Appendices

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Appendices Table of Contents:

Pre-Cast Concrete Structural System

Floor System Design

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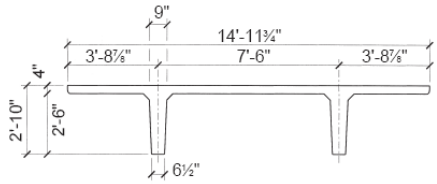
Pre-Cast Concrete Double-Tee Design



Concrete:
f'_c = 6000 psi
w_c = 150 pcf
Strand: ½" dia. low relaxation, 270ksi special, A = 0.167 in²

15DT34

Live load capacity in pounds per square foot (psf)

Strand Pattern	e_e	DESIGN SPAN (FT)																				
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
88-S	18.65	184	168	154	141	129	117	107	98	89	81	74	67	61	55	49	44	39	35	31	27	23
128-S	19.82				257	238	221	205	190	177	165	153	143	133	123	115	107	99	92	86	79	74
168-S	19.96										242	227	213	200	187	176	165	155	146	137	129	121
208-S	19.70																	207	195	184	174	165
248-S	19.23																					

Strand Pattern	e_e	DESIGN SPAN (FT)																				
		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	
88-S	18.65																					
128-S	19.82	68	63	58	53	49	45	41	37	34	30	27	24	21								
168-S	19.96	114	107	100	94	88	83	77	72	68	63	59	55	51	47	44	41	37	34	31	28	
208-S	19.70	156	147	139	132	124	118	111	105	99	94	88	83	79	74	70	66	62	58	54	51	
248-S	19.23									128	122	116	110	104	99	94	89	84	80	76	71	

Section Properties

A	=	1185 in.²
I	=	109,621 in.⁴
Y_b	=	25.65 in.
Y_t	=	8.35 in.
S_b	=	4274 in.³
S_t	=	13,128 in.³
wt	=	1234 plf
		82 psf
V/S	=	2.45 in.

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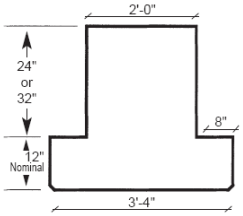
Pre-Cast Concrete Inverted Tee Beam Design as Girder

Strand Pattern Designation
No. of Stands (10)
108 - S ← S = Straight
Diameter of Strand in 16ths



Concrete:
f'_c = 7500 psi
Strand: 1/2" dia. low relaxation, 270ksi, special, A = 0.167 in^2

INVERTED TEE BEAMS

Loads shown are in addition to a dead load of 5000 plf for tee weight. (5000 plf is equivalent to 2-60'-0" bays of 34" deep tees)

24IT36

Normal Weight

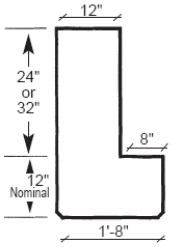
Live load capacity in pounds per lineal foot (plf)

Strand Pattern	e	DESIGN SPAN (Ft.)														
		22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
148–S	**11.75**	7799	5752	4160	2896	1876	1042									
188–S	**11.96**			6717	5101	3797	2730	1846	1105							
228–S	**11.86**				7152	5584	4301	3237	2346	1596	948					
268–S	**11.72**					7292	5802	4567	3533	2657	1909	1266	708			
308–S	**11.62**						7259	5858	4684	3690	2842	2112	1480	928		
348–S	**11.54**							7108	5799	4692	3746	2932	2227	1544	922	
388–S	**11.38**								6837	5554	4442	3466	2617	1876	1226	653
428–S	**11.18**								6986	5672	4550	3584	2747	1998	1339	756

Section Properties
A = 1041 in.^{2}
I = 114,588 in.^{4}
Y_b = 15.7 in.
Y_t = 19.93 in.
Z_b = 7299 in.^{3}
Z_t = 5750 in.^{3}
wt = 1084 plf
V/S = 6.91 in.

Pre-Cast Concrete L-Beam Design as Edge Girder

These are standard load tables for uniformly loaded simple spans. These tables are for guidance only. Individual designs may be furnished for unusual loading conditions, changes in cross-section, low camber requirements, etc.



Concrete:
f'_c = 7500 psi
Strand: 1/2" dia. low relaxation, 270ksi, special, A = 0.167 in^2

L BEAMS

Normally Use 23.5" Wide Stem

Loads shown are in addition to a dead load of 2500 plf for tee weight. (2500 plf is equivalent to A-60'-0" bay of 34" deep tees)

12LB36

Normal Weight

Live load capacity in pounds per lineal foot (plf)

Strand Pattern	e	DESIGN SPAN (Ft.)									
		20	22	24	26	28	30	32	34	36	38
78–S	**12.76**	5989	4514	3392	2519	1826	1268	810	431		
98–S	**12.32**	7996	6173	4787	3708	2852	2161	1596	1127	734	402
118–S	**12.03**		7731	6096	4824	3814	3000	2333	1781	1318	926
138–S	**11.84**			7316	5864	4712	3782	3021	2391	1862	1415
168–S	**11.39**				6878	5585	4542	3688	2980	2387	1885
188–S	**11.09**				6706	5436	4412	3574	2879	2297	1804
218–S	**10.76**				6511	5268	4266	3445	2765	2195	1713

Section Properties
A = 504 in.^{2}
I = 56,406 in.^{4}
Y_b = 16.28 in.
Y_t = 19.71 in.
Z_b = 3465 in.^{3}
Z_t = 2862 in.^{3}
wt = 525 plf
V/S = 4.67 in.

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Pigeon Forge, TN

Pre-Cast Concrete Column Design, Center Span Loading

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	14.33	0	0	0	
3	N3	17.33	0	0	0	
4	N4	31.66	0	0	0	
5	N5	34.66	0	0	0	
6	N6	49	0	0	0	
7	N7	52	0	0	0	
8	N8	66.33	0	0	0	
9	N9	69.33	0	0	0	
10	N10	76	0	0	0	
11	N11	79	0	0	0	

Joint Loads and Enforced Displacements (BLC 1 :)

	Joint Label	L,D,M	Direction	Magnitude[k,k-ft in,rad k*s^2/ft]
1	N10	L	X	-88.2
2	N8	L	X	-469.4
3	N6	L	X	-469.4
4	N4	L	X	-469.4
5	N2	L	X	-469.4
6	N10	L	Mz	132.3
7	N2	L	Mz	704
8	N4	L	Mz	704
9	N6	L	Mz	704
10	N8	L	Mz	704

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	1965.8	38.414	NC	0	0	200.698
2	1	N3	0	3.066	0	0	0	0
3	1	N5	0	-2.102	0	0	0	0
4	1	N7	0	5.265	0	0	0	0
5	1	N9	0	-12.796	0	0	0	0
6	1	N11	0	-31.847	0	0	0	0
7	1	Totals:	1965.8	0	0			
8	1	COG (ft):	NC	NC	NC			

Member Section Forces (By Combination)

	LC	Member Label	Sec	Axial[k]	y Shear[k]	z Shear[k]	Torque[k-ft]	y-y Moment[k-...	z-z Moment[k-...
1	1	M1	1	1965.8	38.414	0	0	0	200.698
2			2	1496.4	41.48	0	0	0	138.6
3			3	1027	39.378	0	0	0	33.546
4			4	557.6	44.643	0	0	0	-78.336
5			5	0	31.847	0	0	0	0

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Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Center Span Loading

```
General Information:
====================
   File Name: P:\Final Report\Precast Alternate Design\Typical Column e18.col
   Project:  Boyds Bear Country
   Column:   Typical Roof                 Engineer: Lew
   Code:     ACI 318-02                   Units: English

   Run Option: Design                     Slenderness: Not considered
   Run Axis:   X-axis                     Column Type: Structural

Material Properties:
====================
   f'c   = 8 ksi                          fy   = 60 ksi
   Ec    = 5098.24 ksi                    Es   = 29000 ksi
   Ultimate strain = 0.003 in/in
   Beta1 = 0.65

Section:
========
   Rectangular: Width = 24 in             Depth = 24 in

   Gross section area, Ag =  576 in^2
   Ix =  27648 in^4                       Iy =  27648 in^4
   Xo =  0 in                             Yo =  0 in

Reinforcement:
==============
   Rebar Database: ASTM A615
   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
   ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
   #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
   #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
   #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
   # 14      1.69        2.25   # 18      2.26        4.00

   Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
   phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

   Layout: Rectangular
   Pattern: All Sides Equal  (Cover to longitudinal reinforcement)
   Total steel area, As = 6.24 in^2 at 1.08%
   4 #11   Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)
============================================================
                 Pu          Mux          fMnx
   No.          kip         k-ft          k-ft    fMn/Mu
   --- ------------ ------------ ------------ --------
     1       1965.8        200.7        578.6    2.883
     2       1496.4        138.6        728.5    5.256
     3       1027.0         33.5        767.7   22.916
     4        557.6         78.3        740.2    9.453

   *** Program completed as requested! ***
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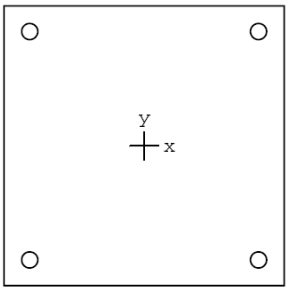
Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Center Span Loading



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Design

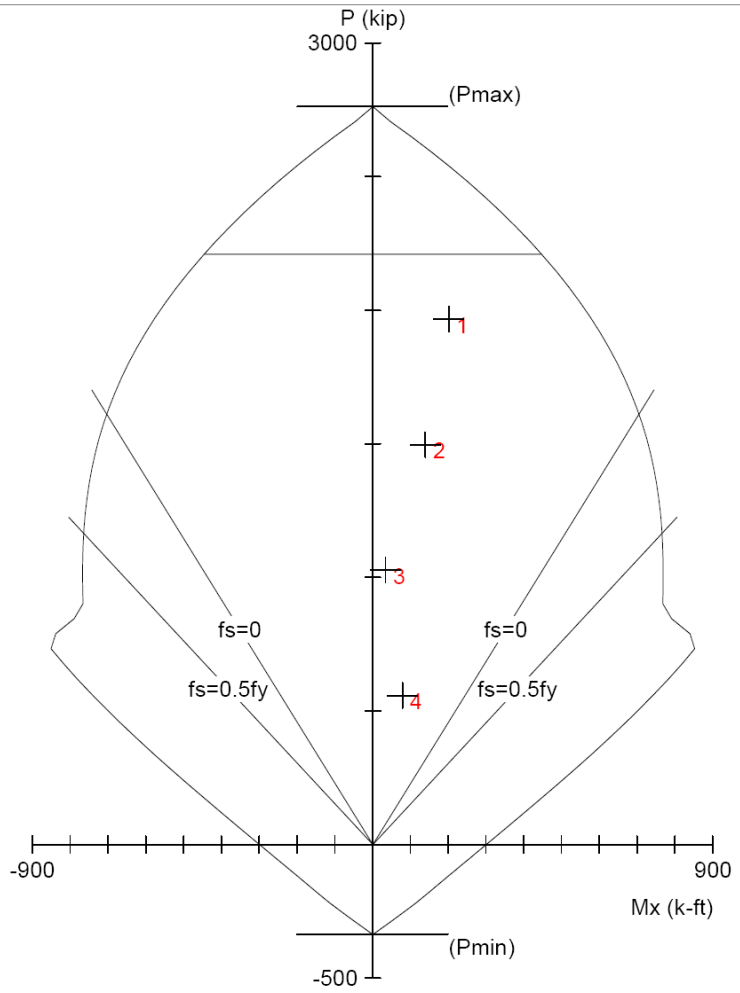
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 03/13/07

Time: 16:12:29



pcaColumn v3.64. Licensed to: Penn State University. License ID: 52411-1010265-4-22545-2B5EC

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Project: Boyds Bear Country

Column: Typical Roof		Engineer: Lew	
f'c = 8 ksi	fy = 60 ksi	Ag = 576 in^2	4 #11 bars
Ec = 5098 ksi	Es = 29000 ksi	As = 6.24 in^2	Rho = 1.08%
fc = 6.8 ksi	fc = 6.8 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.65		Clear spacing = 18.18 in	Clear cover = 1.50 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

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Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Center Span Edge Loading

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	14.33	0	0	0	
3	N3	17.33	0	0	0	
4	N4	31.66	0	0	0	
5	N5	34.66	0	0	0	
6	N6	49	0	0	0	
7	N7	52	0	0	0	
8	N8	66.33	0	0	0	
9	N9	69.33	0	0	0	
10	N10	76	0	0	0	
11	N11	79	0	0	0	

Joint Loads and Enforced Displacements (BLC 1 :)

	Joint Label	L,D,M	Direction	Magnitude[k,k-ft in,rad k*s^2/ft]
1	N10	L	X	-50.4
2	N8	L	X	-268.2
3	N6	L	X	-268.2
4	N4	L	X	-268.2
5	N2	L	X	-268.2
6	N10	L	Mz	75.6
7	N2	L	Mz	402.3
8	N4	L	Mz	402.3
9	N6	L	Mz	402.3
10	N8	L	Mz	402.3

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	1123.2	21.952	NC	0	0	114.688
2	1	N3	0	1.752	0	0	0	0
3	1	N5	0	-1.201	0	0	0	0
4	1	N7	0	3.009	0	0	0	0
5	1	N9	0	-7.312	0	0	0	0
6	1	N11	0	-18.199	0	0	0	0
7	1	Totals:	1123.2	0	0			
8	1	COG (ft):	NC	NC	NC			

Member Section Forces (By Combination)

	LC	Member Label	Sec	Axial[k]	y Shear[k]	z Shear[k]	Torque[k-ft]	y-y Moment[k-...	z-z Moment[k-...
1	1	M1	1	1123.2	21.952	0	0	0	114.688
2			2	855	23.704	0	0	0	79.203
3			3	586.8	22.502	0	0	0	19.17
4			4	318.6	25.511	0	0	0	-44.765
5			5	0	18.199	0	0	0	0

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Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Center Span Edge Loading

```
General Information:
====================
   File Name: P:\Final Report\Precast Alternate Design\Concrete Columns\Concrete Column - Center
   Project:  Boyds Bear Country
   Column:   Typical Roof                 Engineer: Lew
   Code:     ACI 318-02                   Units: English

   Run Option: Design                     Slenderness: Not considered
   Run Axis:   X-axis                     Column Type: Structural

Material Properties:
====================
   f'c   = 6 ksi                          fy   = 60 ksi
   Ec    = 4415.21 ksi                    Es   = 29000 ksi
   Ultimate strain = 0.003 in/in
   Beta1 = 0.75

Section:
========
   Rectangular: Width = 18 in             Depth = 18 in

   Gross section area, Ag =  324 in^2
   Ix =  8748 in^4                        Iy =  8748 in^4
   Xo =  0 in                             Yo =  0 in

Reinforcement:
==============
   Rebar Database: ASTM A615
   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
   ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
   #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
   #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
   #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
   # 14      1.69        2.25   # 18      2.26        4.00

   Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
   phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

   Layout: Rectangular
   Pattern: All Sides Equal  (Cover to longitudinal reinforcement)
   Total steel area, As = 10.16 in^2 at 3.14%
   8 #10   Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)
==========================================================
                 Pu          Mux         fMnx
   No.          kip         k-ft         k-ft   fMn/Mu
   --- ------------ ------------ ------------ --------
     1       1123.2        114.7        175.0    1.526
     2        855.0         79.2        270.8    3.419
     3        586.8         19.2        327.8   17.099
     4        318.6         44.8        403.9    9.015

   *** Program completed as requested! ***
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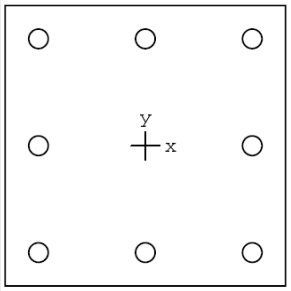
Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Center Span Edge Loading



18 x 18 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Design

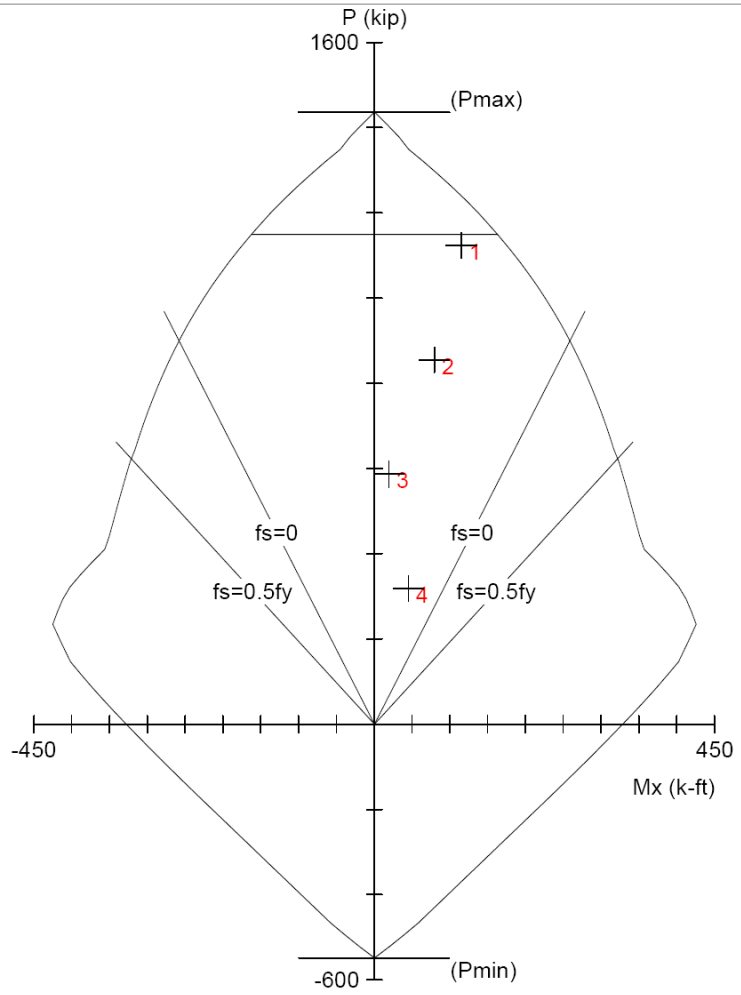
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 03/13/07

Time: 16:30:10



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Project: Boyds Bear Country

Column: Typical Roof		Engineer: Lew	
f'c = 6 ksi	fy = 60 ksi	Ag = 324 in^2	8 #10 bars
Ec = 4415 ksi	Es = 29000 ksi	As = 10.16 in^2	Rho = 3.14%
fc = 5.1 ksi	fc = 5.1 ksi	Xo = 0.00 in	Ix = 8748 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 8748 in^4
Beta1 = 0.75		Clear spacing = 5.60 in	Clear cover = 1.50 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

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Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Mechanical Loading

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	14.33	0	0	0	
3	N3	17.33	0	0	0	
4	N4	31.66	0	0	0	
5	N5	34.66	0	0	0	
6	N6	49	0	0	0	
7	N7	52	0	0	0	
8	N8	66.33	0	0	0	
9	N9	69.33	0	0	0	
10	N10	76	0	0	0	
11	N11	79	0	0	0	

Joint Loads and Enforced Displacements (BLC 1 :)

