GIVEN:

Number of Floors: 2

Reference:	Excel
Section	*Eq/Fig/Table/Notes*
Information	

1. MEMBERS FOR ANALYSIS:

						No translation			Lateral Translation			
Member Ref.	**Frame**	**Floor**	**Member**	**Section**	**Length**	**Axial Load**	**Mom. (x)**	**Mom.(y)**	**Axial Load**	**Mom. (x)**	**Mom.(y)**	**Lateral Deflection**
(#)	*(type)*	*Units*		*(Shape)*	*(ft)*	$P_{nt\ (kip)}$	$M_{ntx\ (kip.ft)}$	$M_{nty\ (kip.ft)}$	$P_{lt\ (kip)}$	$Ml_{tx\ (kip.ft)}$	$Ml_{tx\ (kip.ft)}$	ΔH *(in)*
1	Braced	First	Column	W8X40	15	130	14	0	0	0	0	0
2	Braced	Roof	Column	W8X40	15							
3	Braced	First	Column	W8X40	15	130	14	0	0	0	0	0
4	Braced	Roof	Column	W8X40	15							
5	Braced	First	Column	W8X40	15							
6	Braced	Roof	Column	W8X40	15							
9	Braced	First	Beam	W21X55	36							
10	Braced	First	Interior Beam	W21X55	36							
11	Braced	First	Beam	W21X55	36							
12	Braced	Roof	Beam	W14X34	36							
13	Braced	Roof	Interior Beam	W14X34	36							
14	Braced	Roof	Beam	W14X34	36							
15	Braced	Roof	Braces	WT9X48.5	39							
16	Braced	Roof	Braces	WT9X48.5	39							
17	Braced	First	Braces	WT9X48.5	39							
18	Braced	First	Braces	WT9X48.5	39							
1	Moment	First	Column	W8X40	15							
2	Moment	Roof	Column	W8X40	15							
7	Moment	First	Column	W8X40	15							
8	Moment	Roof	Column	W8X40	15							

21	Moment	First	Column	W8X40	15							
22	Moment	Roof	Column	W8X40	15							
23	Moment	First	Column	W8X40	15	27.2	6	0	3.4	71	0	0.003
24	Moment	Roof	Column	W8X40	15							
25	Moment	Roof	Beam	W12X16	24							
26	Moment	Roof	Interior Beam	W18X35	24	5.3	3.5	0	1	10.4	0	0.003
27	Moment	Roof	Beam	W12X16	24							
28	Moment	First	Beam	W14X22	24							
29	Moment	First	Interior Beam	W21X44	24	6.6	20	0	2	15	0	0.003
30	Moment	First	Beam	W14X22	24							

Reference: AISC 14th
Section *Eq/Fig/Table/Notes*

2. LOADS

Member Ref.	Frame	Floor	P_{story}	P_{mf}	Lateral Shear	α	Gravity Load	Notional Load
(#)	*(type)*	*Units*	*(kip)*	*(kip)*	*(kip)*	*(LRFD)*	*(kip)*	*(kip)*
1-B	Braced	First	3643.2	607.6	31	1	214	0.43
1-M	Moment	First	3643.2	607.6	31	1	214	0.43
2-B	Braced	Roof	622.1	607.6	31	1	470	0.94
2-M	Moment	Roof	622.1	607.6	31	1	470	0.94

