

METHOD OF JOINTS:

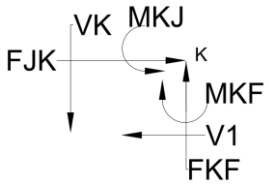
Joint J



Member J-K



Joint K



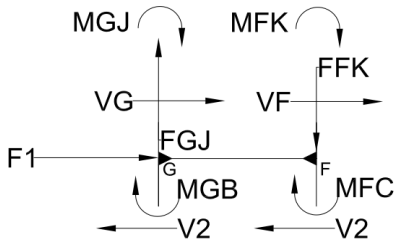
Joint J:

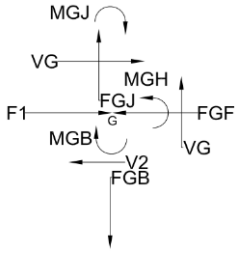
	$M_{JK=}$ 36.69	kip*ft	
$\sum Fx=0$	$F_{JK=}$ 4.89	kips	C
$\sum M/W$	$V_{J=}$ 3.06	kips	
$\sum Fy=0$	$F_{JG=}$ 3.06	kips	T

Joint K:

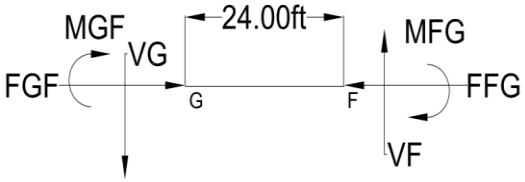
$M_{KJ=}$	36.69	kip*ft	
$F_{JK=}$	4.89	kips	C
$V_{K=}$	3.06	kips	
$F_{KF=}$	3.06	kips	C
$M_{KF=}$	36.69	kips	

Section 2

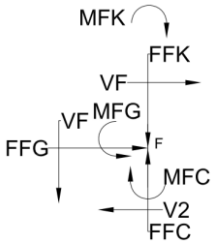




Joint G



Member G-F



Joint F

Joint G:

(F1+FR)/2	$V_{2=}$	14.68	kips	
FJG	$F_{GJ=}$	3.06	kips	T
V2*H/2	$M_{GB=}$	110.1	kip*ft	
(MJG)	$M_{GJ=}$	36.69	kip*ft	
(FJG)	$F_{GJ=}$	3.06	kips	
∑Fx=0	$F_{GF=}$	4.89	kips	C
∑M	$M_{GF=}$	146.76	kip*ft	
∑M/W	$V_{G=}$	12.23	kips	
∑Fy=0	$F_{GB=}$	15.29	kips	

Joint F

(F1+FR)/2	$V_{2=}$	14.68	kips	
FKF	$F_{FK=}$	3.06	kips	T
V2*H/2	$M_{FC=}$	110.1	kip*ft	
MKF	$M_{FK=}$	36.69	kip*ft	
FKF	$F_{FK=}$	3.06	kips	
FGF	$F_{FG=}$	4.89	kips	C
∑M	$M_{FG=}$	146.76	kip*ft	
∑M/W	$V_{G=}$	12.23	kips	
∑Fy=0	$F_{FC=}$	15.29	kips	

3. RESULTS

	Member	Frame	Floor	Function	Force	T/C	Moment
	(#)	*(type)*	*(Units)*		*(kip)*		*(kip.ft)*
GF	29	Moment	First	Beam	4.89	C	146.76
JK	26	Moment	Roof	Beam	4.89	C	36.69
BG	21	Moment	First	Column	15.29	T	110.07
CF	23	Moment	First	Column	15.29	C	110.07
JG	22	Moment	Roof	Column	4.89	T	36.69
KF	24	Moment	Roof	Column	4.89	C	36.69

1. MOMENT FRAME INFORMATION

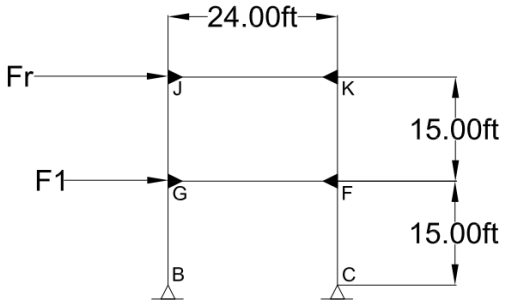


Figure 1 - Moment Frame

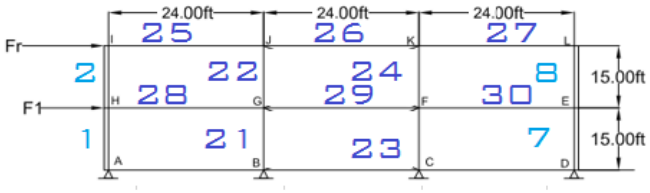


Figure 2 - Member Reference

Story Height, H =	15	ft
Bay Width, W =	24	ft
$F_{r=}$	17.55	kip
$F_{1=}$	17.03	kip