	Joint Label	L,D,M	Direction	Magnitude[k,k-ft in,rad k*s^2/ft]
1	N10	L	X	-75.6
2	N8	L	X	-429.3
3	N6	L	X	-429.3
4	N4	L	X	-429.3
5	N2	L	X	-429.3
6	N10	L	Mz	113.4
7	N2	L	Mz	644
8	N4	L	Mz	644
9	N6	L	Mz	644
10	N8	L	Mz	644

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	1792.8	35.138	NC	0	0	183.582
2	1	N3	0	2.812	0	0	0	0
3	1	N5	0	-1.95	0	0	0	0
4	1	N7	0	4.915	0	0	0	0
5	1	N9	0	-12.681	0	0	0	0
6	1	N11	0	-28.235	0	0	0	0
7	1	Totals:	1792.8	0	0			
8	1	COG (ft):	NC	NC	NC			

Member Section Forces (By Combination)

	LC	Member Label	Sec	Axial[k]	y Shear[k]	z Shear[k]	Torque[k-ft]	y-y Moment[k-...	z-z Moment[k-...
1	1	M1	1	1792.8	35.138	0	0	0	183.582
2			2	1363.5	37.95	0	0	0	126.795
3			3	934.2	36.001	0	0	0	30.711
4			4	504.9	40.916	0	0	0	-71.938
5			5	0	28.235	0	0	0	0

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Boyds Bear Country
Pigeon Forge, TN

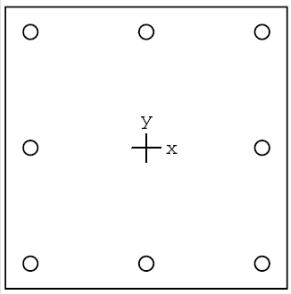
Pre-Cast Concrete Column Design, Mechanical Loading

```
General Information:
====================
   File Name: P:\Final Report\Precast Alternate Design\Concrete Columns\Concrete Column - M
   Project:  Boyds Bear Country
   Column:   Typical Roof                 Engineer: Lew
   Code:     ACI 318-02                   Units: English

   Run Option: Design                     Slenderness: Not considered
   Run Axis:   X-axis                     Column Type: Structural

Material Properties:
====================
   f'c   = 6 ksi                          fy   = 60 ksi
   Ec    = 4415.21 ksi                    Es   = 29000 ksi
   Ultimate strain = 0.003 in/in
   Beta1 = 0.75

Section:
========
   Rectangular: Width = 24 in             Depth = 24 in

   Gross section area, Ag =  576 in^2
   Ix =  27648 in^4                       Iy =  27648 in^4
   Xo =  0 in                             Yo =  0 in

Reinforcement:
==============
   Rebar Database: ASTM A615
   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
   ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
   #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
   #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
   #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
   # 14      1.69        2.25   # 18      2.26        4.00

   Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
   phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

   Layout: Rectangular
   Pattern: All Sides Equal  (Cover to longitudinal reinforcement)
   Total steel area, As = 10.16 in^2 at 1.76%
   8 #10   Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)
==========================================================
                 Pu          Mux         fMnx
   No.          kip         k-ft         k-ft   fMn/Mu
   --- ------------ ------------ ------------ --------
     1       1762.8        183.6        391.4    2.132
     2       1363.5        126.8        574.1    4.528
     3        934.2         30.7        672.3   21.901
     4        504.9         71.9        806.1   11.211

   *** Program completed as requested! ***
```

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Mechanical Loading



24 x 24 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Design

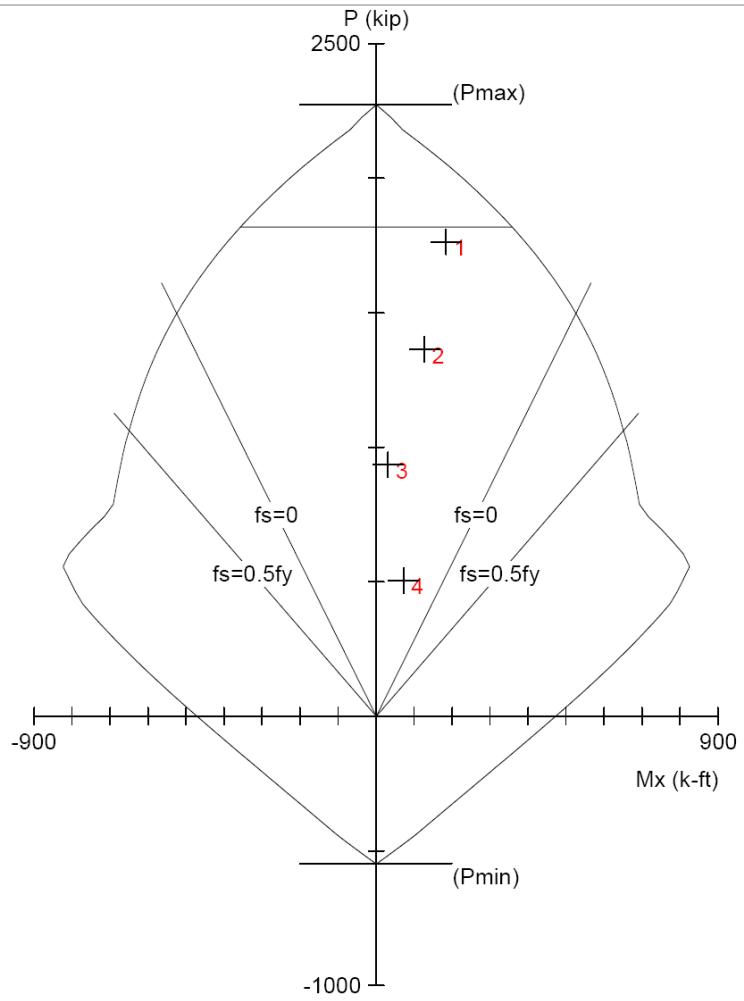
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 03/13/07

Time: 16:21:00



File: P:\Final Report\Precast Alternate Design\Concrete Columns\Concrete Column - Mechanical Span.col

Project: Boyds Bear Country

Column: Typical Roof		Engineer: Lew	
f'c = 6 ksi	fy = 60 ksi	Ag = 576 in^2	8 #10 bars
Ec = 4415 ksi	Es = 29000 ksi	As = 10.16 in^2	Rho = 1.76%
fc = 5.1 ksi	fc = 5.1 ksi	Xo = 0.00 in	Ix = 27648 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 27648 in^4
Beta1 = 0.75		Clear spacing = 8.60 in	Clear cover = 1.50 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Mechanical Edge Loading

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	14.33	0	0	0	
3	N3	17.33	0	0	0	
4	N4	31.66	0	0	0	
5	N5	34.66	0	0	0	
6	N6	49	0	0	0	
7	N7	52	0	0	0	
8	N8	66.33	0	0	0	
9	N9	69.33	0	0	0	
10	N10	76	0	0	0	
11	N11	79	0	0	0	

Joint Loads and Enforced Displacements (BLC 1 :)

	Joint Label	L,D,M	Direction	Magnitude[k,k-ft in,rad k*s^2/ft]
1	N10	L	X	-37.8
2	N8	L	X	-214.7
3	N6	L	X	-214.7
4	N4	L	X	-214.7
5	N2	L	X	-214.7
6	N10	L	Mz	56.7
7	N2	L	Mz	322
8	N4	L	Mz	322
9	N6	L	Mz	322
10	N8	L	Mz	322

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	896.6	17.569	NC	0	0	91.791
2	1	N3	0	1.406	0	0	0	0
3	1	N5	0	-.975	0	0	0	0
4	1	N7	0	2.457	0	0	0	0
5	1	N9	0	-6.34	0	0	0	0
6	1	N11	0	-14.118	0	0	0	0
7	1	Totals:	896.6	0	0			
8	1	COG (ft):	NC	NC	NC			

Member Section Forces (By Combination)

	LC	Member Label	Sec	Axial[k]	y Shear[k]	z Shear[k]	Torque[k-ft]	y-y Moment[k-...	z-z Moment[k-...
1	1	M1	1	896.6	17.569	0	0	0	91.791
2			2	681.9	18.975	0	0	0	63.398
3			3	467.2	18	0	0	0	15.356
4			4	252.5	20.458	0	0	0	-35.969
5			5	0	14.118	0	0	0	0

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

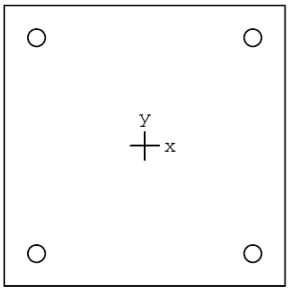
Pre-Cast Concrete Column Design, Mechanical Edge Loading

```
General Information:
====================
   File Name: P:\Final Report\Precast Alternate Design\Concrete Columns\Concrete Column -
   Project:  Boyds Bear Country
   Column:   Typical Roof                 Engineer: Lew
   Code:     ACI 318-02                   Units: English

   Run Option: Design                     Slenderness: Not considered
   Run Axis:   X-axis                     Column Type: Structural

Material Properties:
====================
   f'c   = 6 ksi                          fy   = 60 ksi
   Ec    = 4415.21 ksi                    Es   = 29000 ksi
   Ultimate strain = 0.003 in/in
   Beta1 = 0.75

Section:
========
   Rectangular: Width = 18 in             Depth = 18 in

   Gross section area, Ag =  324 in^2
   Ix =  8748 in^4                        Iy =  8748 in^4
   Xo =  0 in                             Yo =  0 in

Reinforcement:
==============
   Rebar Database: ASTM A615
   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
   ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
   #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
   #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
   #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
   # 14      1.69        2.25   # 18      2.26        4.00

   Confinement: Tied; #3 ties with #10 bars,  #4 with larger bars.
   phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

   Layout: Rectangular
   Pattern: All Sides Equal  (Cover to longitudinal reinforcement)
   Total steel area, As = 4.00 in^2 at 1.23%
   4 #9   Cover = 1.5 in

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)
==========================================================
                  Pu          Mux          fMnx
   No.           kip         k-ft          k-ft    fMn/Mu
   --- ------------ ------------ ------------ --------
     1        896.6         91.8        182.1     1.984
     2        681.9         63.4        246.1     3.882
     3        467.2         15.4        274.6    17.833
     4        252.5         36.0        279.0     7.751

   *** Program completed as requested! ***
```

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Pre-Cast Concrete Column Design, Mechanical Edge Loading



18 x 18 in

Code: ACI 318-02

Units: English

Run axis: About X-axis

Run option: Design

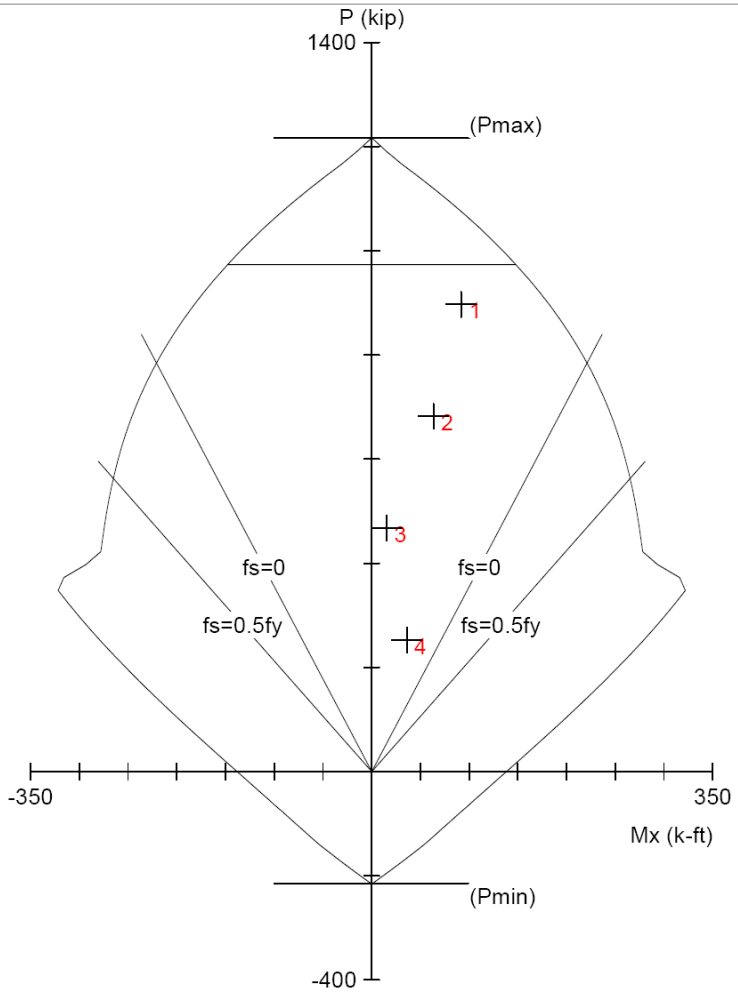
Slenderness: Not considered

Column type: Structural

Bars: ASTM A615

Date: 03/13/07

Time: 16:35:31



File: P:\Final Report\Precast Alternate Design\Concrete Columns\Concrete Column - Mechanical Span Edge.col

Project: Boyds Bear Country

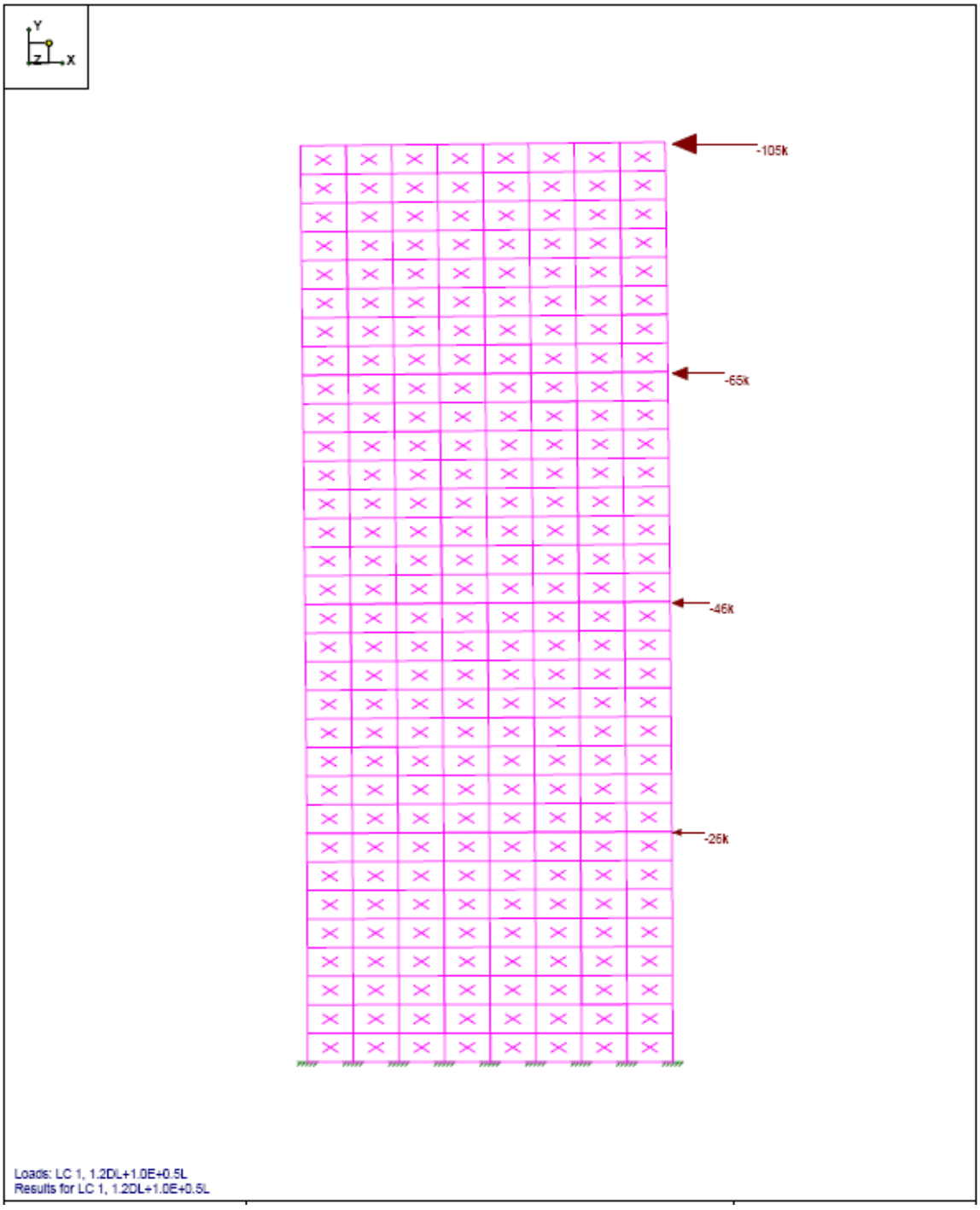
Column: Typical Roof		Engineer: Lew	
f'c = 6 ksi	fy = 60 ksi	Ag = 324 in^2	4 #9 bars
Ec = 4415 ksi	Es = 29000 ksi	As = 4.00 in^2	Rho = 1.23%
fc = 5.1 ksi	fc = 5.1 ksi	Xo = 0.00 in	Ix = 8748 in^4
e_u = 0.003 in/in		Yo = 0.00 in	Iy = 8748 in^4
Beta1 = 0.75		Clear spacing = 12.74 in	Clear cover = 1.50 in
Confinement: Tied	phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65		

Lateral System Design

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

East-West Lateral Force Resisting Wall, Loading and Deflection Diagram.



Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

East-West Lateral Force Resisting Wall, Joint Locations

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	27.5	0	0	0	
3	N3	0	17.33	0	0	
4	N4	27.5	17.33	0	0	
5	N5	0	34.66	0	0	
6	N6	27.5	34.66	0	0	
7	N7	0	51.99	0	0	
8	N8	27.5	51.99	0	0	
9	N9	0	69.33	0	0	
10	N10	27.5	69.33	0	0	

East-West Lateral Force Resisting Wall, Base Shear Forces

Plate Forces (per ft) (By Combination)

	LC	Plate Label	Qx[k]	Qy[k]	Mx[k-ft]	My[k-ft]	Mxy[k-ft]	Fx[k]	Fy[k]	Fxy[k]
1	1	P1	0	0	0	0	0	-91.317	-8.57	10.242
2	1	P8	0	0	0	0	0	-60.744	-.027	2.906
3	1	P57	0	0	0	0	0	91.719	8.601	10.217
4	1	P64	0	0	0	0	0	59.522	-4.99	5.462
5	1	P65	0	0	0	0	0	-57.294	-.028	2.871
6	1	P72	0	0	0	0	0	-34.725	-.05	2.503
7	1	P121	0	0	0	0	0	56.157	-4.992	.144
8	1	P128	0	0	0	0	0	32.642	-8.82	7.076
9	1	P129	0	0	0	0	0	-31.783	-.05	2.437
10	1	P136	0	0	0	0	0	-13.173	-.039	2.069
11	1	P185	0	0	0	0	0	29.813	-8.817	-2.349
12	1	P192	0	0	0	0	0	12.122	-12.359	7.955
13	1	P193	0	0	0	0	0	-10.771	-.052	2.011
14	1	P200	0	0	0	0	0	-.044	-.122	0
15	1	P249	0	0	0	0	0	10.596	-12.308	-5.522
16	1	P256	0	0	0	0	0	4.441	-45.953	14.704

East-West Lateral Force Resisting Wall, Deflections

Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N1	0	0	0	0	0	0
2	1	N2	0	0	0	0	0	0
3	1	N3	-.02	-.021	0	0	0	0
4	1	N4	-.021	.021	0	0	0	0
5	1	N5	-.06	-.034	0	0	0	0
6	1	N6	-.061	.034	0	0	0	0
7	1	N7	-.111	-.04	0	0	0	0
8	1	N8	-.113	.041	0	0	0	0
9	1	N9	-.165	-.042	0	0	0	0
10	1	N10	-.174	.046	0	0	0	0

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

East-West Lateral Force Resisting Wall, Uplift Values

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	30.806	183.467	0	0	0	0
2	1	N2	30.819	-184.249	0	0	0	0
3	1	N18	28.316	245.186	0	0	0	0
4	1	N27	25.497	151.233	0	0	0	0
5	1	N36	24.42	73.844	0	0	0	0
6	1	N45	24.273	.521	0	0	0	0
7	1	N54	24.356	-73.007	0	0	0	0
8	1	N63	25.354	-151.025	0	0	0	0
9	1	N72	28.158	-245.969	0	0	0	0
10	1	Totals:	242	0	0			
11	1	COG (ft):	NC	NC	NC			

Strength per bar: $\Phi f_y A_s$ = (0.9) (60 ksi) (1.56 in^2) = 84.24 kips

246 kips = 2.93 bars = Use (4) #11's
84.24 kips

.