3. DETERMINATION OF LATERAL-TORSIONAL BUCKLING FACTOR C_b

F Eq. F1-1

Member Ref.	Frame	Floor	Member	Section	Length	M_{max}	$M_{.25}$	$M_{.5}$	$M_{.75}$	C_b	K
(#)	*(type)*	*Units*		*(Shape)*	*(ft)*	*(kip.ft)*	*(kip.ft)*	*(kip.ft)*	*(kip.ft)*		
1	Braced	First	Column	W8X40	15	500.00	270.13	440.24	285.65	1.34	
3	Braced	First	Column	W8X40	15	500.00	270.13	440.24	285.65	1.34	
9	Braced	First	Beam	W21X55	36	500.00	270.13	440.24	285.65	1.34	
7	Moment	First	Column	W8X40	15	500.00	270.13	440.24	285.65	1.34	
8	Moment	Roof	Column	W8X40	15	500.00	270.13	440.24	285.65	1.34	
23	Moment	First	Column	W8X40	15	500.00	270.13	440.24	285.65	1.34	
24	Moment	Roof	Column	W8X40	15	500.00	270.13	440.24	285.65	1.34	
26	Moment	Roof	Interior Beam	W18X35	24	500.00	270.13	440.24	285.65	1.34	
27	Moment	Roof	Beam	W12X16	24	500.00	270.13	440.24	285.65	1.34	
29	Moment	First	Interior Beam	W21X44	24	500.00	270.13	440.24	285.65	1.34	
30	Moment	First	Beam	W14X22	24	500.00	270.13	440.24	285.65	1.34	

4. PRE-DETERMINATION OF EFFECTIVE LENGTH FACTOR K

Appendix 7 Eq. C-A-7-1

Member Ref.	Frame	Floor	Member	Section	Length	Moment of Inertia	Modulus of Elasticity	Support end A	Support end B	Stiffness	Factor K
(#)	*(type)*	*Units*		*(Shape)*	*(ft)*	*(in^4)*	*(ksi)*	*(type)*	*(type)*	*(kip.ft)*	
1	Braced	First	Column	W8X40	15	146	29000	Pin	2/9	1960.2	0.8
2	Braced	Roof	Column	W8X40	15	146	29000	1*9	12	1960.2	
3	Braced	First	Column	W8X40	15	146	29000	Pin	4/9-10	1960.2	0.745
4	Braced	Roof	Column	W8X40	15	146	29000	3/9-10	12/13	1960.2	
9	Braced	First	Beam	W21X55	36	1140	29000	1*2/9	3-4*9-10	9566.0	0.66
10	Braced	First	Interior Beam	W21X55	36	1140	29000	Pin	Pin	9566.0	
12	Braced	Roof	Beam	W14X34	36	340	29000	Pin	Pin	2853.0	
13	Braced	Roof	Interior Beam	W14X34	36	340	29000	Pin	Pin	2853.0	
7	Moment	First	Column	W8X40	15	146	29000	Pin	8/30	1960.2	2.5
8	Moment	Roof	Column	W8X40	15	146	29000	7/30	27	1960.2	2.18
21	Moment	First	Column	W8X40	15	146	29000	Pin	21-22/28-29	1960.2	
22	Moment	Roof	Column	W8X40	15	146	29000	22-21/28-29	Pin	1960.2	
23	Moment	First	Column	W8X40	15	146	29000	Pin	24/29-30	1960.2	1.88
24	Moment	Roof	Column	W8X40	15	146	29000	23/29-30	26-27	1960.2	1.2
25	Moment	Roof	Beam	W12X16	24	103	29001	23/29-31	26-28	432.2	
26	Moment	Roof	Interior Beam	W18X35	24	510	29000	2*25	22/25-26	2139.8	1.25
27	Moment	Roof	Beam	W12X16	24	103	29000	24*26-27	8*27	432.1	1.6
28	Moment	First	Beam	W14X22	24	199	29001	1-2*28	21-22/28-29	835.0	
29	Moment	First	Interior Beam	W21X44	24	843	29000	Moment	Moment	3536.9	1.28
30	Moment	First	Beam	W14X22	24	199	29000	23-24/29-30	7*8/30	834.9	1.65

5. DETERMINATION OF EFFECTIVE LENGTH FACTOR K

Appendix 7 Eq. C-A-7-2

Member Ref.	End	Support	Column 1	Column 2	Beam 1	Beam 2	Beam 3	Beam 4	Rotational Stiffness (G)	K
(#)	*(type)*	*Units*		*(Shape)*	*(ft)*	*(in^4)*	*(ksi)*	*(kip.ft)*	*(kip.ft)*	