2.1 MEMBER FORCES DISTRIBUTION

Compute Shear Forces

$\sum F_x=0$

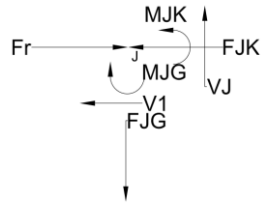
$F_{r=}$	17.55	kips
# of shear forces	2	
$V_{1=}$	8.78	kips

Compute moments at top of columns

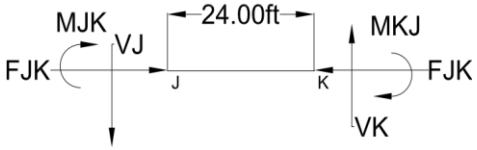
$M_{JG=}$	65.82	kip*ft
$M_{KF=}$	65.82	kip*ft

METHOD OF JOINTS:

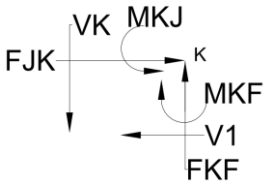
Joint J



Member J-K



Joint K



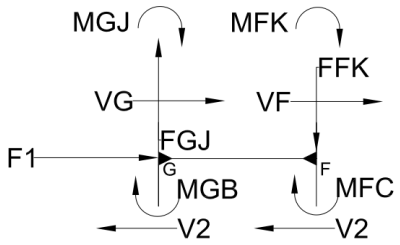
Joint J:

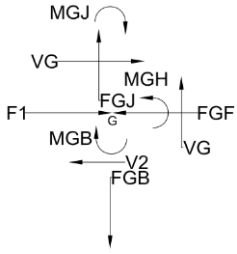
	$M_{JK=}$ 65.82	kip*ft	
$\sum Fx=0$	$F_{JK=}$ 8.78	kips	C
$\sum M/W$	$V_{J=}$ 5.49	kips	
$\sum Fy=0$	$F_{JG=}$ 5.49	kips	T

Joint K:

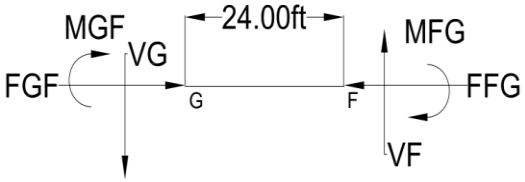
$M_{KJ=}$	65.82	kip*ft	
$F_{JK=}$	8.78	kips	C
$V_{K=}$	5.49	kips	
$F_{KF=}$	5.49	kips	C
$M_{KF=}$	65.82	kips	

Section 2

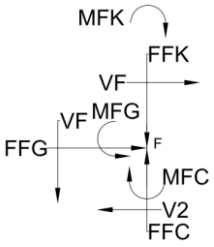




Joint G



Member G-F



Joint F

Joint G:

(F1+FR)/2	$V_{2=}$	7.9	kips	
FJG	$F_{GJ=}$	5.49	kips	T
V2*H/2	$M_{GB=}$	59.44	kip*ft	
(MJG)	$M_{GJ=}$	65.82	kip*ft	
(FJG)	$F_{GJ=}$	5.49	kips	
∑Fx=0	$F_{GF=}$	9.11	kips	T
∑M	$M_{GF=}$	125.3	kip*ft	
∑M/W	$V_{G=}$	10.4	kips	
∑Fy=0	$F_{GB=}$	15.9	kips	

Joint F

(F1+FR)/2	$V_{2=}$	7.9	kips	
FKF	$F_{FK=}$	5.5	kips	C
V2*H/2	$M_{FC=}$	59.4	kip*ft	
MKF	$M_{FK=}$	65.8	kip*ft	
FKF	$F_{FK=}$	5.49	kips	
FGF	$F_{FG=}$	9.11	kips	T
∑M	$M_{FG=}$	125.3	kip*ft	
∑M/W	$V_{G=}$	10.4	kips	
∑Fy=0	$F_{FC=}$	15.9	kips	

3. RESULTS

	Member	Frame	Floor	Function	Force	T/C	Moment
	(#)	*(type)*	*(Units)*		*(kip)*		*(kip.ft)*
GF	29	Moment	First	Beam	9.11	T	125.26
JK	26	Moment	Roof	Beam	8.78	C	65.82
BG	21	Moment	First	Column	15.92	T	59.44
CF	23	Moment	First	Column	15.92	C	59.44
JG	22	Moment	Roof	Column	9.11	T	65.82
KF	24	Moment	Roof	Column	9.11	C	65.82