Shearwall Reinforcement - Pre-Cast Concrete System E-W Resisting

Wall Properties:

$b := 30ft$ $f'c := 7000psi$

$w := 14in$ $Pu := 369kip$

$Ag = 35\,ft^2$ $Mu := 7380ft \cdot kip$

$Ig = 2625\,ft^4$ $Vu := 91.3kip$

Calculations:

$fc := \frac{Pu}{Ag} + \frac{Mu \cdot \frac{b}{2}}{Ig}$ $fc = 52.7\,ksf$ $fc = 0.366\,ksi$

$0.2 \cdot f'c = 1400\,psi$ $0.2 \cdot f'c = 1.4\,ksi$ $1.4ksi > 0.366ksi$ No Boundary Elements

$2 \cdot Ag \cdot \sqrt{f'c} = 843.4\,kip$ $\frac{843.4kip}{2} = 421.7\,kip$ $421.7kip > 91.3kip$ One Curtain Reinforcement

$\rho := 0.0012$

$Asrqd := \rho \cdot w \cdot 12in$ $Asrqd = 0.202\,in^2$

Use #5's @ 18" O.C. $\rho_w := 0.00123$

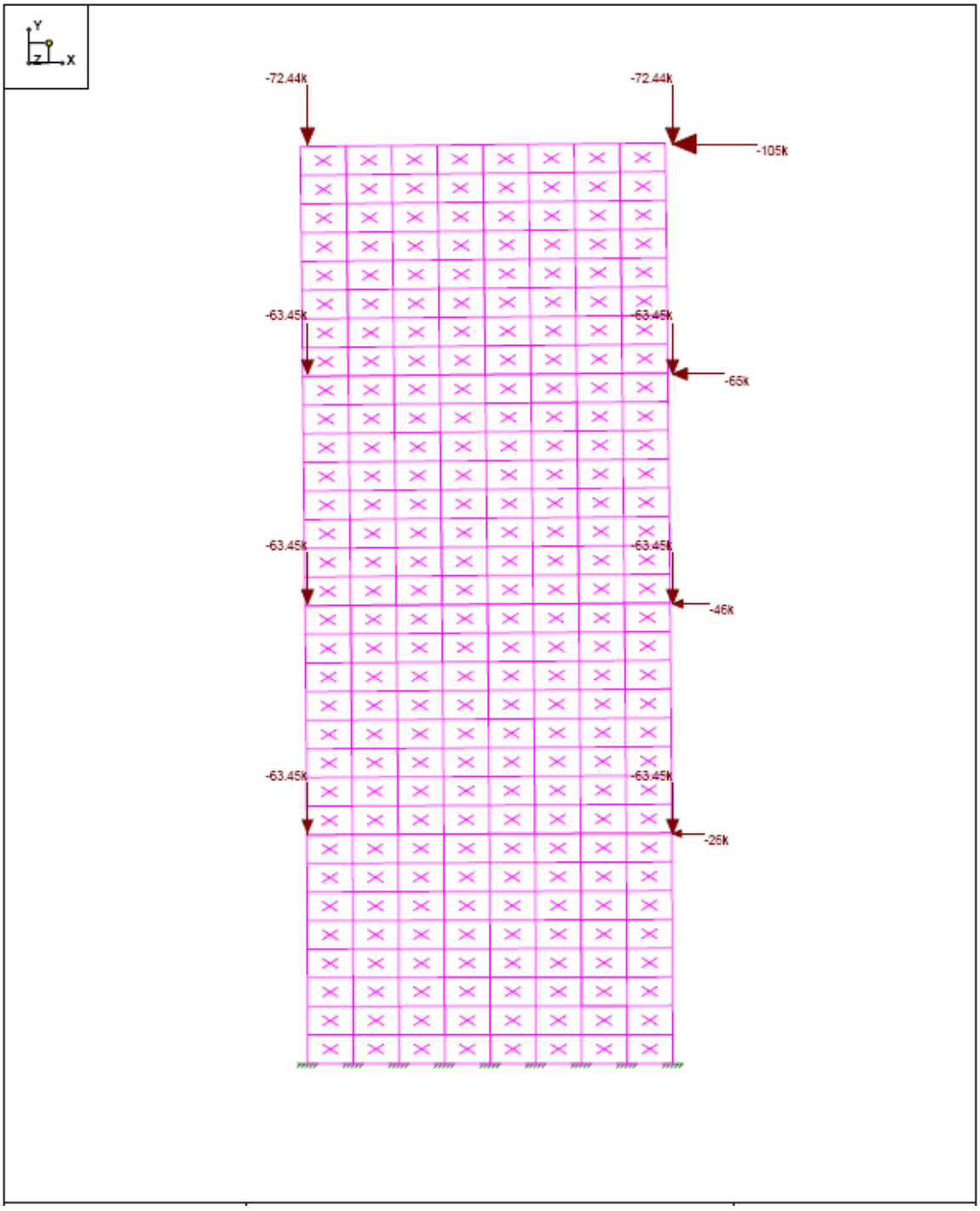
$Asprov := \rho \cdot w \cdot 12in$ $Asprov = 0.207\,in^2$

$Vn := b \cdot w \cdot (2 \cdot \sqrt{f'c} + \rho \cdot 60ksi)$ $Vn = 1215.3\,kip$ $1215.3kip > 91.3kip$ OK

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

North-South Lateral Force Resisting Wall, Loading and Deflection Diagram



Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

North-South Lateral Force Resisting Wall, Joint Locations

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	27.5	0	0	0	
3	N3	0	17.33	0	0	
4	N4	27.5	17.33	0	0	
5	N5	0	34.66	0	0	
6	N6	27.5	34.66	0	0	
7	N7	0	51.99	0	0	
8	N8	27.5	51.99	0	0	
9	N9	0	69.33	0	0	
10	N10	27.5	69.33	0	0	

North-South Lateral Force Resisting Wall, Base Shear

Plate Forces (per ft) (By Combination)

	LC	Plate Label	Qx[k]	Qy[k]	Mx[k-ft]	My[k-ft]	Mxy[k-ft]	Fx[k]	Fy[k]	Fxy[k]
1	1	P5	0	0	0	0	0	-111.778	-10.498	11.692
2	1	P12	0	0	0	0	0	-87.424	-1.814	-2.554
3	1	P61	0	0	0	0	0	71.259	6.673	8.766
4	1	P68	0	0	0	0	0	32.841	-6.777	10.922
5	1	P68A	0	0	0	0	0	-64.12	1.669	-2.646
6	1	P75	0	0	0	0	0	-56.714	-1.784	-3.074
7	1	P124	0	0	0	0	0	49.331	-3.295	5.661
8	1	P131	0	0	0	0	0	10.652	-10.554	12.654
9	1	P131A	0	0	0	0	0	-34.038	1.673	-3.147
10	1	P138	0	0	0	0	0	-31.952	-1.901	-3.992
11	1	P187	0	0	0	0	0	27.558	-7.094	3.235
12	1	P194	0	0	0	0	0	-6.657	-14.22	14.016
13	1	P194A	0	0	0	0	0	-10.444	1.508	-4.244
14	1	P201	0	0	0	0	0	-24.846	5.946	-7.117
15	1	P250	0	0	0	0	0	10.923	-10.748	.734
16	1	P257	0	0	0	0	0	-20.361	-39.885	21.81

North-South Lateral Force Resisting Wall, Deflections

Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N1	0	0	0	0	0	0
2	1	N2	0	0	0	0	0	0
3	1	N3	-.021	-.027	0	0	0	0
4	1	N4	-.021	.015	0	0	0	0
5	1	N5	-.06	-.044	0	0	0	0
6	1	N6	-.061	.025	0	0	0	0
7	1	N7	-.111	-.053	0	0	0	0
8	1	N8	-.113	.029	0	0	0	0
9	1	N9	-.168	-.058	0	0	0	0
10	1	N10	-.171	.029	0	0	0	0

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

North-South Lateral Force Resisting Wall, Uplift Values

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N1	36.26	221.041	0	0	0	0
2	1	N2	25.365	-146.674	0	0	0	0
3	1	N18	31.888	311.572	0	0	0	0
4	1	N27	26.896	215.538	0	0	0	0
5	1	N36	24.776	137.017	0	0	0	0
6	1	N45	24.273	63.223	0	0	0	0
7	1	N54	24.001	-9.834	0	0	0	0
8	1	N63	23.955	-86.719	0	0	0	0
9	1	N72	24.586	-179.583	0	0	0	0
10	1	Totals:	242	525.58	0			
11	1	COG (ft):	X: 13.75	Y: 44.217	Z: 0			

Strength per bar: $\Phi f_y A_s = (0.9)(60\ ksi)(1.56\ in^2) = 84.24\ kips$

180 kips = 2.14 bars = Use (4) #11's
84.24 kips .

Shearwall Reinforcement - Pre-Cast Concrete System N-S Resisting

Wall Properties:

$b := 30ft$ $f'c := 7000psi$

$w := 14in$ $Pu := 652kip$

$Ag = 35\,ft^2$ $Mu := 5370ft \cdot kip$

$Ig = 2625\,ft^4$ $Vu := 112kip$

Calculations:

$fc := \frac{Pu}{Ag} + \frac{Mu \cdot \frac{b}{2}}{Ig}$ $fc = 49.3ksf$ $fc = 0.342ksi$

$0.2 \cdot f'c = 1400\,psi$ $0.2 \cdot f'c = 1.4ksi$ $1.4ksi > 0.342ksi$ No Boundary Elements

$2 \cdot Ag \cdot \sqrt{f'c} = 843.4kip$ $\frac{843.4kip}{2} = 421.7kip$ $421.7kip > 112kip$ One Curtain Reinforcement

$\rho := 0.0012$

$Asrqd := \rho \cdot w \cdot 12in$ $Asrqd = 0.202in^2$

Use #5's @ 18" O.C. $\rho_w := 0.00123$

$Vn := b \cdot w \cdot (2 \cdot \sqrt{f'c} + \rho \cdot 60ksi)$ $Vn = 1215.3kip$ $1215.3kip > 112kip$ OK

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Diaphragm Design - North-South Direction

Input Values:

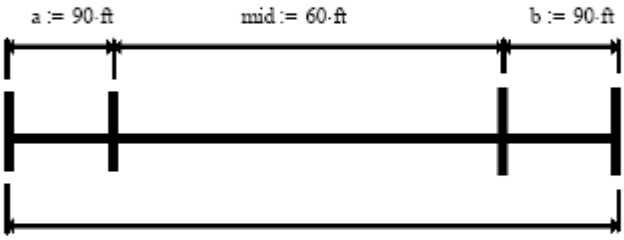
Importance Factor: $I_E := 1.0$

Design Acceleration: $S_{DS} := 0.416$

Floor Weight: $w_p := 2580 \cdot kips$

Irregularily Induced Shear: $V_{px} := 0 \cdot kips$

Max. Floor Shear: $F_{LT3} := 537 \cdot kips$



Length := a + mid + b Length = 240 ft

Calculations:

$F_p := (0.2) I_E \cdot S_{DS} \cdot w_p + V_{px}$

$F_p = 214.656\,kips$

$F_{max} := \max(F_p, F_{LT3})$

$F_{max} = 537\,kips$

$w := \frac{F_{max}}{Length}$

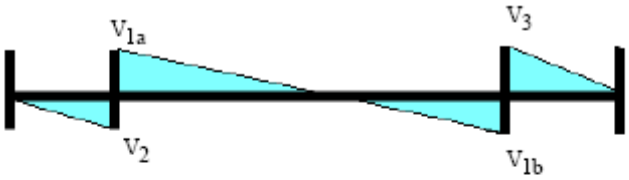
$w = 2.238\,klf$

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Diaphragm Design – North-South Direction

Shear Diagram:



$V_{1a} := \frac{w}{mid}(Length)\left(\frac{Length}{2} - b\right) - w \cdot a$ $V_{1b} := V_{1a} - w \cdot mid$

$V_{1a} = 67.125\,kips$ $V_{1b} = -67.125\,kips$

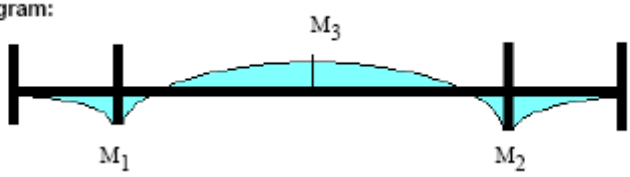
$V_2 := 0 - w \cdot a$ $V_3 := w \cdot b$

$V_2 = -201.375\,kips$ $V_3 = 201.375\,kips$

$V_{max} := max(|V_{1a}|, |V_{1b}|, |V_2|, |V_3|)$

$V_{max} = 201.375\,kips$

Moment Diagram:



$M_1 := \frac{w \cdot a^2}{2}$ $M_2 := \frac{w \cdot b^2}{2}$

$M_1 = 9061.9\,kip \cdot ft$ $M_2 = 9061.9\,kip \cdot ft$

$M_3 = -8.055 \times 10^3\,kip \cdot ft$

$M_{max} := max(|M_1|, |M_2|, |M_3|)$

$M_{max} = 9061.9\,kip \cdot ft$

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Diaphragm Design – North-South Direction

Diaphragm Steel Design:

Inputs:

$\phi := 0.9$

$f_y := 60 \cdot ksi$

$Bay_{Width} := 30 \cdot ft$

$Bar_{Size} := 6$

$Number_{Bays} := 8$

Calculations:

$M_{max} = 9061.9\,kip \cdot ft$

$$A_s := \frac{M_{max}}{(Number_{Bays}) \cdot (Bay_{Width} - 2 \cdot ft) \cdot (\phi) \cdot (f_y)}$$

$A_s = 0.749\,in^2$

$$Bar_{Area} := \pi \left(\frac{Bar_{Size} \cdot in}{2 \cdot 8} \right)^2$$

$$Number_{Bars} := \frac{A_s}{Bar_{Area}}$$

$ceil(Number_{Bars}) = 2$ # $Bar_{Size} = 6$

Lauren Wilke
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Pigeon Forge, TN

Diaphragm Design – East-West Direction

Input Values:

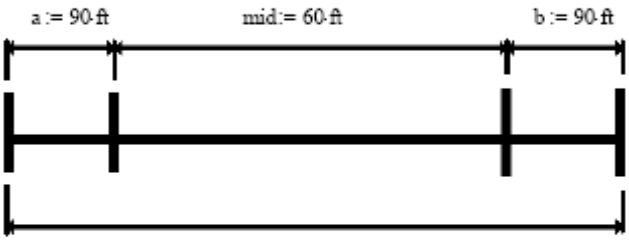
Importance Factor: $I_E := 1.0$

Design Acceleration: $S_{DS} := 0.416$

Floor Weight: $w_p := 2580 \cdot kips$

Irregularily Induced Shear: $V_{px} := 0 \cdot kips$

Max. Floor Shear: $F_{LT3} := 537 \cdot kips$



$Length := a + mid + b \quad Length = 240\,ft$

Calculations:

$F_p := (0.2) I_E \cdot S_{DS} \cdot w_p + V_{px}$

$F_p = 214.656\,kips$

$F_{max} := \max(F_p, F_{LT3})$

$F_{max} = 537\,kips$

$w := \frac{F_{max}}{Length}$

$w = 2.238\,klf$

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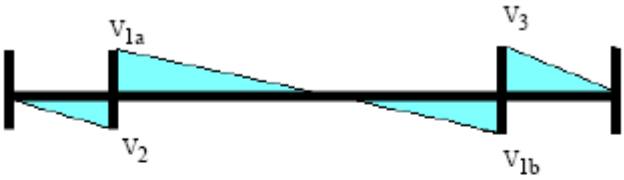
Pigeon Forge, TN

Diaphragm Design – East-West Direction

Shear Diagram:



$V_{1a} := \frac{w}{mid}(Length)\left(\frac{Length}{2} - b\right) - w \cdot a$ $V_{1b} := V_{1a} - w \cdot mid$

$V_{1a} = 67.125\,kips$ $V_{1b} = -67.125\,kips$

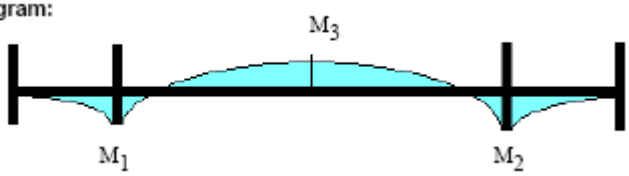
$V_2 := 0 - w \cdot a$ $V_3 := w \cdot b$

$V_2 = -201.375\,kips$ $V_3 = 201.375\,kips$

$V_{max} := max\left(\left|V_{1a}\right|, \left|V_{1b}\right|, \left|V_2\right|, \left|V_3\right|\right)$

$V_{max} = 201.375\,kips$

Moment Diagram:



$M_1 := \frac{w \cdot a^2}{2}$ $M_2 := \frac{w \cdot b^2}{2}$

$M_1 = 9061.9\,kip \cdot ft$ $M_2 = 9061.9\,kip \cdot ft$

$M_3 = -8.055 \times 10^3\,kip \cdot ft$

$M_{max} := max\left(\left|M_1\right|, \left|M_2\right|, \left|M_3\right|\right)$

$M_{max} = 9061.9\,kip \cdot ft$

Lauren Wilke
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Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Diaphragm Design – East-West Direction

Diaphragm Steel Design:

Inputs:

$\phi := 0.9$

$f_y := 60 \cdot ksi$

$Bay_{Width} := 30 \cdot ft$

$Bar_{Size} := 6$

$Number_{Bays} := 4$

Calculations:

$M_{max} = 9061.9\,kip \cdot ft$

$$A_s := \frac{M_{max}}{(Number_{Bays}) \cdot (Bay_{Width} - 2 \cdot ft) \cdot (\phi) \cdot (f_y)}$$

$A_s = 1.498\,in^2$

$$Bar_{Area} := \pi \left(\frac{Bar_{Size} \cdot in}{2 \cdot 8} \right)^2$$

$$Number_{Bars} := \frac{A_s}{Bar_{Area}}$$

$ceil(Number_{Bars}) = 4$ # $Bar_{Size} = 6$

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Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Column Supporting Fourth Floor - Center Span Loading