1	A	Pin					10.00	0.80
	B	2/9	2	1	9		0.41	
3		Pin					10.00	0.745
		4/9-10	4	3	9	10	0.20	
9		1*2/9	1	2	9		0.41	0.66
		3-4*9-10	3	4	9		0.41	
7		Pin					10.00	2.5
		8/30	8	7	30		4.70	
8		7/30	7	8	30		4.70	2.18
		27	8		27		4.54	
23		Pin					10.00	1.88
		24/29-30	23	24	29	30	0.90	
24		23/29-30	23	24	29	30	0.90	1.2
		26-27	24		26	27	0.76	
26		2*25	24		26	27	0.45	1.25
		22/25-26	22		25	26	0.76	
27		24*26-27	24		26	27	0.76	1.6
		8*27	8		27		4.54	
29		Moment	22	21	28	29	0.90	1.28
		Moment	23	24	29	30	0.90	
30		23-24/29-30	24	23	30	29	0.90	1.65
		7*8/30	7	8	30		4.70	

6. RESULTS

F

Member Ref.	Frame	Floor	Member	Pre-Section	Length	New-Section	Unit Weight	Spacing or a	Beams/Bay	Qty of Members	Amount of Steel
(#)	(type)	Units		(Shape)	(ft)	(Shape)	(plf)	(ft)	(Units)	(Units)	(kips)
1	Braced	First	Column	W8X40	15	**W8X40**	40	12.0	0.0	1.20	1.50
2	Braced	Roof	Column	W8X40	15	W8X40	40	1.7	0.0	1.20	1.50
3	Braced	First	Column	W8X40	15	**W8X40**	40	5.0	0.0	1.20	1.50
4	Braced	Roof	Column	W8X40	15	**W8X40**	40	0.0	0.0	1.20	1.20
5	Braced	First	Column	W8X40	15	W8X40	40	0.0	0.0	1.20	1.50
6	Braced	Roof	Column	W8X40	15	W8X40	40	0.0	0.0	1.20	1.50
9	Braced	First	Beam	W21X55	36	**W21X55**	55	0.0	0.0	2.16	2.16
10	Braced	First	Interior Beam	W21X55	36	W21X55	55	0.0	0.0	2.16	2.16
11	Braced	First	Beam	W21X55	36	W21X55	55	0.0	0.0	2.16	2.16
12	Braced	Roof	Beam	W14X34	36	W14X34	34	0.0	0.0	1.37	1.37
13	Braced	Roof	Interior Beam	W14X34	36	W14X34	34	0.0	0.0	1.37	1.37
14	Braced	Roof	Beam	W14X34	36	W14X34	34	0.0	0.0	1.37	1.37
15	Braced	Roof	Braces	WT9X48.5	39	W10X33	33	0.0	0.0	3.78	2.57
16	Braced	Roof	Braces	WT9X48.5	39	W10X33	33	0.0	0.0	3.78	2.57
17	Braced	First	Braces	WT9X48.5	39	**W10X33**	33	0.0	0.0	3.78	2.57
18	Braced	First	Braces	WT9X48.5	39	**W10X33**	33	0.0	0.0	3.78	2.57
1	Moment	First	Column	W8X40	15	**W8X40**	40	12.0	0.0	1.20	1.50
2	Moment	Roof	Column	W8X40	15	**W8X40**	40	1.7	0.0	1.20	1.50
7	Moment	First	Column	W8X40	15	W8X40	40	0.0	0.0	1.20	1.50
8	Moment	Roof	Column	W8X40	15	W8X40	40	0.0	0.0	1.20	1.50
21	Moment	First	Column	W8X40	15	W8X40	40	0.0	0.0	1.17	2.04
22	Moment	Roof	Column	W8X40	15	W8X40	40	0.0	0.0	1.17	2.04
23	Moment	First	Column	W8X40	15	W8X40	40	0.0	0.0	1.17	2.04
24	Moment	Roof	Column	W8X40	15	W8X40	40	5.0	0.0	1.17	2.04
25	Moment	Roof	Beam	W12X16	24	**W12X16**	16	8.0	0.0	1.44	1.44
26	Moment	Roof	Interior Beam	W18X35	24	W18X35	35	0.0	0.0	1.92	1.87
27	Moment	Roof	Beam	W12X16	24	W12X16	16	0.0	0.0	1.44	1.44
28	Moment	First	Beam	W14X22	24	**W14X22**	22	0.0	0.0	1.92	1.92
29	Moment	First	Interior Beam	W21X44	24	W21X44	44	0.0	0.0	1.92	2.54
30	Moment	First	Beam	W14X22	24	W14X22	22	0.0	0.0	1.92	1.92

COLUMN-CAPACITY

Member Ref:	1	
Frame:	Braced	
Floor:	First	
Member:	Column	
Ref. 2:	1-B	

ASSUMPTIONS:

No transverse loads are applied to the member (Per section 7)

1. MATERIAL PROPERTIES:

Modulus of Elasticity:	$E =$	29000	ksi
	$G =$	11200	ksi
Yield Strength:	$F_{y} =$	50	ksi

2. MEMBER GEOMETRIC INFORMATION:

Beam Length	$L =$	15	ft	15	*Project Information*

Column Slenderness Parameters:

Unbraced Length, x:	$L_{bx} =$	15	ft	Global or Local System?
Unbraced Length, y:	$L_{by} =$	15	ft	
Unbraced Length, z:	$L_{bz} =$	15	ft	
Eff. Length Factor, x:	$K_{x} =$	1		
Eff. Length Factor, y:	$K_{y} =$	1		
Eff. Length Factor, z:	$K_{z} =$	1		

Reference: Excel

	Section	*Eq/Fig/Table/Notes*
3. SECTION PROPERTIES	Information	

Section: W **W8X40**
Member is in: Compression

Moment of Inertia, x:	$I_{xw} =$	146	in^4	Depth:	d =	8.25	in
Moment of Inertia, y	$I_{yw} =$	49.1	in^4	Width:	$b_f =$	8.07	in
Polar Moment of Inertia:	$J_w =$	1.12	in^4	Flange Thickness:	$t_f =$	0.56	in
Radius of Gyration, x:	$r_{xw} =$	3.53	in	Web Thickness:	$t_w =$	0.36	in
Radius of Gyration, y	ryw =	2.04	in	Area:	A =	11.7	in^2
Section Modulus:	$S_x =$	35.5	in^3	r_{ts}	$r_{ts} =$	2.81	in
Plastic Section Modulus, x:	Z =	39.8	in^3	Distance flange/centro	$h_0 =$	11.60	in
T	T =	0	in	Warping Constant	$C_w =$	726	in

3. PRELIMINARY ANALYSIS Eq. E 6-2a/b

Slenderness Ratios:	$(KL/r)_x =$	51.0			
	$(KL/r)_y =$	88.2	AISC	Table	3-2
	$(KL)_z =$	180.0	AISC	Table	3-2
Largest Possible Ratio:		88.2			
Compressive Control:		113.43	E		
Critical Stress, Fcr equation:		**USE E3-2**			

4. LOCAL SLENDERNESS CHECK: Table B4.1a

	Web	**Flange**
Member	**h/tw**	**bf/2t**
	17.6	7.21
Critical	λ_r	λ_r
Case	[case 5]	[case 1]
	35.9	*35.9*
Check	Nonslender	Nonslender

	Reference:	AISC 14th
	Section	*Eq/Fig/Table/Notes*
5. BUCKLING ANALYSIS:	E	

Euler Buckling Stress:	$F_{e3} =$	36.8	ksi	*Eq. E3-4*
Torsional Buckling Stress:	$F_{e4} =$	97.2	ksi	*Eq. E4-4*
Controling Euler Stress:	Fe3 =	36.8	ksi	
Critical Buckling Stress:	$F_{cr} =$	28.3	ksi	*Eq. E3-2*

6. COLUMN CAPACITY: Eq. E3-1

Compressive Strength:	P_{n} =	331.1	ksi	*Eq. E3-1*
Factor:	Φ =	0.9		
Column Capacity:	$\Phi.P_{n}$ =	298.0	ksi	

BEAM-COLUMN ANALYSIS

1. MATERIAL PROPERTIES:

Modulus of Elasticity:	E =	29000	ksi
	G =	11200	ksi
Yield Strength:	F_{y} =	50	ksi