Member Properties:

Height := 17.333ft

le := 11ft

TribArea := $1012ft^2$

b := 14in

d := 14in

A = $196\,in^2$

Sx = $457.3\,in^3$

Sy = $457.3\,in^3$

Ix = $3201.3\,in^4$

Iy = $3201.3\,in^4$

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

e = 2.338 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 61.25 plf

wLive := (LL)TribArea

wLive = 101200 lbf

Psupport := 27148lbf

P := (DL + LL)·TribArea + SW·Height + Psupport

P = 154709.6 lbf

Adjustment Factors:

Cd := 1.0 Cl := 1.0

Cm := 1.0 Cfu := 1.0

Ct := 1.0 Cc := 1.0

Cv = 0.975 Cv := 1.0

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ Fce = 9061.6 psi

Fcstar := Fc·Cd Fcstar = 2300 psi

Cp = 0.968

Effects on Foundation

Lauren Wilke
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Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Foundation Design - Typical Pre-Cast Concrete Column

Member Properties:

$b := 12.5ft$

$d := 36in$

$A := b^2$ $A = 156.3\ ft^2$

$V := A \cdot d$ $V = 468.7ft^3$

Material Properties:

$fc := 3000psi$

$q := 3.0ksf$

Supported Loads:

$P := 1541.7kip$

Calculations:

$$\sqrt{\frac{P}{q}} = 22.669\ ft$$

$$Vu1 := \frac{P}{b^2} \cdot \left[b^2 - (24in + d)^2\right] \quad Vu1 = 1295kip \qquad \phi Vc := 0.75 \cdot 4 \cdot \sqrt{fc} \cdot 4 \cdot (24in + d) \cdot d \quad \phi Vc = 1419.7kip$$

Check = "OK"

$$Vu2 := \frac{P}{b^2} \cdot \left(\frac{b}{2} - d\right) b \qquad Vu2 = 400.8kip \qquad \phi Vc := 0.75 \cdot 2 \cdot \sqrt{fc} \cdot d \cdot b \qquad \phi Vc = 443.7kip$$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Foundation Wall Pilaster Design

Member Properties:

$L := 17.5ft$ $Mu := 20.58ft \cdot kip$

$bw := 24in$ $tp := bw$ $fy := 60ksi$

$hf := 16in$ $tw := hf$ $f'c := 4ksi$

$a := hf$ $a = 16in$

$d := tp - 2.5in$ $d = 21.5in$

Calculations:

$beff1 := bw + 16hf$ $beff1 = 23.333ft$

$beff2 := \frac{L}{4}$ $beff2 = 4.375ft$

$\phi := 0.9$ $beff := \min(beff1, beff2)$

$Asrqd := \frac{Mu}{\left[\phi \cdot fy \cdot \left(d - \frac{a}{2}\right)\right]}$ $Asrqd = 0.339in^2$ Try (2) #4's $As := 0.40in^2$

$Asmin1 := \frac{3\sqrt{f'c} \cdot bw \cdot d}{fy}$ $Asmin1 = 1.632in^2$

$Asmin2 := \frac{200psi \cdot bw \cdot d}{fy}$ $Asmin2 = 1.72in^2$ $\max(Asmin1, Asmin2) = 1.72in^2$

Try (4) #6's $As := 1.76in^2$

$acalc := \frac{As \cdot fy}{0.85 \cdot f'c \cdot beff}$ $acalc = 0.592in$ $acalc < hf$ OK

$Asadj := \frac{Mu}{\left[\phi \cdot fy \cdot \left(d - \frac{a}{2}\right)\right]}$ $Asadj = 0.339in^2$ Min Controls

$\frac{\frac{acalc}{0.85}}{d} = 0.032$ $0.032 < 0.0325$ OK

$\phi Mn := \phi \cdot As \cdot fy \cdot \left(d - \frac{acalc}{2}\right)$ $\phi Mn = 167.937\,ft \cdot kip$ $\phi Mn > Mu$ OK

Engineered Wood Structural Design

Floor System Design

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Floor Plank

Wooden Floor Plank Design

Member Properties:

Span := 2ft

Spacing := 6in

b := 6in

d := 2in

$A = 12\,in^2$

$Sx = 4\,in^3$

$Sy = 12\,in^3$

$Ix = 4\,in^4$

$Iy = 36\,in^4$

le := 2ft

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

Material Properties:

γ := 45pcf

G := 125000psi

E := 1800000psi

Emin := 660000psi

Fb := 2300psi

Fcperp := 660psi

Ft := 1200psi

Fcparallel := 1800psi

Fv := 175psi

Loading:

DL := 25psf

LL := 125psf

SL := 0psf

$SW := \gamma \cdot b \cdot d$

$SW = 3.75\,plf$

$wLive := (LL + SL) Spacing$

$wLive = 62.5\,plf$

$w := (DL + LL + SL) \cdot Spacing + SW$

$w = 78.75\,plf$

$P := \frac{461kip}{240ft} \cdot b$

$P = 960\,lbf$

Adjustment Factors:

Cd := 1.0 Cfu := 1.0

Cm := 1.0 Cc := 1.0

Ct := 1.0 Cf := 1.10

Cl := 1.0

$Cv := \left(\frac{21ft}{Span}\right)^{0.05} \cdot \left(\frac{12in}{d}\right)^{0.05} \cdot \left(\frac{5.125in}{b}\right)^{0.05}$

Cv = 1.221

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ $Fce = 3767.5\,psi$

Fcstar := Fcparallel·Cd Fcstar = 1800psi

Cp = 0.926

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Advisor: M.K. Parfitt

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Pigeon Forge, TN

Member Properties:

Calculations:

$M := \frac{w \cdot Span^2}{8}$ $M = 39.4\,lbf \cdot ft$

$V := \frac{w \cdot Span}{2}$ $V = 78.8\,lbf$

$fb := \frac{M}{Sx}$ $fb = 118.1\,psi$ $Fb' := Cd \cdot Cm \cdot Ct \cdot Cv \cdot Cfu \cdot Cc \cdot Fb$ $Fb' = 2807.2\,psi$

Check = "OK"

$fv := \frac{1.5 \cdot V}{A}$ $fv = 9.844\,psi$ $Fv' := Cd \cdot Cm \cdot Ct \cdot Fv$ $Fv' = 175\,psi$

Check = "OK"

$\Delta L := \frac{5 \cdot wLive \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta L = 3.125 \times 10^{-3}\,in$ $\Delta L' := \frac{Span}{360}$ $\Delta L' = 0.067\,in$

Check = "OK"

$\Delta T := \frac{5 \cdot w \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta T = 3.938 \times 10^{-3}\,in$ $\Delta T' := \frac{Span}{240}$ $\Delta T' = 0.1\,in$

Check = "OK"

$Fc' := Fcstar \cdot Cp$ $Fc' = 1667.6\,psi$ $fc := \frac{P}{A}$ $fc = 80\,psi$

Check = "OK"

$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2$ $fb = 2490.1\,psi$

Check = "OK"

$Fbe := \frac{1.20 \cdot Emin}{Rb^2}$ $Fbe = 594000\,psi$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.997$$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Joists under Typical Floor Loading – Spaced 2' O.C.

TJM™ TRUSS ALLOWABLE UNIFORM LOAD TABLE (PLF) / PARALLEL CHORD

For economical truss design, see page 5.

Span	Depth																											
	20"		22"		24"		26"		28"		30"		32"		34"		36"		38"		40"		42"		44"		46"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
24'	323 / 186	356 / 356	328 / 228	356 / 356	328 / 273	356 / 356	328 / 327	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356	328	356 / 356
26'	275 / 147	316 / 329	303 / 183	329 / 329	303 / 221	329 / 329	303 / 257	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329	303	329 / 329
28'	237 / 120	273 / 280	265 / 148	305 / 305	282 / 177	305 / 305	282 / 207	305 / 305	282 / 243	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305	282	305 / 305
30'	207 / 98	238 / 258	231 / 120	266 / 284	256 / 146	285 / 285	263 / 175	285 / 285	263 / 200	285 / 285	263 / 230	285 / 285	263 / 262	285 / 285	263	285 / 285	263	285 / 285	263	285 / 285	263	285 / 285	263	285 / 285	263	285 / 285	263	285 / 285
32'	182 / 81	209 / 224	203 / 100	234 / 254	224 / 121	258 / 268	246 / 142	268 / 268	247 / 170	268 / 268	247 / 192	268 / 268	247 / 218	268 / 268	247	268 / 268	247	268 / 268	247	268 / 268	247	268 / 268	247	268 / 268	247	268 / 268	247	268 / 268
34'	161 / 67	185 / 201	180 / 84	207 / 224	199 / 101	229 / 249	218 / 121	251 / 252	232 / 141	252 / 252	232 / 165	252 / 252	232 / 187	252 / 252	232 / 212	252 / 252	232	252 / 252	232	252 / 252	232	252 / 252	232	252 / 252	232	252 / 252	232	252 / 252
36'	143 / 57	165 / 179	160 / 71	184 / 200	177 / 86	204 / 222	194 / 102	223 / 238	211 / 120	238 / 238	220 / 138	238 / 238	220 / 160	238 / 238	220 / 181	238 / 238	220 / 202	238 / 238	220	238 / 238	220	238 / 238	220	238 / 238	220	238 / 238	220	238 / 238
38'	121 / 48	148 / 155	144 / 60	166 / 180	159 / 74	183 / 199	174 / 87	201 / 218	190 / 103	218 / 224	205 / 119	226 / 226	208 / 135	226 / 226	208 / 154	226 / 226	208 / 172	226 / 226	208 / 193	226 / 226	208	226 / 226	208	226 / 226	208	226 / 226	208	226 / 226
40'	103 / 41	133 / 133	130 / 52	149 / 162	144 / 63	165 / 179	157 / 76	181 / 197	171 / 88	197 / 214	185 / 102	213 / 215	198 / 117	215 / 215	198 / 133	215 / 215	198 / 149	215 / 215	198 / 166	215 / 215	198 / 183	215 / 215	198	215 /	198	215 /	198	215 / 215
42'	89 / 36	115 / 115	112 / 45	135 / 144	130 / 54	150 / 163	143 / 65	164 / 178	155 / 77	178 / 194	168 / 90	193 / 204	180 / 103	204 / 204	189 / 117	204 / 204	189 / 131	204 / 204	189 / 146	204 / 204	189 / 160	204 / 204	189 / 176	204 / 204	189	204 / 204	189	204 / 204
44'	77 / 31	101 / 101	97 / 39	123 / 125	118 / 47	136 / 148	130 / 56	150 / 163	141 / 67	163 / 177	153 / 77	176 / 191	164 / 89	189 / 195	176 / 101	195 / 195	180 / 115	195 / 195	180 / 128	195 / 195	180 / 142	195 / 195	180 / 155	195 / 195	180 / 170	195 / 195	180	195 / 195
46'	67 / 27	88 / 88	84 / 34	110 / 110	104 / 42	125 / 134	119 / 49	137 / 149	129 / 58	149 / 162	140 / 68	161 / 175	150 / 78	173 / 187	161 / 88	185 / 187	171 / 100	187 / 187	172 / 112	187 / 187	172 / 125	187 / 187	172 / 137	187 / 187	172 / 150	187 / 187	172 / 163	187 / 187
48'		78 / 78	75 / 30	97 / 97	91 / 37	115 / 118	109 / 44	126 / 137	119 / 51	137 / 149	128 / 60	148 / 161	138 / 69	159 / 172	148 / 78	170 / 179	157 / 88	179 / 179	165 / 99	179 / 179	165 / 110	179 / 179	165 / 121	179 / 179	165 / 132	179 / 179	165 / 143	179 / 179
50'		69 / 69	66 / 26	86 / 86	80 / 32	105 / 105	97 / 39	116 / 125	109 / 46	126 / 137	118 / 53	136 / 148	127 / 61	146 / 159	136 / 70	156 / 170	145 / 79	167 / 172	154 / 88	172 / 172	159 / 98	172 / 172	159 / 107	172 / 172	159 / 118	172 / 175	159 / 128	172 / 175
52'		61 / 61		76 / 76	72 / 29	93 / 93	86 / 34	107 / 112	101 / 41	116 / 127	109 / 47	126 / 137	118 / 55	135 / 147	126 / 62	145 / 157	134 / 70	154 / 165	142 / 79	163 / 165	150 / 88	165 / 165	153 / 96	165 / 165	153 / 106	165 / 165	153 / 115	165 / 168
54'		55 / 55		68 / 68	64 / 26	83 / 83	77 / 31	99 / 100	91 / 36	108 / 117	101 / 42	117 / 127	109 / 49	125 / 136	117 / 55	134 / 146	124 / 62	143 / 155	132 / 70	151 / 159	139 / 78	159 / 159	147 / 86	159 / 159	147 / 94	159 / 159	147 / 103	159 / 159
56'		49 / 49		61 / 61		75 / 75	69 / 27	90 / 90	81 / 32	100 / 106	94 / 38	108 / 118	101 / 44	117 / 127	108 / 50	125 / 135	115 / 56	133 / 144	122 / 63	141 / 153	130 / 70	149 / 154	137 / 77	154 / 154	142 / 85	154 / 154	142 / 93	154 / 154
58'		44 / 44		55 / 55		67 / 67	62 / 25	81 / 81	73 / 29	94 / 95	86 / 34	101 / 110	94 / 39	109 / 118	101 / 45	116 / 126	108 / 51	124 / 134	114 / 57	131 / 143	121 / 63	139 / 148	127 / 70	146 / 148	133 / 77	148 / 148	137 / 84	148 / 148
60'		40 / 40		50 / 50		61 / 61		73 / 73	66 / 26	86 / 86	77 / 31	94 / 100	88 / 36	102 / 110	94 / 41	109 / 118	101 / 46	116 / 126	107 / 52	123 / 133	113 / 57	130 / 141	119 / 64	137 / 143	125 / 70	143 / 143	134 / 77	143 / 143
62'				45 / 45		55 / 55		66 / 66		78 / 78	70 / 28	88 / 91	81 / 32	95 / 103	88 / 37	102 / 111	94 / 42	108 / 118	100 / 47	115 / 125	106 / 52	122 / 132	111 / 57	128 / 139	117 / 63	135 / 139	123 / 69	139 / 139
64'				41 / 41		50 / 50		60 / 60		71 / 71	63 / 25	83 / 83	73 / 29	89 / 96	83 / 33	95 / 104	88 / 38	102 / 110	94 / 42	108 / 117	99 / 47	114 / 124	105 / 52	120 / 131	110 / 58	126 / 135	115 / 63	133 / 135
66'						46 / 46		55 / 55		65 / 65		76 / 76	67 / 27	84 / 87	77 / 31	90 / 98	83 / 35	96 / 104	88 / 39	101 / 110	93 / 43	107 / 117	98 / 48	113 / 123	103 / 53	119 / 129	108 / 58	125 / 131
68'						42 / 42		50 / 50		60 / 60		69 / 69	61 / 25	79 / 80	70 / 28	85 / 91	78 / 32	90 / 98	83 / 36	96 / 104	88 / 40	101 / 110	93 / 44	107 / 116	97 / 48	112 / 122	102 / 53	118 / 127
70'								46 / 46		55 / 55		64 / 64		73 / 73	64 / 26	80 / 84	73 / 29	85 / 92	78 / 33	90 / 98	83 / 36	95 / 104	87 / 40	101 / 109	92 / 44	106 / 115	96 / 48	111 / 121

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Boyds Bear Country
Pigeon Forge, TN

Joists under Mechanical Loading – Spaced 2' O.C.

TJH™ TRUSS ALLOWABLE UNIFORM LOAD TABLE (PLF) / PARALLEL CHORD

For economical truss design, see page 5.

Span	Depth																													
	24"		27"		30"		33"		36"		39"		42"		45"		48"		51"		54"		57"		60"		63"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
30'	353	406	416	480	473	505	398	513	454	509	448	512	434	499	432	497	407	463	389	448	370	402	357	402	343	395	335	383
	188	441	246	500	306	509	378	516	443	521		526		524		528		496		486		437		435		421		416
32'	311	360	366	420	420	473	452	469	437	483	397	439	427	485	407	471	410	471	385	427	369	423	350	399	341	395	339	364
	157	392	206	458	258	475	314	481	371	487		491		497		494		497		464		452		434		424		395
34'	277	318	326	374	374	429	337	451	427	440	418	456	411	455	410	462	383	449	388	444	366	408	350	400	332	382	310	357
	132	336	173	407	218	448	267	452	317	456	366	460		462		470		465		470		426		435		410		388
36'	247	284	291	334	334	384	369	425	393	427	341	431	342	403	390	437	351	441	368	426	371	403	349	387	330	382	322	365
	112	309	147	364	187	419	228	427	272	428	320	433		437		440		442		441		438		420		408		396
38'	222	255	261	301	301	346	341	391	303	405	371	406	335	413	348	413	394	413	378	417	346	402	347	387	332	371	315	363
	95	278	126	328	159	376	196	392	234	405	275	406	319	413		416		416		421		421		416		399		394
40'	201	231	237	272	272	313	297	351	339	372	370	388	307	390	320	392	368	396	329	396	341	386	330	383	336	359	315	342
	82	251	109	296	138	341	169	377	204	385	238	389	278	390	317	393	353	396		398		394		401		388		374
42'	177	210	215	247	248	285	280	321	312	360	328	368	355	371	355	352	362	374	358	375	348	378	325	371	315	363	295	345
	71	228	94	269	120	310	148	336	178	366	210	368	240	370	276	373	315	377		379		380		380		383		373
44'	154	191	196	225	226	260	255	293	282	326	310	350	325	354	341	354	341	358	302	358	328	361	333	363	315	358	302	349
	61	199	82	245	105	280	130	319	157	336	184	351	212	354	242	354	274	357		360		362		364		368		369
46'	134	174	180	207	207	238	233	268	258	300	267	330	295	336	272	313	326	335	326	343	329	330	317	344	321	348	306	345
	54	175	72	224	92	259	114	292	138	325	162	336	190	336	219	337	244	342	271	344	299	345		345		349		351
48'	119	155	159	190	190	219	216	248	239	276	260	300	287	294	284	325	316	294	317	326	316	331	309	329	306	330	306	336
	48	155	64	206	82	238	101	269	122	300	145	318	167	322	192	324	216	327	244	329	270	328	299	333		330		336
50'	105	138	140	174	175	202	199	229	221	254	244	280	267	307	277	311	303	308	307	289	304	317	305	318	305	318	292	321
	42	137	56	182	72	219	90	249	109	276	128	304	150	310	173	311	194	311	217	315	243	317	266	319	293	320		317
52'	93	122	124	161	161	187	184	212	205	236	227	260	247	283	244	300	256	299	292	301	294	303	294	292	292	307	291	309
	37	122	50	162	64	203	80	231	97	257	116	280	135	280	154	297	175	300	196	303	217	303	241	305	262	307	285	309
54'	83	109	111	146	144	174	171	196	191	219	210	240	229	263	248	284	241	289	281	268	290	285	285	293	286	295	284	295
	33	109	44	146	57	187	72	213	87	224	104	262	121	280	139	280	158	287	177	290	197	293	217	293	239	295	259	295
56'	75	98	100	131	129	161	159	182	177	204	195	224	213	244	231	252	249	278	264	280	277	281	248	282	279	271	274	285
	30	98	40	131	52	168	64	198	79	222	94	244	109	266	126	276	142	278	161	280	179	281	199	283	213	271	233	285
58'	67	88	90	118	115	150	145	171	165	190	183	209	199	229	214	246	224	264	234	268	244	271	264	261	268	262	267	272
	27	89	36	118	46	151	58	186	71	207	85	224	99	248	114	265	131	268	147	274	164	267	179	273	197	274	216	272
60'	61	80	81	107	104	136	131	160	155	178	171	196	186	214	201	231	215	248	222	257	246	263	241	262	244	253	257	243
	24	80	32	107	42	137	52	168	64	193	77	213	90	232	103	251	118	257	134	264	148	265	164	262	181	264	198	265
62'		73	74	97	95	124	119	149	145	167	160	183	174	200	188	216	201	232	216	248	220	245	229	252	246	254	256	256
		73	29	97	38	124	48	155	58	181	70	199	81	217	94	230	107	248	122	249	137	253	152	254	165	244	178	255
64'		66	67	88	86	113	108	140	132	157	150	173	163	188	176	203	190	218	202	233	216	245	230	244	226	247	242	227
		66	27	88	35	113	43	141	53	168	63	188	74	204	86	221	98	224	112	242	124	243	137	246	152	247	166	227
66'		60	61	80	78	103	98	128	121	148	141	162	153	177	166	191	178	205	191	220	203	231	215	239	228	239	237	240
		60	24	80	31	103	39	129	48	157	58	168	68	192	79	207	90	224	102	224	114	233	127	236	139	239	153	240
68'		55		74	72	95	90	118	110	139	133	153	145	166	156	180	168	193	180	207	191	220	203	230	214	233	214	213
		55		74	29	95	36	118	44	144	53	166	62	181	72	195	83	210	94	224	105	224	117	227	129	230	141	233
70'		51		68	66	87	83	108	101	131	121	144	136	157	147	170	159	182	170	195	181	208	192	220	203	225	204	205
		51		68	26	87	33	108	40	132	48	157	57	168	66	184	76	198	86	212	97	224	108	224	119	214	131	205

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

iLevel™ TRUS JOIST® commercial

TJM™ and TJH™ Trusses

Top and Bottom Chords:
- TJM™ Trusses: Double 1½" x 3½" MSR lumber.
- TJH™ Trusses: Double 1½" x 5½" MSR lumber.