2. MEMBER GEOMETRIC INFORMATION:

Beam Length	L =	15	ft	*Project Information*
Column Slenderness Parameters:				
Unbraced Length, x:	L_{bx} =	15	ft	*Global or Local System?*
Unbraced Length, y:	L_{by} =	15	ft	
Unbraced Length, z:	L_{bz} =	15	ft	
Eff. Length Factor Check:		**K<1**		*Check for values below*
Eff. Length Factor, x:	K_x =	0.8		
Eff. Length Factor, y:	K_y =	0.8		
Eff. Length Factor, z:	K_z =	1		
Plastic Zones Lengths and Info:				
Full plastic yield Length:	L_p =	7.2	ft	
LTB Length:	L_r =	29.9	ft	
	$\phi_b BF$ =	2.46	kips	
	$\phi_b M_{px}$ =	149	kip.ft	

Reference:	Excel
Section Information	*Eq/Fig/Table/Notes*

3. SECTION PROPERTIES

Section:	W	**W8X40**					
Member is in:		Compression					
Moment of Inertia, x:	I_{xw} =	146	in^4	Depth:	d =	8.25	in
Moment of Inertia, y	I_{yw} =	49.1	in^4	Width:	b_f =	8.07	in
Polar Moment of Inertia:	J_w =	1.12	in^4	Flange Thickness:	t_f =	0.56	in
Radius of Gyration, x:	r_{xw} =	3.53	in	Web Thickness:	t_w =	0.36	in
Radius of Gyration, y	ryw =	2.04	in	Area:	A =	11.7	in^2
Section Modulus:	S_x =	35.5	in^3	r_{ts}	r_{ts} =	2.81	in
Plastic Section Modulus, x:	Z =	39.8	in^3	Distance flange/centro	h_0 =	11.60	in
Plastic Section Modulus, y:	Z_y =	18.5	in	Warping Constant	C_w =	726	in
T	T =	0	in	Section Modulus:	S_y =	12.2	in^3

3. SLENDERNESS CHARACTERISTICS:
Table B4.1a

	Web	Flange
Flexure	Compact	Compact
Compression	Mntx =	14

4. CONSIDERATION OF IMPERFECTIONS - NOTIONAL LOADS:
C2.2(b)

Notional Load:	$Z_i =$	0.428	kip	Eq.	C2-1
Second/First order drift ratio:		2	in		

Is it applied at all levels in all combinations? **YES** Ref. to C.2.3(3)

Reference: GTS
Section *Eq/Fig/Table/Notes*

5. FIRST ORDER ANALYSIS FORCES:
GTS

Ultimate Axial Load, NT	$P_{nt} =$	130	kips
Ultimate Moment, NT, x	$M_{ntx} =$	14	kip.ft
Ultimate Moment, NT, y	$M_{nty} =$	0	kip.ft
Ultimate Axial Load, LT	$P_{lt} =$	0	kips
Ultimate Moment, LT, y	$Ml_{tx} =$	0	kip.ft
Ultimate Moment, LT, y	$Ml_{tx} =$	0	kip.ft

Total V. load in story	$P_{story} =$	3643.2	kip	
	$P_{mf} =$	607.6	kip	
Story Shear in Direction of	H =	31	kip	
	α =	1		*LRFD*
Lateral Deflection	ΔH =	0.215	in	
Fact. Story Drift Limit	ΔH/L =	0.0012		

6. MEMBER CAPACITY:
Eq. E3-1

Axial Capacity	$\phi.P_n =$	298.0	ksi		
Flexure Capacity					
Along axis x:	Zone =	2			
	Cb =	1.34			
Flexure Capacity, x	$M_{cx} =$	149.0	kip.ft		
Along axis y:	Fy.Zy =	925		Eq.	F6-1
	1.6Fy.Sy =	976		Eq.	F6-1
Flexure Capacity, y	$M_{cy} =$	832.5	kip.ft		

Reference: AISC 14th
Section *Eq/Fig/Table/Notes*

7. APPROXIMATE SECOND ORDER ANALYSIS:
C

Along axis x: DAM: Use reduced stiffness per C2.3

	τ_b =	1.00		*Apply to all*	C	2.3(2)
Type of Curvature:		Single				
Smaller 1st-O End Mom:	M_1 =	-1				
Larger 1st-O End Mom:	M_2 =	1				
Modif. Coefficient, x:	C_{mx} =	1		App. 8	Eq.	A-8-4
Elastic Buckling Strength, x	P_{ex} =	1612	kip	App. 8	Eq.	A-8-5
Amplification Factor	B_{1x} =	1.0		App. 8	Eq.	A-8-3
Factor Check:		OK		*Check*		

Along axis y:

	τ_b =	1		*Apply to all*	C	2.3(2)
Type of Curvature:		Single				
Smaller 1st-O End Mom:	M_1 =	-1				
Larger 1st-O End Mom:	M_2 =	1				
Modif. Coefficient, y	C_{my} =	1		App. 8	Eq.	A-8-4
Elastic Buckling Strength	P_{ey} =	542	kip	App. 8	Eq.	A-8-5
Amplification Factor	B_{1y} =	1.0		App. 8	Eq.	A-8-3
Factor Check:		OK		*Check*		

Calculate P-Δ Amplification Factor:

Along axis x:

	R_m =	0.97		A-8-8
	$P_{e\text{-}story}$ =	25304.2	kip	A-8-7
	B_{2x} =	1.17		A-8-6
2nd-Order Axial Strength	P_r =	130.0	kip	A-8-2
2nd-Order Mom. Strength	M_{rx} =	0.0	kip.ft	A-8-1

Along axis y:

	R_{my} =	0.97		A-8-8
	$P_{e\text{-}storyY}$ =	25304.2	kip	A-8-7
	B_{2y} =	1.00		A-8-6
2nd-Order Axial Strength	P_{ry} =	130.0	kip	A-8-2
2nd-Order Mom. Strength	M_{ry} =	-14.0	kip.ft	A-8-1

8. COMBINED FORCES INTERACTION EQUATION: GTS

Check Pr/Pc	P_r/P_c =	0.436			
Pr/Pc ≥ 0,2		1.294	OK	Eq.	H.1-1a
Pr/Pc < 0,2		0.000	OK	Eq.	H.1-1b
Design Check			OK	Eq.	H.1-1a

COLUMN-CAPACITY

Member Ref:	3
Frame:	Braced
Floor:	First
Member:	Column
Ref. 2:	1-B

ASSUMPTIONS:

No transverse loads are applied to the member (Per section 7)

1. MATERIAL PROPERTIES:

Modulus of Elasticity:	E =	29000	ksi
	G =	11200	ksi
Yield Strength:	F_{y} =	50	ksi

2. MEMBER GEOMETRIC INFORMATION:

Beam Length	L =	15	ft	15	*Project Information*

Column Slenderness Parameters:

Unbraced Length, x:	L_{bx} =	0.745	ft	Global or Local System?
Unbraced Length, y:	L_{by} =	0.745	ft	
Unbraced Length, z:	L_{bz} =	15	ft	
Eff. Length Factor, x:	K_{x} =	1		
Eff. Length Factor, y:	K_{y} =	1		
Eff. Length Factor, z:	K_{z} =	1		

Reference: Excel

	Section	*Eq/Fig/Table/Notes*
3. SECTION PROPERTIES	Information	

Section: W **W8X40**
Member is in: Compression

Moment of Inertia, x:	$I_{xw} =$	146	in^4	Depth:	d =	8.25	in
Moment of Inertia, y	$I_{yw} =$	49.1	in^4	Width:	$b_f =$	8.07	in
Polar Moment of Inertia:	$J_w =$	1.12	in^4	Flange Thickness:	$t_f =$	0.56	in
Radius of Gyration, x:	$r_{xw} =$	3.53	in	Web Thickness:	$t_w =$	0.36	in
Radius of Gyration, y	ryw =	2.04	in	Area:	A =	11.7	in^2
Section Modulus:	$S_x =$	35.5	in^3	r_{ts}	$r_{ts} =$	2.81	in
Plastic Section Modulus, x:	Z =	39.8	in^3	Distance flange/centro	$h_0 =$	11.60	in
T	T =	0	in	Warping Constant	$C_w =$	726	in