Webs:
Up to 2" diameter tubular steel members varying in gauge and diameter according to requirements. Minimum yield of 45,000 psi.

Weight:
- TJM™ Trusses: 8 to 9 lbs/ft
- TJH™ Trusses: 10 to 12 lbs/ft

Depths:	TJM™	TJH™
Minimum depth at wall	20"	24"
Maximum depth at wall	60"	72"
Maximum pitched ridge depth	72"	114"

Any depth between minimum and maximum is available.

Profiles

1

Parallel Chord

Truss Rigidity Properties

Truss Series	EI Truss Only (Roof)	EI Nailed Floor	EI Glue-Nailed Floor
TJL™	5.00 x 10^6d^2	5.42 x 10^6d^2	5.75 x 10^6d^2
TJLX™	5.26 x 10^6d^2	5.69 x 10^6d^2	6.03 x 10^6d^2
TJW™	6.78 x 10^6d^2	7.20 x 10^6d^2	7.54 x 10^6d^2
TJS™	6.94 x 10^6d^2	7.41 x 10^6d^2	7.79 x 10^6d^2
TJM™	10.06 x 10^6d^2	10.60 x 10^6d^2	11.02 x 10^6d^2
TJH™	15.93 x 10^6d^2	16.54 x 10^6d^2	17.03 x 10^6d^2

d = The average pin-to-pin depth of the truss in inches, which is the average depth of the truss minus the following:

TJL™, TJLX™, and TJW™ Trusses	1.5 inches
TJS™ Trusses	2.3 inches
TJM™ Trusses	3.5 inches
TJH™ Trusses	5.5 inches

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Truss Deflection - TJM Trusses

Member Properties:

$w := 200\ plf$

$L := 30\ ft$

$d := 30 - 3.5$ $\quad d = 26.5\ in$

$EI := 11020000 \cdot d^2$ $\quad EI = 7.739 \times 10^9$

Calculations:

$\Delta := \frac{22.5 \cdot w \cdot L^4}{EI}$ $\quad \Delta = 0.471\ in$

$\frac{L \cdot 12}{600} = 0.6$ $\quad 0.6in > 0.471in$ OK

Truss Deflection - TJH Trusses

Member Properties:

$w := 250\ plf$

$L := 30\ ft$

$d := 30 - 5.5$ $\quad d = 24.5\ in$

$EI := 17030000 \cdot d^2$ $\quad EI = 1.022 \times 10^{10}$

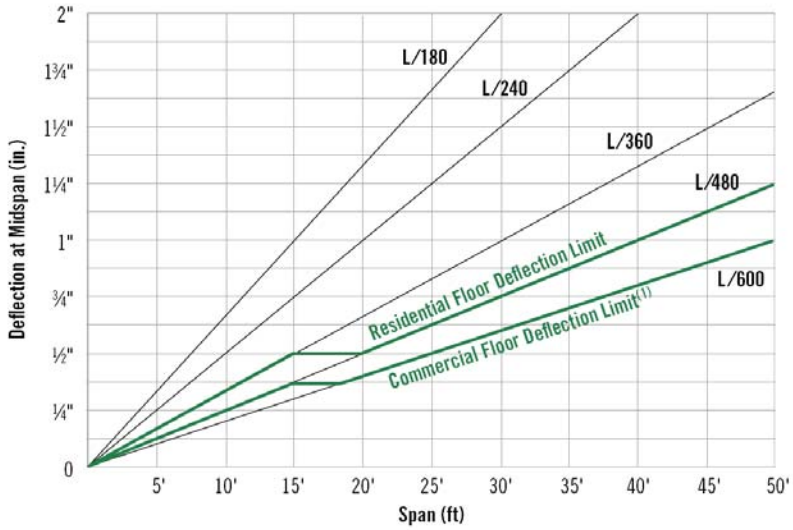
Calculations:

$\Delta := \frac{22.5 \cdot w \cdot L^4}{EI}$ $\quad \Delta = 0.446\ in$

$\frac{L \cdot 12}{600} = 0.6$ $\quad 0.6in > 0.446in$ OK

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

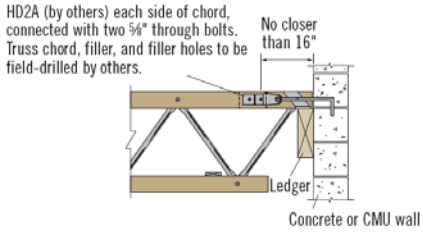
Boyds Bear Country
Pigeon Forge, TN



(1) For live load applications greater than 50 psf, check the L/600 deflection limit using a 50 psf live load (movable partitions need not be considered), and check the code prescribed deflection limit using the full live load.

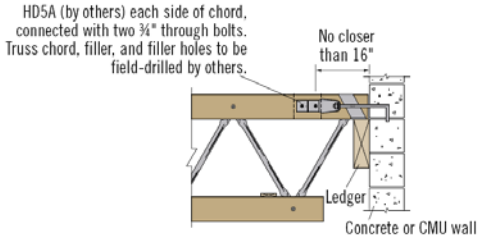
WIND OR SEISMIC CONNECTIONS

60 TJM™ Truss with Wall Tie



Truss assembly tension capacity is 5,550 lbs at 133% or 160%. (Wall and anchorage design by others.)

61 TJH™ Truss with Wall Tie



Truss assembly tension capacity is 7,410 lbs at 133% or 160%. (Wall and anchorage design by others.)

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Girder Design - Typical Bay

Member Properties:

Span := 22.5ft

TribWidth := 30ft

b := 10.5in

d := 28in

$A = 294\,in^2$

$Sx = 1372\,in^3$

$Sy = 514.5\,in^3$

$Ix = 19208\,in^4$

$Iy = 2701.1\,in^4$

Material Properties: Parallam PSL

γ := 45pcf

G := 125000psi

E := 2000000psi

$Fb := 2900psi \cdot \left(\frac{12in}{d}\right)^{.111}$

Fb = 2639.7 psi

Ft := 2025psi

Fcparallel := 2900psi

Fcperp := 750psi

Fv := 290psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 91.875 plf

wLive := LL·TribWidth

wLive = 3000 plf

w := (DL + LL)·TribWidth + SW

w = 3841.9 plf

Adjustment Factors:

Cd := 1.0

Cm := 1.0

Ct := 1.0

Cl := 1.0

$Cv := \left(\frac{21ft}{Span}\right)^{0.05} \cdot \left(\frac{12in}{d}\right)^{0.05} \cdot \left(\frac{5.125in}{b}\right)^{0.05}$

Cv = 0.922

Cfu := 1.0

Cc := 1.0

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country

Pigeon Forge, TN

Member Properties:

Calculations:

$M := \frac{w \cdot Span^2}{8}$ $M = 243118.7\,lbf \cdot ft$

$V := \frac{w \cdot Span}{2}$ $V = 43221.1\,lbf$

$fb := \frac{M}{Sx}$ $fb = 2126.4\,psi$ $Fb' := Cd \cdot Cm \cdot Ct \cdot Cv \cdot Cfu \cdot Cc \cdot Fb$ $Fb' = 2432.7\,psi$

Check = "OK"

$fv := \frac{1.5 \cdot V}{A}$ $fv = 220.5\,psi$ $Fv' := Cd \cdot Cm \cdot Ct \cdot Fv$ $Fv' = 290\,psi$

Check = "OK"

$\Delta L := \frac{5 \cdot wLive \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta L = 0.45\,in$ $\Delta L' := \frac{Span}{360}$ $\Delta L' = 0.75\,in$

Check = "OK"

$\Delta T := \frac{5 \cdot w \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta T = 0.577\,in$ $\Delta T' := \frac{Span}{240}$ $\Delta T' = 1.125\,in$

Check = "OK"

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Girder Design - Center Span

Member Properties:

Span := 22.5ft

TribWidth := 45ft

b := 10.5in

d := 34in

$A = 357\,in^2$

$Sx = 2023\,in^3$

$Sy = 624.75\,in^3$

$Ix = 34391\,in^4$

$Iy = 3279.9\,in^4$

Material Properties: Parallam PSL

γ := 45pcf

G := 125000psi

E := 2000000psi

$Fb := 2900psi \cdot \left(\frac{12in}{d}\right)^{.111}$

Fb = 2583.4 psi

Ft := 2025psi

Fcparallel := 2900psi

Fcperp := 750psi

Fv := 290psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 111.563 plf

wLive := LL·TribWidth

wLive = 4500 plf

w := (DL + LL)·TribWidth + SW

w = 5736.6 plf

Adjustment Factors:

Cd := 1.0

Cm := 1.0

Ct := 1.0

Cl := 1.0

$Cv := \left(\frac{21ft}{Span}\right)^{0.05} \cdot \left(\frac{12in}{d}\right)^{0.05} \cdot \left(\frac{5.125in}{b}\right)^{0.05}$

Cv = 0.913

Cfu := 1.0

Cc := 1.0

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Member Properties:

Calculations:

$M := \frac{w \cdot Span^2}{8}$ $M = 363016.8\,lbf \cdot ft$

$V := \frac{w \cdot Span}{2}$ $V = 64536.3\,lbf$

$fb := \frac{M}{Sx}$ $fb = 2153.3\,psi$ $Fb' := Cd \cdot Cm \cdot Ct \cdot Cv \cdot Cfu \cdot Cc \cdot Fb$ $Fb' = 2357.8\,psi$

Check = "OK"

$fv := \frac{1.5 \cdot V}{A}$ $fv = 271.2\,psi$ $Fv' := Cd \cdot Cm \cdot Ct \cdot Fv$ $Fv' = 290\,psi$

Check = "OK"

$\Delta L := \frac{5 \cdot wLive \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta L = 0.377\,in$ $\Delta L' := \frac{Span}{360}$ $\Delta L' = 0.75\,in$

Check = "OK"

$\Delta T := \frac{5 \cdot w \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta T = 0.481\,in$ $\Delta T' := \frac{Span}{240}$ $\Delta T' = 1.125\,in$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Girder Design - Mechanical Loading

Member Properties:

Span := 22.5ft

TribWidth := 30ft

b := 10.5in

d := 28in

$A = 294\,in^2$

$Sx = 1372\,in^3$

$Sy = 514.5\,in^3$

$Ix = 19208\,in^4$

$Iy = 2701.1\,in^4$

Material Properties: Parallam PSL

$\gamma := 45pcf$

$G := 125000psi$

$E := 2000000psi$

$Fb := 2900psi \cdot \left(\frac{12in}{d}\right)^{.111}$

$Fb = 2639.7\,psi$

$Ft := 2025psi$

$Fcparallel := 2900psi$

$Fcperp := 750psi$

$Fv := 290psi$

Loading:

$DL := 25psf$

$LL := 112.5psf$

$SW := \gamma \cdot b \cdot d$

$SW = 91.875\,plf$

$wLive := LL \cdot TribWidth$

$wLive = 3375\,plf$

$w := (DL + LL) \cdot TribWidth + SW$

$w = 4216.9\,plf$

Adjustment Factors:

$Cd := 1.0$

$Cm := 1.0$

$Ct := 1.0$

$Cl := 1.0$

$Cv := \left(\frac{21ft}{Span}\right)^{0.05} \cdot \left(\frac{12in}{d}\right)^{0.05} \cdot \left(\frac{5.125in}{b}\right)^{0.05}$

$Cv = 0.922$

$Cfu := 1.0$

$Cc := 1.0$

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Member Properties:

Calculations:

$M := \frac{w \cdot Span^2}{8}$ $M = 266849.1\ lbf \cdot ft$

$V := \frac{w \cdot Span}{2}$ $V = 47439.8\ lbf$

$fb := \frac{M}{Sx}$ $fb = 2334\ psi$ $Fb' := Cd \cdot Cm \cdot Ct \cdot Cv \cdot Cfu \cdot Cc \cdot Fb$ $Fb' = 2432.7\ psi$

Check = "OK"

$fv := \frac{1.5 \cdot V}{A}$ $fv = 242\ psi$ $Fv' := Cd \cdot Cm \cdot Ct \cdot Fv$ $Fv' = 290\ psi$

Check = "OK"

$\Delta L := \frac{5 \cdot wLive \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta L = 0.507\ in$ $\Delta L' := \frac{Span}{360}$ $\Delta L' = 0.75\ in$

Check = "OK"

$\Delta T := \frac{5 \cdot w \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta T = 0.633\ in$ $\Delta T' := \frac{Span}{240}$ $\Delta T' = 1.125\ in$

Check = "OK"

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Girder Design - Mechanical Loading

Member Properties:

Span := 22.5ft

TribWidth := 15ft

b := 10.5in

d := 22in

$A = 231\,in^2$

$Sx = 847\,in^3$

$Sy = 404.25\,in^3$

$Ix = 9317\,in^4$

$Iy = 2122.3\,in^4$

Material Properties: Parallam PSL

γ := 45pcf

G := 125000psi

E := 2000000psi

$Fb := 2900psi \cdot \left(\frac{12in}{d}\right)^{.111}$

Fb = 2711.3 psi

Ft := 2025psi

Fcparallel := 2900psi

Fcperp := 750psi

Fv := 290psi

Loading:

DL := 25psf

LL := 125psf

SW := γ·b·d

SW = 72.188 plf

wLive := LL·TribWidth

wLive = 1875 plf

w := (DL + LL)·TribWidth + SW

w = 2322.2 plf

Adjustment Factors:

Cd := 1.0

Cm := 1.0

Ct := 1.0

Cl := 1.0

$Cv := \left(\frac{21ft}{Span}\right)^{0.05} \cdot \left(\frac{12in}{d}\right)^{0.05} \cdot \left(\frac{5.125in}{b}\right)^{0.05}$

Cv = 0.933

Cfu := 1.0

Cc := 1.0

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Member Properties:

Calculations:

$M := \frac{w \cdot Span^2}{8}$ $M = 146950.9\,lbf \cdot ft$

$V := \frac{w \cdot Span}{2}$ $V = 26124.6\,lbf$

$fb := \frac{M}{Sx}$ $fb = 2081.9\,psi$ $Fb' := Cd \cdot Cm \cdot Ct \cdot Cv \cdot Cfu \cdot Cc \cdot Fb$ $Fb' = 2529\,psi$

Check = "OK"

$fv := \frac{1.5 \cdot V}{A}$ $fv = 169.6\,psi$ $Fv' := Cd \cdot Cm \cdot Ct \cdot Fv$ $Fv' = 290\,psi$

Check = "OK"

$\Delta L := \frac{5 \cdot wLive \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta L = 0.58\,in$ $\Delta L' := \frac{Span}{360}$ $\Delta L' = 0.75\,in$

Check = "OK"

$\Delta T := \frac{5 \cdot w \cdot Span^4}{384 \cdot E \cdot Ix}$ $\Delta T = 0.719\,in$ $\Delta T' := \frac{Span}{240}$ $\Delta T' = 1.125\,in$

Check = "OK"

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Typical Column Supporting Roof Trusses

Member Properties:

Height := 9.667ft

TribArea := 675ft^2

b := 7in

d := 7in

A = 49 in^2

Sx = 57.2 in^3

Sy = 57.2 in^3

Ix = 200.1 in^4

Iy = 200.1 in^4

$$Rb := \sqrt{\frac{Height \cdot d}{b^2}}$$

e = 1.169 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 20psf

LL := 20psf

SW := γ·b·d

SW = 15.313 plf

wLive := (LL)TribArea

wLive = 13500 lbf

P := (DL + LL)·TribArea + SW·Height

P = 27148 lbf

Adjustment Factors:

Cd := 1.0 Cl := 1.0

Cm := 1.0 Cfu := 1.0

Ct := 1.0 Cc := 1.0

Cv = 1.051 Cv := 1.0

$$Fce := \frac{0.822 \cdot Emin}{\left(\frac{Height}{d}\right)^2}$$ Fce = 2933.2 psi

Fcstar := Fc·Cd Fcstar = 2300 psi

Cp = 0.839

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 1929.3\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 554\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2 \quad fb = 865.5\,psi$$

Check = "OK"

$$Fbe := \frac{1.20 \cdot Emin}{Rb^2} \quad Fbe = 70963.1\,psi$$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.931$$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Typical Column Supporting Fourth Floor

Member Properties:

Height := 17.333ft

le := 11ft

TribArea := $675ft^2$

b := 12in

d := 12in

A = $144\,in^2$

Sx = $288\,in^3$

Sy = $288\,in^3$

Ix = $1728\,in^4$

Iy = $1728\,in^4$

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

e = 2.004 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 45 plf

wLive := (LL)TribArea

wLive = 67500 lbf

Psupport := 27148lbf

P := (DL + LL)·TribArea + SW·Height + Psupport

P = 112303 lbf

Adjustment Factors:

Cd := 1.0 Cl := 1.0

Cm := 1.0 Cfu := 1.0

Ct := 1.0 Cc := 1.0

Cv = 0.99 Cv := 1.0

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ Fce = 6657.5 psi

Fcstar := Fc·Cd Fcstar = 2300 psi

Cp = 0.953

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 2192.4\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 779.9\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2 \quad fb = 769.6\,psi$$