3. PRELIMINARY ANALYSIS Eq. E 6-2a/b

Slenderness Ratios:	$(KL/r)_x =$	2.5			
	$(KL/r)_y =$	4.4	AISC	Table	3-2
	$(KL)_z =$	180.0	AISC	Table	3-2
Largest Possible Ratio:		4.4			
Compressive Control:		113.43	E		
Critical Stress, Fcr equation:		**USE E3-2**			

4. LOCAL SLENDERNESS CHECK: Table B4.1a

	Web	**Flange**
Member	**h/tw**	**bf/2t**
	17.6	7.21
Critical	λ_r	λ_r
Case	[case 5]	[case 1]
	35.9	*35.9*
Check	Nonslender	Nonslender

	Reference:	AISC 14th
	Section	*Eq/Fig/Table/Notes*
5. BUCKLING ANALYSIS:	E	

Euler Buckling Stress:	$F_{e3} =$	14903.3	ksi	*Eq. E3-4*
Torsional Buckling Stress:	$F_{e4} =$	97.2	ksi	*Eq. E4-4*
Controling Euler Stress:	Fe4 =	97.2	ksi	
Critical Buckling Stress:	$F_{cr} =$	INSERT	ksi	*Eq. E3-2*

6. COLUMN CAPACITY: Eq. E3-1

Compressive Strength:	$P_{n} =$	#VALUE!	ksi	*Eq. E3-1*
Factor:	$\Phi =$	0.9		
Column Capacity:	$\Phi.P_{n} =$	#VALUE!	ksi	

BEAM-COLUMN ANALYSIS

1. MATERIAL PROPERTIES:

Modulus of Elasticity:	$E =$	29000	ksi
	$G =$	11200	ksi
Yield Strength:	$F_{y} =$	50	ksi

2. MEMBER GEOMETRIC INFORMATION:

Beam Length	$L =$	15	ft	*Project Information*

Column Slenderness Parameters:

Unbraced Length, x:	$L_{bx} =$	15	ft	*Global or Local System?*
Unbraced Length, y:	$L_{by} =$	15	ft	
Unbraced Length, z:	$L_{bz} =$	15	ft	
Eff. Length Factor Check:		**K<1**		*Check for values below*
Eff. Length Factor, x:	$K_{x} =$	1		
Eff. Length Factor, y:	$K_{y} =$	1		
Eff. Length Factor, z:	$K_{z} =$	1		

Plastic Zones Lengths and Info:

Full plastic yield Length:	$L_{p} =$	7.2	ft
LTB Length:	$L_{r} =$	29.9	ft
	$\phi_b BF =$	2.46	kips
	$\phi_b M_{px} =$	149	kip.ft

Reference:	Excel
Section Information	*Eq/Fig/Table/Notes*

3. SECTION PROPERTIES

Section:	W	**W8X40**	
Member is in:		Compression	

Moment of Inertia, x:	$I_{xw} =$	146	in^4	Depth:	$d =$	8.25	in
Moment of Inertia, y	$I_{yw} =$	49.1	in^4	Width:	$b_{f} =$	8.07	in
Polar Moment of Inertia:	$J_{w} =$	1.12	in^4	Flange Thickness:	$t_{f} =$	0.56	in
Radius of Gyration, x:	$r_{xw} =$	3.53	in	Web Thickness:	$t_{w} =$	0.36	in
Radius of Gyration, y	ryw =	2.04	in	Area:	$A =$	11.7	in^2
Section Modulus:	$S_{x} =$	35.5	in^3	r_{ts}	$r_{ts} =$	2.81	in
Plastic Section Modulus, x:	$Z =$	39.8	in^3	Distance flange/centro	$h_{0} =$	11.60	in
Plastic Section Modulus, y:	$Z_{y} =$	18.5	in	Warping Constant	$C_{w} =$	726	in
T	$T =$	0	in	Section Modulus:	$S_{y} =$	12.2	in^3

3. SLENDERNESS CHARACTERISTICS: Table B4.1a

	Web	Flange
Flexure	Compact	Compact
Compression	Mntx =	14

4. CONSIDERATION OF IMPERFECTIONS - NOTIONAL LOADS: C2.2(b)

Notional Load:	$Z_i =$	0.428	kip	Eq.	C2-1
Second/First order drift ratio:		2	in		

Is it applied at all levels in all combinations? **YES** Ref. to C.2.3(3)