Check = "OK"

$$Fbe := \frac{1.20 \cdot Emin}{Rb^2} \quad Fbe = 106909.1\,psi$$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.975$$

Check = "OK"

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 2227.4\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 789.3\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2$ $\quad fb = 799.1\,psi$

Check = "OK"

$Fbe := \frac{1.20 \cdot Emin}{Rb^2}$ $\quad Fbe = 124727.3\,psi$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.963$$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Column Supporting Fourth Floor - Mechanical Loading

Member Properties:

Height := 17.333ft

le := 11ft

TribArea := $675ft^2$

b := 12in

d := 12in

A = $144\,in^2$

Sx = $288\,in^3$

Sy = $288\,in^3$

Ix = $1728\,in^4$

Iy = $1728\,in^4$

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

e = 2.004 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 25psf

LL := 112.5psf

SW := γ·b·d

SW = 45 plf

wLive := (LL)TribArea

wLive = 75937.5 lbf

Psupport := 27148lbf

P := (DL + LL)·TribArea + SW·Height + Psupport

P = 120740.5 lbf

Adjustment Factors:

Cd := 1.0 Cl := 1.0

Cm := 1.0 Cfu := 1.0

Ct := 1.0 Cc := 1.0

Cv = 0.99 Cv := 1.0

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ Fce = 6657.5 psi

Fcstar := Fc·Cd Fcstar = 2300 psi

Cp = 0.953

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 2192.4\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 838.5\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2$ $\quad fb = 700\,psi$

Check = "OK"

$Fbe := \frac{1.20 \cdot Emin}{Rb^2}$ $\quad Fbe = 106909.1\,psi$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.999$$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Typical Column Supporting Third Floor

Member Properties:

Height := 17.333ft

le := 11ft

TribArea := $675ft^2$

b := 15in

d := 15in

A = $225\,in^2$

Sx = $562.5\,in^3$

Sy = $562.5\,in^3$

Ix = $4218.8\,in^4$

Iy = $4218.8\,in^4$

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

e = 2.505 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 70.313 plf

wLive := (LL)TribArea

wLive = 67500 lbf

Psupport := 112303lbf

P := (DL + LL)·TribArea + SW·Height + Psupport

P = 197896.7 lbf

Adjustment Factors:

Cd := 1.0 Cl := 1.0

Cm := 1.0 Cfu := 1.0

Ct := 1.0 Cc := 1.0

Cv = 0.968 Cv := 1.0

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ Fce = 10402.4 psi

Fcstar := Fc·Cd Fcstar = 2300 psi

Cp = 0.973

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 2238.6\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 879.5\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2 \quad fb = 708.6\,psi$$

Check = "OK"

$$Fbe := \frac{1.20 \cdot Emin}{Rb^2} \quad Fbe = 133636.4\,psi$$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.99$$

Check = "OK"

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Typical Column Supporting Second Floor

Member Properties:

Height := 17.333ft

le := 11ft

TribArea := $675ft^2$

b := 18in

d := 18in

A = $324\,in^2$

Sx = $972\,in^3$

Sy = $972\,in^3$

Ix = $8748\,in^4$

Iy = $8748\,in^4$

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

e = 3.006 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 101.25 plf

wLive := (LL)TribArea

wLive = 67500 lbf

Psupport := 197897lbf

P := (DL + LL)·TribArea + SW·Height + Psupport

P = 284027 lbf

Adjustment Factors:

Cd := 1.0 | Cl := 1.0

Cm := 1.0 | Cfu := 1.0

Ct := 1.0 | Cc := 1.0

Cv = 0.951 | Cv := 1.0

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ | Fce = 14979.4 psi

Fcstar := Fc·Cd | Fcstar = 2300 psi

Cp = 0.983

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Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 2259.8\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 876.6\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2 \quad fb = 740.7\,psi$$

Check = "OK"

$$Fbe := \frac{1.20 \cdot Emin}{Rb^2} \quad Fbe = 160363.6\,psi$$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.975$$

Check = "OK"

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Wooden Column Design - Typical Column Supporting First Floor

Member Properties:

Height := 17.333ft

le := 11ft

TribArea := $675ft^2$

b := 20in

d := 20in

A = $400\,in^2$

Sx = $1333.3\,in^3$

Sy = $1333.3\,in^3$

Ix = $13333.3\,in^4$

Iy = $13333.3\,in^4$

$Rb := \sqrt{\frac{le \cdot d}{b^2}}$

e = 3.34 in

Material Properties: SP 50 N1D14

γ := 45pcf

E := 1900000psi

Emin := 980000psi

Fby := 2300psi

Fbx := 2100psi

Fc := 2300psi

Fv := 260psi

Loading:

DL := 25psf

LL := 100psf

SW := γ·b·d

SW = 125 plf

wLive := (LL)TribArea

wLive = 67500 lbf

Psupport := 284027lbf

P := (DL + LL)·TribArea + SW·Height + Psupport

P = 370568.6 lbf

Adjustment Factors:

Cd := 1.0 Cl := 1.0

Cm := 1.0 Cfu := 1.0

Ct := 1.0 Cc := 1.0

Cv = 0.941 Cv := 1.0

$Fce := \frac{0.822 \cdot Emin}{\left(\frac{le}{d}\right)^2}$ Fce = 18493.1 psi

Fcstar := Fc·Cd Fcstar = 2300 psi

Cp = 0.986

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Advisor: M.K. Parfitt

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Wooden Column Design

Calculations:

$Fc' := Fcstar \cdot Cp$ $\quad Fc' = 2268.3\,psi$ $\quad fc := \frac{P}{A}$ $\quad fc = 926.4\,psi$

Check = "OK"

$Fb' := Cd \cdot Cm \cdot Ct \cdot Cl \cdot Cv \cdot Cfu \cdot Cc \cdot Fbx$ $\quad Fb' = 2100\,psi$

$$fb := \left[Fb' \cdot \left(1 - \frac{fc}{Fce}\right)\right] \cdot \left(1 - \frac{fc}{Fc'}\right)^2 \quad fb = 698.1\,psi$$

Check = "OK"

$$Fbe := \frac{1.20 \cdot Emin}{Rb^2} \quad Fbe = 178181.8\,psi$$

$$\left(\frac{fc}{Fc'}\right)^2 + \frac{fb + \frac{fc \cdot 6 \cdot e}{d} \cdot \left(1 + 0.234 \cdot \frac{fc}{Fce}\right)}{Fb' \cdot \left(1 - \frac{fc}{Fce}\right)} = 0.988$$

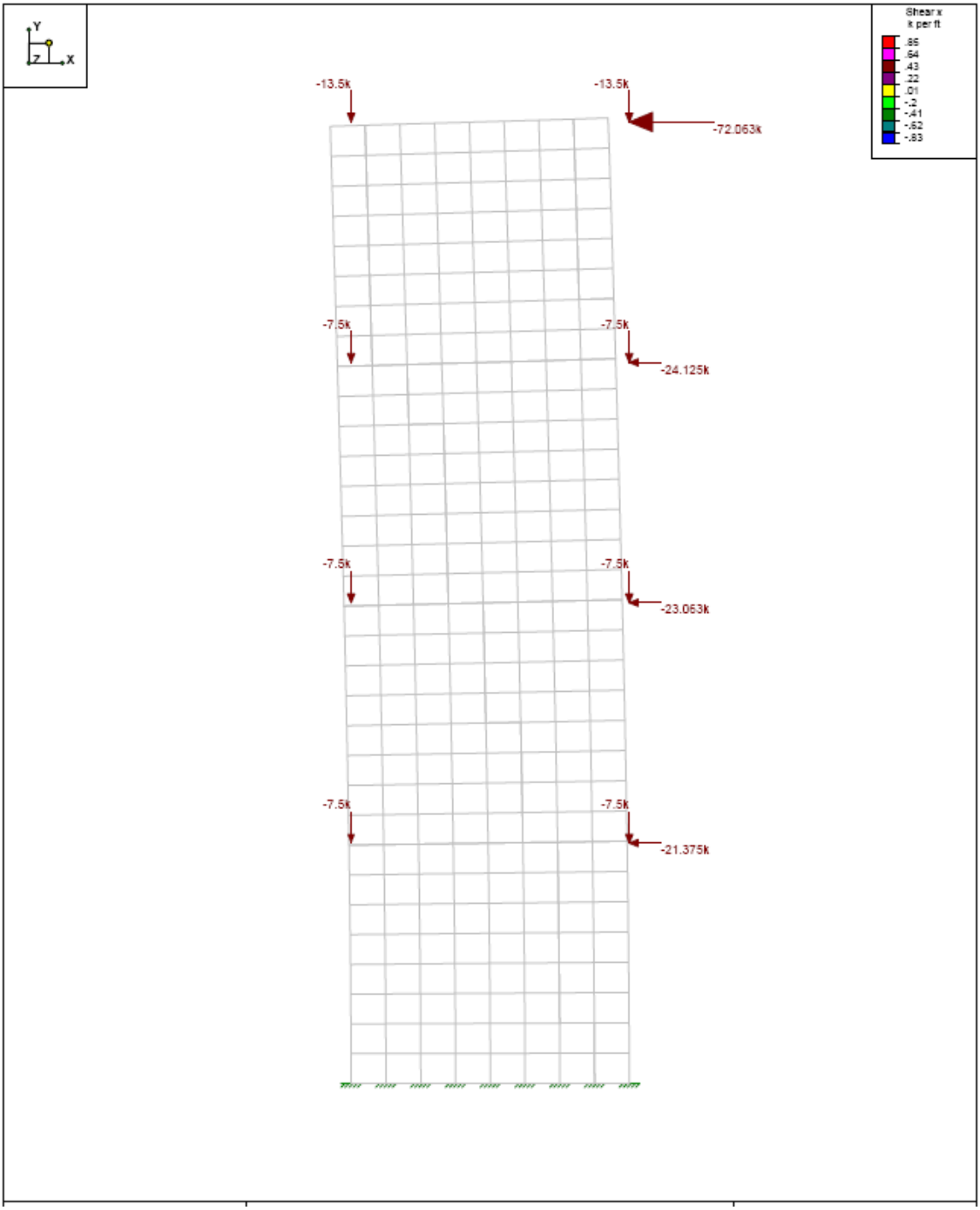
Check = "OK"

Lateral System Design

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

East-West Lateral Force Resisting Wall, Loading and Deflection Diagram



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Structural Option
Advisor: M.K. Parfitt

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Pigeon Forge, TN

East-West Lateral Force Resisting Wall, Joint Coordinates

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	20	0	0	0	
3	N3	0	17.33	0	0	
4	N4	20	17.33	0	0	
5	N5	0	34.66	0	0	
6	N6	20	34.66	0	0	
7	N7	0	51.99	0	0	
8	N8	20	51.99	0	0	
9	N9	0	69.33	0	0	
10	N10	20	69.33	0	0	

East-West Lateral Force Resisting Wall, Base Shear

Plate Forces (per ft) (By Combination)

	LC	Plate Label	Qx[k]	Qy[k]	Mx[k-ft]	My[k-ft]	Mxy[k-ft]	Fx[k]	Fy[k]	Fxy[k]
1	4	P1	0	0	0	0	0	-102.802	-8.722	9.055
2	4	P8	0	0	0	0	0	-71.936	-.289	1.49
3	4	P57	0	0	0	0	0	95.348	8.064	8.418
4	4	P64	0	0	0	0	0	61.083	-4.889	5.554
5	4	P65	0	0	0	0	0	-65.208	.229	1.434
6	4	P72	0	0	0	0	0	-43.914	-.293	1.104
7	4	P121	0	0	0	0	0	60.484	-4.364	.511
8	4	P128	0	0	0	0	0	34.502	-5.244	5.395
9	4	P129	0	0	0	0	0	-37.822	.227	1.042
10	4	P136	0	0	0	0	0	-20.861	-.275	.781
11	4	P185	0	0	0	0	0	34.502	-4.723	-.06
12	4	P192	0	0	0	0	0	13.336	-5.446	5.02
13	4	P193	0	0	0	0	0	-15.282	.247	.755
14	4	P200	0	0	0	0	0	-6.172	.954	-1.765
15	4	P249	0	0	0	0	0	14.184	-4.909	-.747
16	4	P256	0	0	0	0	0	-1.201	-33.77	12.685

East-West Lateral Force Resisting Wall, Deflections

Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	3	N1	0	0	0	0	0	0
2	3	N2	0	0	0	0	0	0
3	3	N3	-.049	-.044	0	0	0	0
4	3	N4	-.05	.042	0	0	0	0
5	3	N5	-.155	-.072	0	0	0	0
6	3	N6	-.157	.069	0	0	0	0
7	3	N7	-.297	-.087	0	0	0	0
8	3	N8	-.298	.083	0	0	0	0
9	3	N9	-.451	-.091	0	0	0	0
10	3	N10	-.461	.09	0	0	0	0

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

East-West Lateral Force Resisting Wall, Uplift Forces

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	3	N1	38.817	237.03	0	0	0	0
2	3	N2	37.193	-227.931	0	0	0	0
3	3	N18	26.999	324.305	0	0	0	0
4	3	N27	21.538	206.782	0	0	0	0
5	3	N36	18.508	105.505	0	0	0	0
6	3	N45	17.638	8.086	0	0	0	0
7	3	N54	18.064	-89.439	0	0	0	0
8	3	N63	20.615	-191.001	0	0	0	0
9	3	N72	25.627	-308.537	0	0	0	0
10	3	Totals:	225	64.8	0			
11	3	COG (ft):	X: 10	Y: 47.661	Z: 0			

Strength per bar: $\Phi f_y A_s$ = (0.9) (60 ksi) (1.56 in^2) = 84.24 kips

309 kips / 84.24 kips = 3.68 bars = Use (4) #11's

Shearwall Reinforcement - Wooden System E-W Resisting

Wall Properties:

$b := 20ft$ $f'c := 7000psi$

$w := 12in$ $Pu := 297kip$

$Ag = 20\,ft^2$ $Mu := 6160ft \cdot kip$

$Ig = 667\,ft^4$ $Vu := 102.8kip$

Calculations:

$fc := \frac{Pu}{Ag} + \frac{Mu \cdot \frac{b}{2}}{Ig}$ $fc = 107.3ksf$ $fc = 0.745ksi$

$0.2 \cdot f'c = 1400\,psi$ $0.2 \cdot f'c = 1.4ksi$ $1.4ksi > 0.745ksi$ No Boundary Elements

$2 \cdot Ag \cdot \sqrt{f'c} = 481.9kip$ $\frac{843.4kip}{2} = 421.7kip$ $421.7kip > 102.8kip$ One Curtain Reinforcement

$\rho := 0.0012$

$Asrqd := \rho \cdot w \cdot 12in$ $Asrqd = 0.173in^2$

Use #5's @ 18" O.C. $\rho_w := 0.00123$

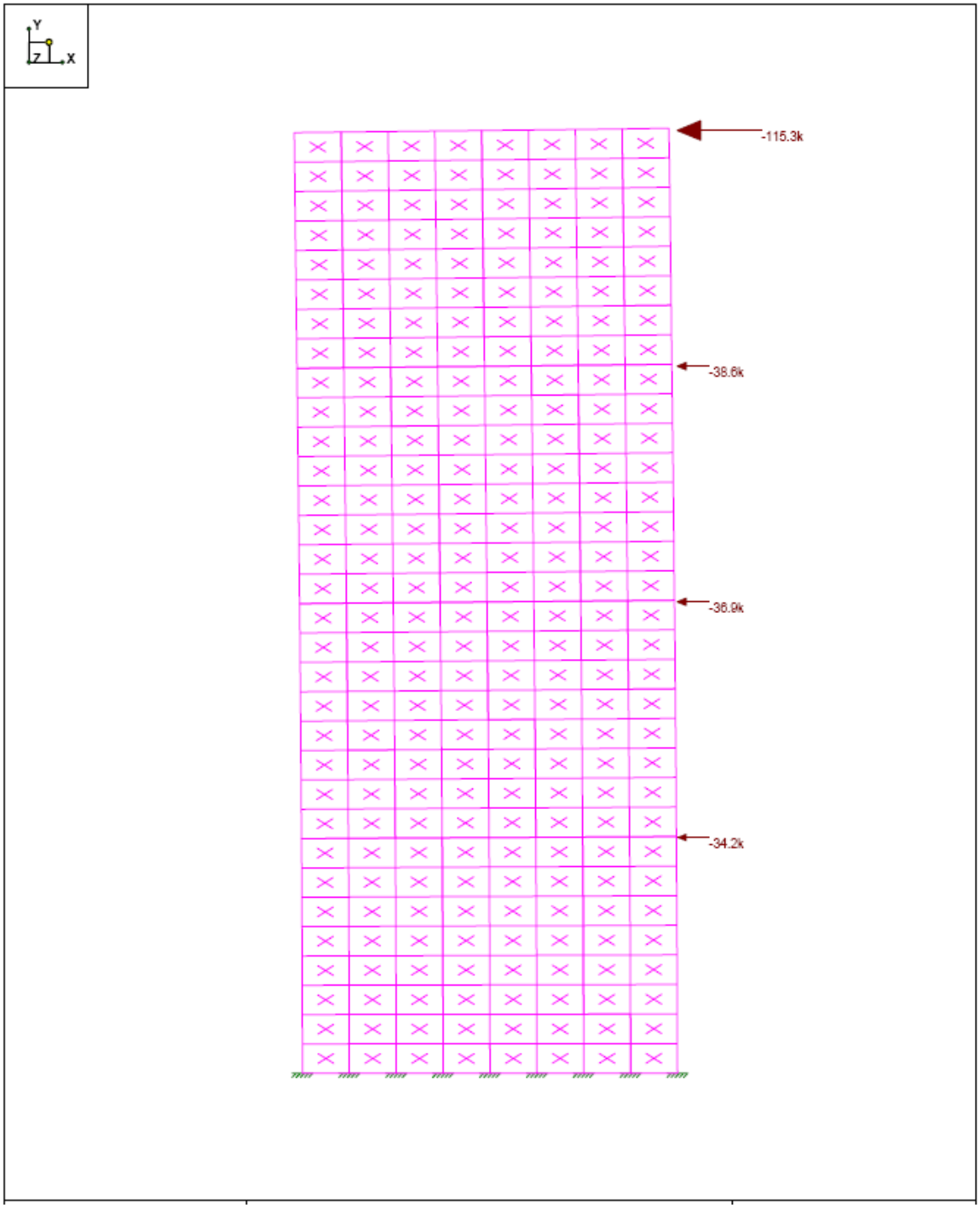
$Asprov := \rho \cdot w \cdot 12in$ $Asprov = 0.177in^2$

$Vn := b \cdot w \cdot (2 \cdot \sqrt{f'c} + \rho \cdot 60ksi)$ $Vn = 694.5kip$ $694.5kip > 102.8kip$ OK

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

North-South Lateral Force Resisting Wall, Loading and Deflection Diagram



Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

North-South Lateral Force Resisting Wall, Joint Coordinates

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	27.5	0	0	0	
3	N3	0	17.33	0	0	
4	N4	27.5	17.33	0	0	
5	N5	0	34.66	0	0	
6	N6	27.5	34.66	0	0	
7	N7	0	51.99	0	0	
8	N8	27.5	51.99	0	0	
9	N9	0	69.33	0	0	
10	N10	27.5	69.33	0	0	

North-South Lateral Force Resisting Wall, Base Shear

Plate Forces (per ft) (By Combination)

	LC	Plate Label	Qx[k]	Qy[k]	Mx[k-ft]	My[k-ft]	Mxy[k-ft]	Fx[k]	Fy[k]	Fxy[k]
1	4	P1	0	0	0	0	0	-53.288	-5	5.962
2	4	P8	0	0	0	0	0	-35.629	-.024	1.65
3	4	P57	0	0	0	0	0	53.616	5.026	5.949
4	4	P64	0	0	0	0	0	34.518	-4.105	3.78
5	4	P65	0	0	0	0	0	-33.676	-.024	1.619
6	4	P72	0	0	0	0	0	-21.131	-.024	1.384
7	4	P121	0	0	0	0	0	32.604	-4.107	-.589
8	4	P128	0	0	0	0	0	20.101	-4.421	3.703
9	4	P129	0	0	0	0	0	-19.499	-.022	1.354
10	4	P136	0	0	0	0	0	-8.721	0	1.284
11	4	P185	0	0	0	0	0	18.504	-4.418	-1.025
12	4	P192	0	0	0	0	0	9.178	-4.544	3.224
13	4	P193	0	0	0	0	0	-7.215	0	1.28
14	4	P200	0	0	0	0	0	-.034	-.092	0
15	4	P249	0	0	0	0	0	8.299	-4.51	-1.842
16	4	P256	0	0	0	0	0	3.041	-31.56	10.075

North-South Lateral Force Resisting Wall, Deflections

Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	3	N1	0	0	0	0	0	0
2	3	N2	0	0	0	0	0	0
3	3	N3	-.022	-.023	0	0	0	0
4	3	N4	-.023	.023	0	0	0	0
5	3	N5	-.065	-.038	0	0	0	0
6	3	N6	-.067	.038	0	0	0	0
7	3	N7	-.122	-.045	0	0	0	0
8	3	N8	-.123	.045	0	0	0	0
9	3	N9	-.182	-.046	0	0	0	0
10	3	N10	-.193	.052	0	0	0	0

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

North-South Lateral Force Resisting Wall, Uplift Forces

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	3	N1	28.722	171.243	0	0	0	0
2	3	N2	28.759	-172.286	0	0	0	0
3	3	N18	26.343	229.033	0	0	0	0
4	3	N27	23.673	141.427	0	0	0	0
5	3	N36	22.654	69.183	0	0	0	0
6	3	N45	22.52	.671	0	0	0	0
7	3	N54	22.604	-68.098	0	0	0	0
8	3	N63	23.539	-141.137	0	0	0	0
9	3	N72	26.184	-230.036	0	0	0	0
10	3	Totals:	225	0	0			
11	3	COG (ft):	NC	NC	NC			

Strength per bar: $\Phi f_y A_s$ = (0.9) (60 ksi) (1.56 in^2) = 84.24 kips

230 kips = 2.74bars = Use (4) #11's
84.24 kips .

Shearwall Reinforcement - Wooden System N-S Resisting

Wall Properties:

$b := 30ft$ $f'c := 7000psi$

$w := 12in$ $Pu := 210kip$

$Ag = 30\,ft^2$ $Mu := 6900ft \cdot kip$

$Ig = 2250\,ft^4$ $Vu := 53.3kip$

Calculations:

$fc := \frac{Pu}{Ag} + \frac{Mu \cdot \frac{b}{2}}{Ig}$ $fc = 53\,ksf$ $fc = 0.368\,ksi$

$0.2 \cdot f'c = 1400\,psi$ $0.2 \cdot f'c = 1.4\,ksi$ $1.4ksi > 0.368ksi$ No Boundary Elements

$2 \cdot Ag \cdot \sqrt{f'c} = 722.9\,kip$ $\frac{843.4kip}{2} = 421.7\,kip$ $421.7kip > 53.3kip$ One Curtain Reinforcement

$\rho := 0.0012$

$Asrqd := \rho \cdot w \cdot 12in$ $Asrqd = 0.173\,in^2$

Use #5's @ 18" O.C. $\rho_w := 0.00123$

$Asprov := \rho \cdot w \cdot 12in$ $Asprov = 0.177\,in^2$

$Vn := b \cdot w \cdot (2 \cdot \sqrt{f'c} + \rho \cdot 60ksi)$ $Vn = 1041.7\,kip$ $1014.7kip > 53.3kip$ OK

Effects on Foundation

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Foundation Design - Typical Wooden Column

Member Properties:

$b := 10ft$

$d := 28in$

$A := b^2$ $A = 100\,ft^2$

$V := A \cdot d$ $V = 233.3\,ft^3$

Material Properties:

$fc := 3000psi$

$q := 3.0ksf$

Supported Loads:

$P := 1014.3kip$

Calculations:

$$\sqrt{\frac{P}{q}} = 18.387\,ft$$

$$Vu1 := \frac{P}{b^2}\cdot\left[b^2 - (20in + d)^2\right] \quad Vu1 = 852\,kip$$

$\phi Vc := 0.75 \cdot 4 \cdot \sqrt{fc} \cdot 4 \cdot (20in + d) \cdot d$ $\phi Vc = 883.4\,kip$

Check = "OK"

$$Vu2 := \frac{P}{b^2}\cdot\left(\frac{b}{2} - d\right)b \quad Vu2 = 270.5\,kip$$

$\phi Vc := 0.75 \cdot 2 \cdot \sqrt{fc} \cdot d \cdot b$ $\phi Vc = 276.1\,kip$

Check = "OK"

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Foundation Wall Pilaster Design

Member Properties:

$L := 17.5ft$ $Mu := 20.58ft \cdot kip$

$bw := 24in$ $tp := bw$ $fy := 60ksi$

$hf := 16in$ $tw := hf$ $f'c := 4ksi$

$a := hf$ $a = 16in$

$d := tp - 2.5in$ $d = 21.5in$

Calculations:

$beff1 := bw + 16hf$ $beff1 = 23.333ft$

$beff2 := \frac{L}{4}$ $beff2 = 4.375ft$

$\phi := 0.9$ $beff := \min(beff1, beff2)$

$Asrqd := \frac{Mu}{\left[\phi \cdot fy \cdot \left(d - \frac{a}{2}\right)\right]}$ $Asrqd = 0.339in^2$ Try (2) #4's $As := 0.40in^2$

$Asmin1 := \frac{3\sqrt{f'c} \cdot bw \cdot d}{fy}$ $Asmin1 = 1.632in^2$

$Asmin2 := \frac{200psi \cdot bw \cdot d}{fy}$ $Asmin2 = 1.72in^2$ $\max(Asmin1, Asmin2) = 1.72in^2$

Try (4) #6's $As := 1.76in^2$

$acalc := \frac{As \cdot fy}{0.85 \cdot f'c \cdot beff}$ $acalc = 0.592in$ $acalc < hf$ OK

$Asadj := \frac{Mu}{\left[\phi \cdot fy \cdot \left(d - \frac{a}{2}\right)\right]}$ $Asadj = 0.339in^2$ Min Controls

$\frac{\frac{acalc}{0.85}}{d} = 0.032$ $0.032 < 0.0325$ OK

$\phi Mn := \phi \cdot As \cdot fy \cdot \left(d - \frac{acalc}{2}\right)$ $\phi Mn = 167.937\,ft \cdot kip$ $\phi Mn > Mu$ OK

Cost, Schedule and Coordination Analysis

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Original Steel System Take-Off from ICE

ItemCode	Description	Quantity	UM	Labor$	MH/Unit	Units/MH
Masonry						
Clay masonry units						
Clay masonry units						
Alternates Blank						
04210.011	MORTAR	85.36	CUYD			
04210.502	ADD FOR COMMON (AMERICAN) B	39,105.00	SQFT	0.8431	0.032821	30.46875
04210.580	ADD FOR FLUSH CUT	13,825.00	SQFT	0.2316	0.009014	110.9375
04210.582	ADD FOR RAKED JOINT	25,280.00	SQFT	0.1890	0.007356	135.9375
04219.990	* MASONRY WALL AREA *	39,105.00	SQFT			
	***** Total Alternates Blank*				*$45,217.29*	
	**** Total Clay masonry units*				*$45,217.29*	
	*** Total Clay masonry units*				*$45,217.29*	
Concrete masonry units						
Concrete masonry units						
Alternates Blank						
04220.100	FILL VOIDS W/MORTAR	53.85	CUYD	20.5520	0.80	1.25
04220.102	FILL VOIDS W/ CONCRETE	494.16	CUYD	20.5520	0.80	1.25
04220.502	8X8X16 CONC BLOCK	26,543.05	PCS	1.9929	0.077576	12.89063
04220.872	8X8X16 FOUNDATION BLOCK	545.60	PCS	1.9929	0.077576	12.89063
04220.874	12X8X16 FOUNDATION BLOCK	13,821.93	PCS	2.5690	0.10	10.00
04224.122	MASONRY REBAR	564.43	CWT	20.5520	0.80	1.25
04224.200	4" LADDER REINF, UNCOATED	38,038.00	LNFT			
04224.201	6" LADDER REINF, UNCOATED	7,900.00	LNFT			
04224.202	8" LADDER REINF, UNCOATED	11,100.00	LNFT			
	***** Total Alternates Blank*				*$235,343.74*	
	**** Total Concrete masonry units*				*$235,343.74*	
	*** Total Concrete masonry units*				*$235,343.74*	
	** Total Masonry*				*$280,561.03*	
07140.011	WATERPROOFING ON MASONRY	13,825.00	SQFT	0.4983	0.019394	51.5625
	***** Total Alternates Blank*				*$11,843.88*	
	**** Total Fluid applied waterproofing*				*$11,843.88*	
	*** Total Fluid applied waterproofing*				*$11,843.88*	

ItemCode	Description	Quantity	UM	Labor$	MH/Unit	Units/MH
Metals						
Structural steel						
Structural steel						
Alternates Blank						
05129.101	STEEL BEAMS		****			
05129.102	I BEAMS	6,029.16	CWT	28.7300	0.90	1.11111
05129.104	ANGLES	45.00	CWT	38.3067	1.20	0.83333
05129.121	STEEL COLUMNS		****			
05129.404	SHEAR STUD, 3/4"	6,450.00	EACH	0.5434	0.017143	58.33333
05129.501	SHOP PAINT		****			
05129.502	RED OXIDE	80,670.69	SQFT	0.0990	0.004	250.00
05129.990	* STRUCTURAL STEEL WEIGHT *	303.71	TONS			
	***** Total Alternates Blank*				*$442,378.16*	
	**** Total Structural steel*				*$442,378.16*	
	*** Total Structural steel*				*$442,378.16*	
Steel deck						
Steel deck						
Alternates Blank						
05310.019	3" METAL DECK	79,200.00	SQFT	0.4445	0.013926	71.80556
	***** Total Alternates Blank*				*$115,291.44*	
	**** Total Steel deck*				*$115,291.44*	
	*** Total Steel deck*				*$115,291.44*	
	** Total Metals*				*$557,669.60*	
07810.031	CEMENTITIOUS FIREPROOFING	40,335.34	BDFT	44.8066	1.99308	0.50174
	***** Total Alternates Blank*				*$1,828,586.62*	
	**** Total Applied fireproofing*				*$1,828,586.62*	
	*** Total Applied fireproofing*				*$1,828,586.62*	

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Original Steel System Take-Off from ICE Continued

ItemCode	Description	Quantity	UM	Labor$	MH/Unit	Units/MH
Concrete						
Concrete accessories						
Concrete accessories						
Alternates Blank						
03150.650	SCREEDS FOR SLAB	**9,504.00**	LNFT	0.9219	0.0352	28.40909
03150.651	CONSTRUCTION JOINTS	**15,360.00**	LNFT	1.8437	0.0704	14.20455
	***** Total Alternates Blank*				***$47,825.29***	
	**** Total Concrete accessories*				***$47,825.29***	
	*** Total Concrete accessories*				***$47,825.29***	
Welded wire fabric						
Welded wire fabric						
Alternates Blank						
03220.012	6x6 W2.9/W2.9 MESH	**871.20**	SQS	23.1663	0.982456	1.01786
	***** Total Alternates Blank*				***$33,250.48***	
	**** Total Welded wire fabric*				***$33,250.48***	
	*** Total Welded wire fabric*				***$33,250.48***	
Structural concrete						
Structural concrete						
Alternates Blank						
03311.700	**CONC IN SLAB OVER MTL DECK*		********			
03311.706	3000 PSI W/PUMP	**611.11**	CUYD	12.5997	0.533333	1.875
03315.991	* SLAB OVER METAL DECK AREA *	**79,200.00**	SQFT			
	***** Total Alternates Blank*				***$44,537.59***	
	**** Total Structural concrete*				***$44,537.59***	
	*** Total Structural concrete*				***$44,537.59***	
Finishing						
Finishing						
Alternates Blank						
03350.132	FLOAT FINISH	**79,200.00**	SQFT	0.2754	0.010667	93.75
	***** Total Alternates Blank*				***$21,811.68***	
	**** Total Finishing*				***$21,811.68***	
	*** Total Finishing*				***$21,811.68***	
Curing						
Curing						
Alternates Blank						
03390.010	PROTECT & CURE	**79,200.00**	SQFT	0.1102	0.004267	234.375
	***** Total Alternates Blank*				***$10,248.48***	
	**** Total Curing*				***$10,248.48***	
	*** Total Curing*				***$10,248.48***	
	** Total Concrete*				***$157,673.52***	

Lauren Wilke
Structural Option
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Boyds Bear Country
Pigeon Forge, TN

Original Steel System Take-Off from ICE Continued

ItemCode	Description	Quantity	UM	Labor$	MH/Unit	Units/MH
Wood and plastics						
Wood framing						
Wood framing						
Alternates Blank						
06110.140	NAILS & ROUGH HARDWARE	**259.63**	LBS			
06110.400	TRUSS 8 /12 PITCH 90' O"	**121.00**	EACH	69.5914	2.571429	0.38889
06112.503	* WOOD ROOF AREA *	**21,600.00**	SQFT			
	***** Total Alternates Blank*				*$55,050.88*	
	**** Total Wood framing*				*$55,050.88*	
	*** Total Wood framing*				*$55,050.88*	
Sheathing						
Sheathing						
Alternates Blank						
06160.179	5/8" CDX PLYWOOD @ ROOF	**25,963.20**	SQFT	0.2246	0.008297	120.52136
	***** Total Alternates Blank*				*$25,303.73*	
	**** Total Sheathing*				*$25,303.73*	
	*** Total Sheathing*				*$25,303.73*	
	** Total Wood and plastics*				*$80,354.61*	
Shingles						
Shingles						
Alternates Blank						
07310.141	30 LB FELT 216 SQFT ROLL	**120.20**	ROLL	29.8483	1.102907	0.90669
	***** Total Alternates Blank*				*$5,087.86*	
	**** Total Shingles*				*$5,087.86*	
	*** Total Shingles*				*$5,087.86*	
Manufactured roof specialties						
Manufactured roof specialties						
Alternates Blank						
07710.032	6" ALUMINUM GUTTER	**480.00**	LNFT	1.7784		
	***** Total Alternates Blank*				*$2,174.59*	
	**** Total Manufactured roof specialties*				*$2,174.59*	
	*** Total Manufactured roof specialties*				*$2,174.59*	

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Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Original Steel System Take-Off from ICE Continued

ItemCode	Description	Quantity	UM	Labor$	MH/Unit	Units/MH
Concrete						
Structural CIP forms						
Structural CIP forms						
Alternates Blank						
03110.520	COLUMN FOOTING EDGE FORMS	**4,100.50**	SQFT	4.4257	0.168983	5.91775
	******* Total Alternates Blank***				***$22,406.77***	
	****** Total Structural CIP forms***				***$22,406.77***	
	***** Total Structural CIP forms***				***$22,406.77***	
Concrete accessories						
Concrete accessories						
Alternates Blank						
03150.651	CONSTRUCTION JOINTS	**3,840.00**	LNFT	1.8437	0.0704	14.20455
	******* Total Alternates Blank***				***$9,005.57***	
	****** Total Concrete accessories***				***$9,005.57***	
	***** Total Concrete accessories***				***$9,005.57***	
Welded wire fabric						
Welded wire fabric						
Alternates Blank						
03220.011	6x6 W2.1/W2.1 MESH	**316.80**	SQS	22.0080	0.933333	1.07143
	******* Total Alternates Blank***				***$10,346.05***	
	****** Total Welded wire fabric***				***$10,346.05***	
	***** Total Welded wire fabric***				***$10,346.05***	
Structural concrete						
Structural concrete						
Alternates Blank						
03310.200	**CONC IN COLUMN FOOTING**		********			
03310.201	3000 PSI DIRECT	**452.90**	CUYD	11.0090	0.45	2.22222
03310.350	**CONC IN SLAB ON GRADE**		********			
03310.356	3000 PSI W/PUMP	**355.56**	CUYD	13.7451	0.581818	1.71875
03315.972	* NO. OF COLUMN FOOTINGS *	**58.00**	EACH			
03315.976	* SOG AREA *	**28,800.00**	SQFT			
	******* Total Alternates Blank***				***$56,215.54***	
	****** Total Structural concrete***				***$56,215.54***	
	***** Total Structural concrete***				***$56,215.54***	
Finishing						
Finishing						
Alternates Blank						
03350.132	FLOAT FINISH	**28,800.00**	SQFT	0.2754	0.010667	93.75
	******* Total Alternates Blank***				***$7,931.52***	
	****** Total Finishing***				***$7,931.52***	
	***** Total Finishing***				***$7,931.52***	
Curing						
Curing						
Alternates Blank						
03390.010	PROTECT & CURE	**28,800.00**	SQFT	0.1102	0.004267	234.375
	******* Total Alternates Blank***				***$3,726.72***	
	****** Total Curing***				***$3,726.72***	
	***** Total Curing***				***$3,726.72***	
	**** Total Concrete***				***$109,632.18***	

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Structural System Take-Off Summaries

Original Steel Structure Pricing	
note: Member prices include installation costs	
Values as reported from ICE, available in Appendix	
Material	**Total Price**
Masonry	
Mortar	$45,217.29
Block / Reinforcement	$235,343.74
Waterproofing	$11,843.88
Metals	
Structural Steel	$442,378.16
Metal Deck	$115,291.44
Fireproofing	$1,828,686.62
Concrete	
Slab on Deck	$157,673.32
Foundations	
Concrete	$31,491.99
Formwork	$22,406.77
Slab On Grade	
Concrete / Installation	$55,733.42
Roof	
Wood Trusses	$55,050.88
Wood Sheathing	$25,303.73
Accessories	$7,262.45
Total:	**$3,033,683.69**

Lauren Wilke
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Advisor: M.K. Parfitt