Reference: GTS
Section *Eq/Fig/Table/Notes*

5. FIRST ORDER ANALYSIS FORCES: GTS

Ultimate Axial Load, NT	$P_{nt} =$	130	kips	
Ultimate Moment, NT, x	$M_{ntx} =$	14	kip.ft	
Ultimate Moment, NT, y	$M_{nty} =$	0	kip.ft	
Ultimate Axial Load, LT	$P_{lt} =$	0	kips	
Ultimate Moment, LT, y	$Ml_{tx} =$	0	kip.ft	
Ultimate Moment, LT, y	$Ml_{tx} =$	0	kip.ft	
Total V. load in story	$P_{story} =$	3643.2	kip	
	$P_{mf} =$	607.6	kip	
Story Shear in Direction of	H =	31	kip	
	α =	1		*LRFD*
Lateral Deflection	ΔH =	0.215	in	
Fact. Story Drift Limit	$\Delta H/L$ =	0.0012		

6. MEMBER CAPACITY: Eq. E3-1

Axial Capacity	$\phi.P_n =$	#VALUE!	ksi		
Flexure Capacity					
Along axis x:	Zone =	2			
	Cb =	1.34			
Flexure Capacity, x	$M_{cx} =$	149.0	kip.ft		
Along axis y:	Fy.Zy =	925		Eq.	F6-1
	1.6Fy.Sy =	976		Eq.	F6-1
Flexure Capacity, y	$M_{cy} =$	832.5	kip.ft		

Reference: AISC 14th
Section *Eq/Fig/Table/Notes*

7. APPROXIMATE SECOND ORDER ANALYSIS: C

Along axis x: DAM: Use reduced stiffness per C2.3

	τ_b =	1.00		*Apply to all*	C	2.3(2)
Type of Curvature:		Single				
Smaller 1st-O End Mom:	M_1 =	-1				
Larger 1st-O End Mom:	M_2 =	1				
Modif. Coefficient, x:	C_{mx} =	1		App. 8	Eq.	A-8-4
Elastic Buckling Strength, x	P_{ex} =	1612	kip	App. 8	Eq.	A-8-5
Amplification Factor	B_{1x} =	1.0		App. 8	Eq.	A-8-3
Factor Check:		OK		*Check*		

Along axis y:

	τ_b =	1		*Apply to all*	C	2.3(2)
Type of Curvature:		Single				
Smaller 1st-O End Mom:	M_1 =	-1				
Larger 1st-O End Mom:	M_2 =	1				
Modif. Coefficient, y	C_{my} =	1		App. 8	Eq.	A-8-4
Elastic Buckling Strength	P_{ey} =	542	kip	App. 8	Eq.	A-8-5
Amplification Factor	B_{1y} =	1.0		App. 8	Eq.	A-8-3
Factor Check:		OK		*Check*		

Calculate P-Δ Amplification Factor:

Along axis x:

	R_m =	0.97		A-8-8
	$P_{e\text{-}story}$ =	25304.2	kip	A-8-7
	B_{2x} =	1.17		A-8-6
2nd-Order Axial Strength	P_r =	130.0	kip	A-8-2
2nd-Order Mom. Strength	M_{rx} =	0.0	kip.ft	A-8-1

Along axis y:

	R_{my} =	0.97		A-8-8
	$P_{e\text{-}storyY}$ =	25304.2	kip	A-8-7
	B_{2y} =	1.00		A-8-6
2nd-Order Axial Strength	P_{ry} =	130.0	kip	A-8-2
2nd-Order Mom. Strength	M_{ry} =	-14.0	kip.ft	A-8-1

8. COMBINED FORCES INTERACTION EQUATION: GTS

Check Pr/Pc	P_r/P_c =	#VALUE!			
Pr/Pc ≥ 0,2		1.294	OK	Eq.	H.1-1a
Pr/Pc < 0,2		0.000	OK	Eq.	H.1-1b
Design Check			OK	Eq.	H.1-1a