Boyds Bear Country

Pigeon Forge, TN

Pre-Cast Concrete Structure Pricing				
note: Member prices do not include crane installation costs				
Member	**Measurement**	**Quantity**	**Unit Price**	**Total Price**
Double Tees				
15DT34-128S	45 ft	35	$5,457.00	$190,995.00
15DT34-168S	45 ft	33	$5,500.00	$181,500.00
15DT34-208S	60 ft	22	$6,931.82	$152,500.04
15DT34-248S	60 ft	16	$7,000.00	$112,000.00
Girders				
12LB36-118S	30 ft	32	$5,881.00	$188,192.00
24IT36-228S	30 ft	30	$5,250.00	$157,500.00
Columns				
18"x18" CHE	36 ft	32	$7,560.00	$241,920.00
24"x24" CHI	72 ft	14	$15,120.00	$211,680.00
Installation Costs				
Rural Location	Picks/Pc	Quantity		
Open Storage	2	214	$1,200.00	$513,600.00
Shearwalls				
30'x14" Panels	18.75 cwt	32	$59.69	$35,814.00
Foundation Walls				
Concrete	27.16 cuyd	16	$79.59	$34,586.63
Steel	352 cwt	1	$59.71	$21,017.92
Formwork	17360 sf	1	$11.73	$203,632.80
Foundations				
Concrete				$36,215.79
Formwork				$22,406.77
Slab On Grade				
Concrete / Installation				$55,733.42
Roof				
Wood Trusses				$55,050.88
Wood Sheathing				$25,303.73
Accessories				$7,262.45
Total:				**$2,244,938.39**

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

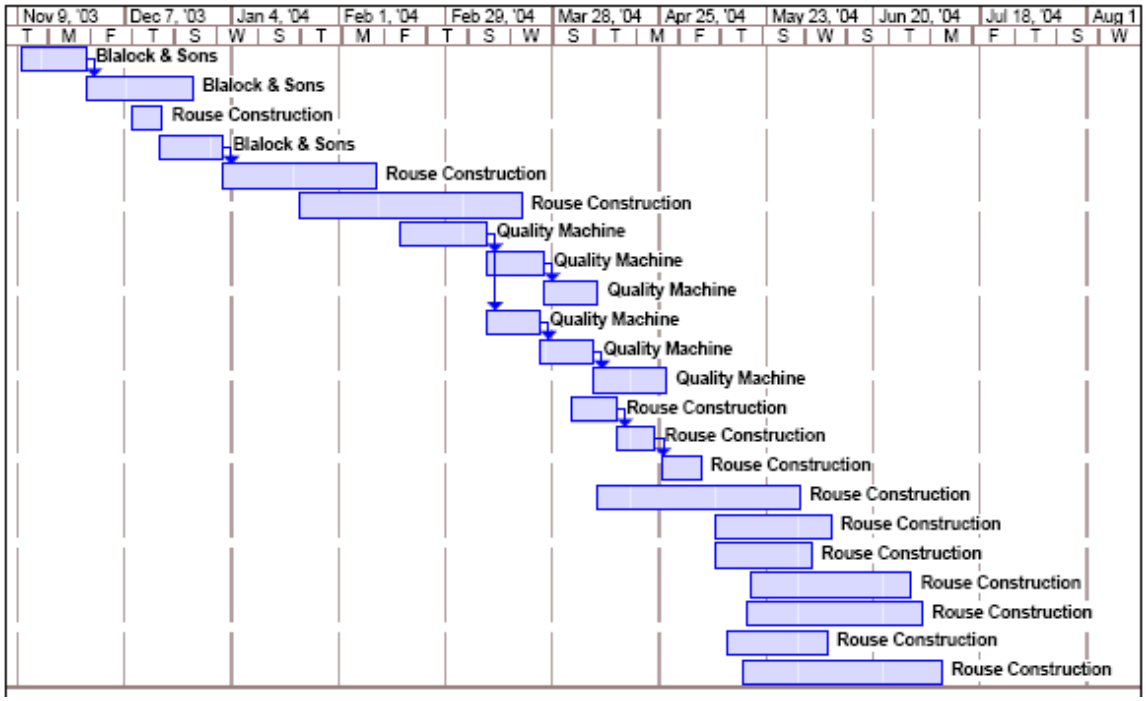
Wooden Structure Pricing					
note: Member prices include installation costs					
Member	**Measurement**		**Quantity**	**Unit Price**	**Total Price**
Floor Plank					
2"x6" T and G	160.1	MBF	1	$2,450.00	$392,245.00
Tubular Steel Trusses					
30" TJM	66000	sf	1	$4.10	$270,600.00
30" TJH	21600	sf	1	$4.32	$93,312.00
Girders					
10.5"x22" PSL	22.5	ft	24	$41.25	$22,275.00
10.5"x28" PSL	22.5	ft	103	$56.88	$131,819.40
Columns					
7" x 7"	8	ft	53	$14.20	$6,020.80
12" x 12"	17.7	ft	53	$38.32	$35,947.99
14" x 14"	17.7	ft	34	$55.00	$33,099.00
16" x 16"	17.7	ft	36	$71.84	$45,776.45
18" x 18"	17.7	ft	28	$90.92	$45,059.95
20" x 20"	17.7	ft	30	$112.25	$59,604.75
Shearwalls					
30'x12" Panels	16.07	cwt	16	$59.69	$15,347.49
20'x12" Panels	13.45	cwt	16	$59.69	$12,845.29
Foundation Walls					
Concrete	27.16	cuyd	16	$79.59	$34,586.63
Steel	352	cwt	1	$59.71	$21,017.92
Formwork	17360	sf	1	$11.73	$203,632.80
Foundations					
Concrete					$23,618.99
Formwork					$22,406.77
Slab On Grade					
Concrete / Installation					$55,733.42
Roof					
Wood Trusses					$55,050.88
Wood Sheathing					$25,303.73
Accessories					$7,262.45
Total:					**$1,612,566.71**

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

Original as Built Schedule

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	Site Clearing	13 days	Mon 11/10/03	Wed 11/26/03		Blalock & Sons
2	Site Grading	20 days	Thu 11/27/03	Wed 12/24/03	1	Blalock & Sons
3	Foundation Rebar	6 days	Tue 12/9/03	Tue 12/16/03		Rouse Construction
4	Foundation Excavation	13 days	Tue 12/16/03	Thu 1/1/04		Blalock & Sons
5	Concrete Foundations	28 days	Fri 1/2/04	Tue 2/10/04	4	Rouse Construction
6	Block Foundation Walls	42 days	Thu 1/22/04	Fri 3/19/04		Rouse Construction
7	Structural Steel Phase 1	17 days	Tue 2/17/04	Wed 3/10/04		Quality Machine
8	Structural Steel Phase 2	11 days	Thu 3/11/04	Thu 3/25/04	7	Quality Machine
9	Structural Steel Phase 3	10 days	Fri 3/26/04	Thu 4/8/04	8	Quality Machine
10	Steel Deck Phase 1	10 days	Thu 3/11/04	Wed 3/24/04	7	Quality Machine
11	Steel Deck Phase 2	10 days	Thu 3/25/04	Wed 4/7/04	10	Quality Machine
12	Steel Deck Phase 3	13 days	Thu 4/8/04	Mon 4/26/04	11	Quality Machine
13	Concrete Deck Phase 1	8 days	Fri 4/2/04	Tue 4/13/04		Rouse Construction
14	Concrete Deck Phase 2	8 days	Wed 4/14/04	Fri 4/23/04	13	Rouse Construction
15	Concrete Deck Phase 3	8 days	Mon 4/26/04	Wed 5/5/04	14	Rouse Construction
16	Exterior Metal Studs	37 days	Fri 4/9/04	Mon 5/31/04		Rouse Construction
17	Plywood Sheathing	22 days	Mon 5/10/04	Tue 6/8/04		Rouse Construction
18	Interior Metal Studs	19 days	Mon 5/10/04	Thu 6/3/04		Rouse Construction
19	Wood Roof Trusses	30 days	Wed 5/19/04	Tue 6/29/04		Rouse Construction
20	Exterior Sheathing	34 days	Tue 5/18/04	Fri 7/2/04		Rouse Construction
21	Shearwalls	18 days	Thu 5/13/04	Mon 6/7/04		Rouse Construction
22	Roof Sheathing	38 days	Mon 5/17/04	Wed 7/7/04		Rouse Construction

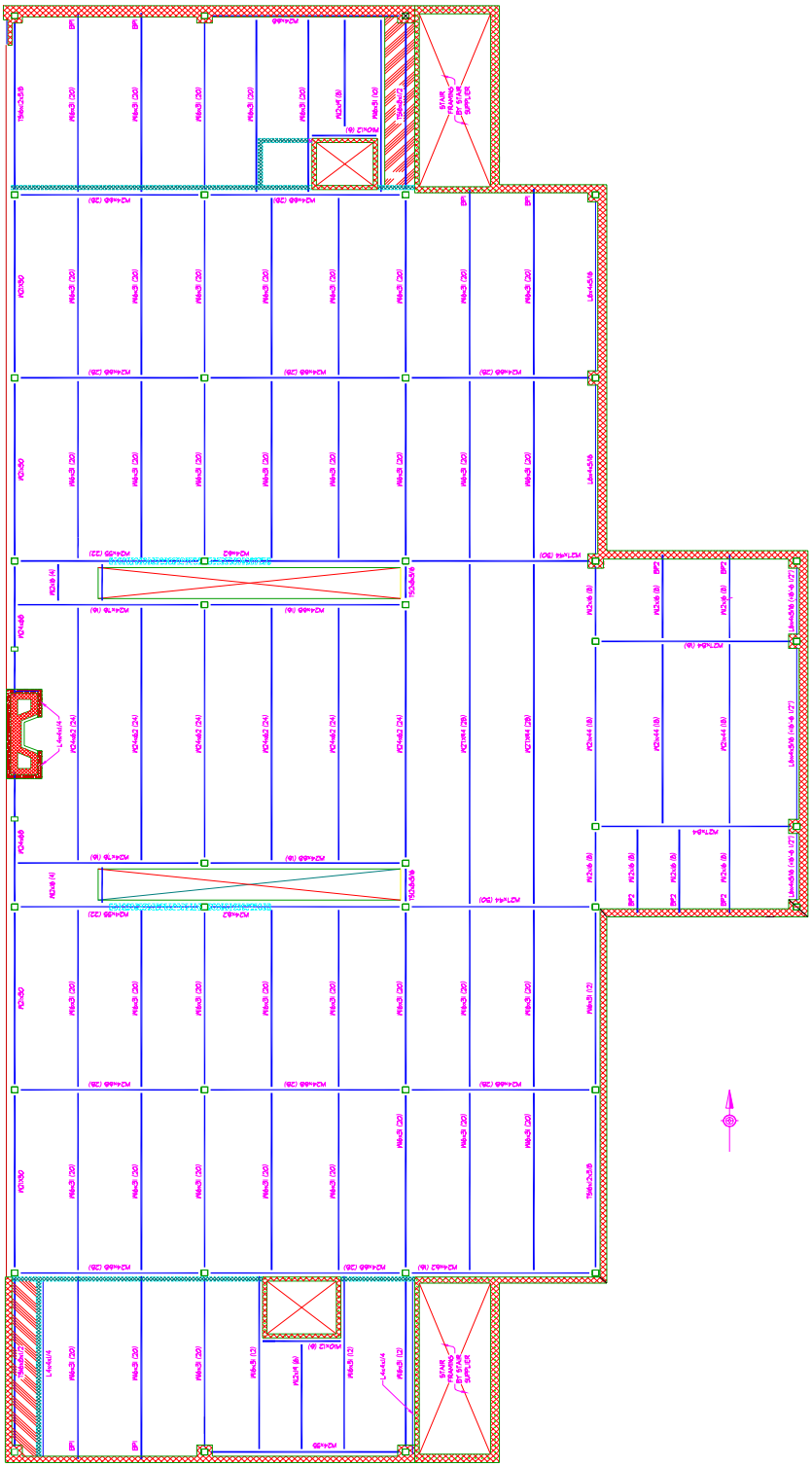


Architectural Analysis

Original Steel System Floor Plans

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

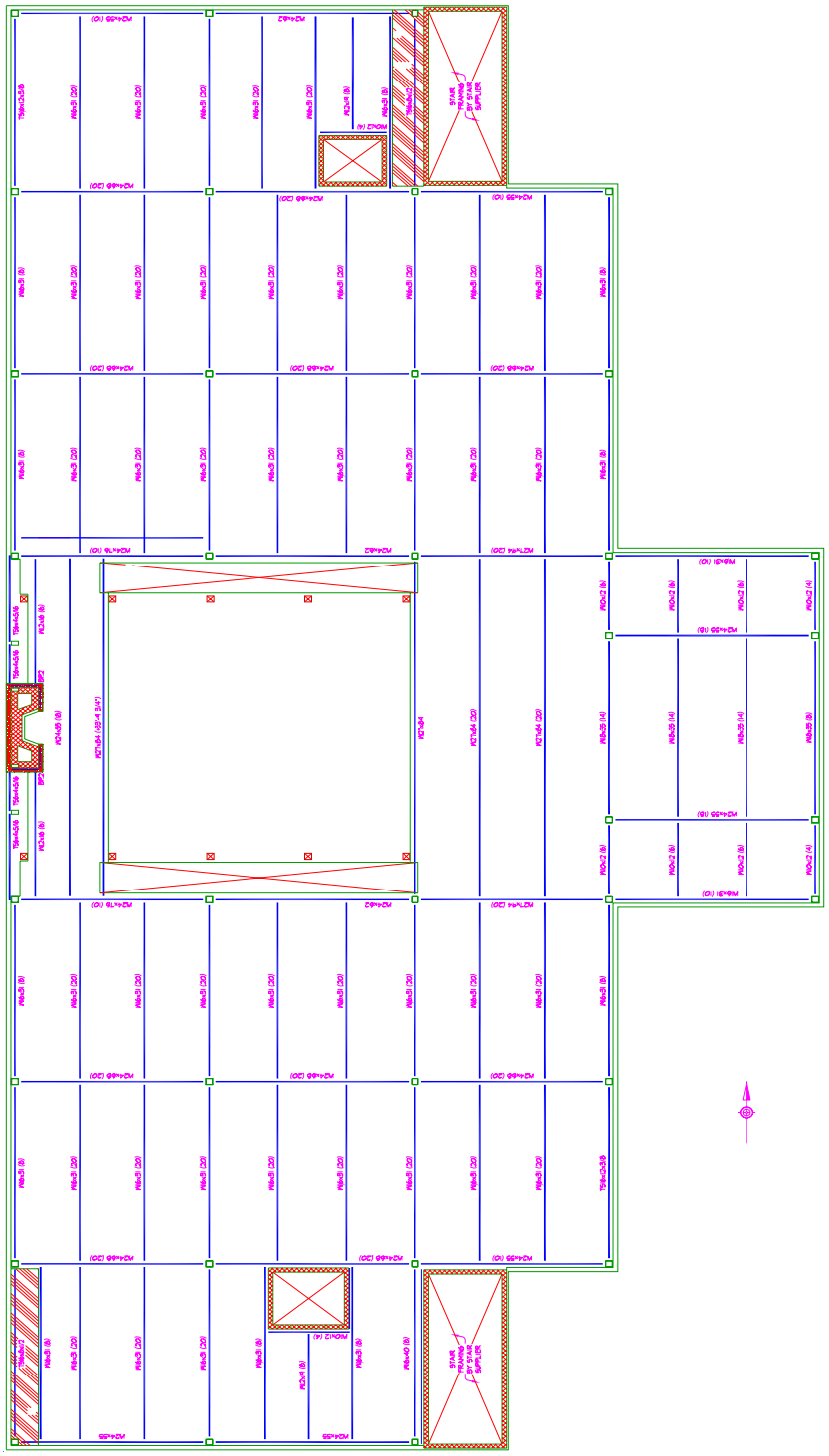
Boyds Bear Country
Pigeon Forge, TN



Original Steel Framing System – First Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

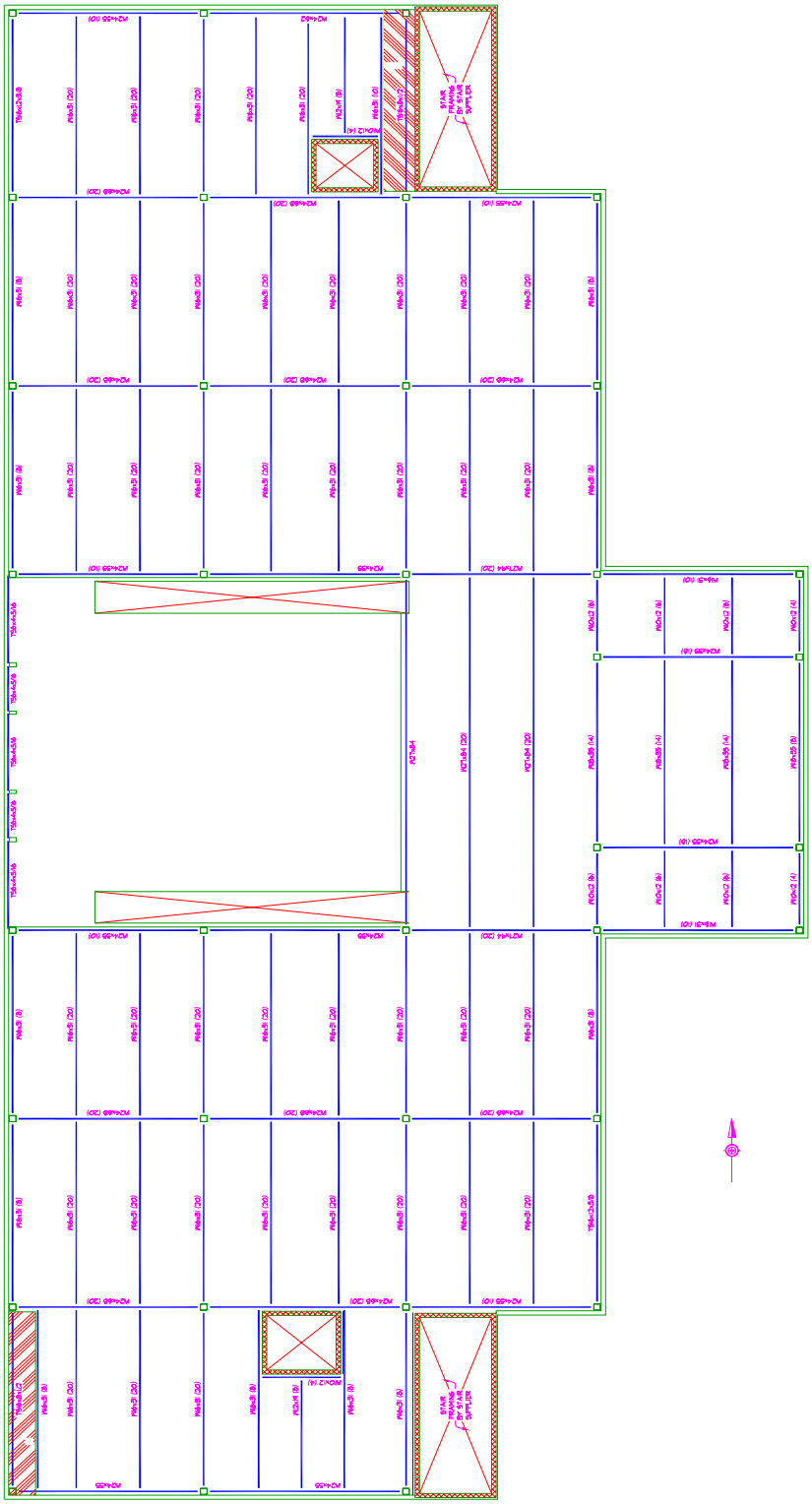
Boyds Bear Country
Pigeon Forge, TN



Original Steel Framing System – Second Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

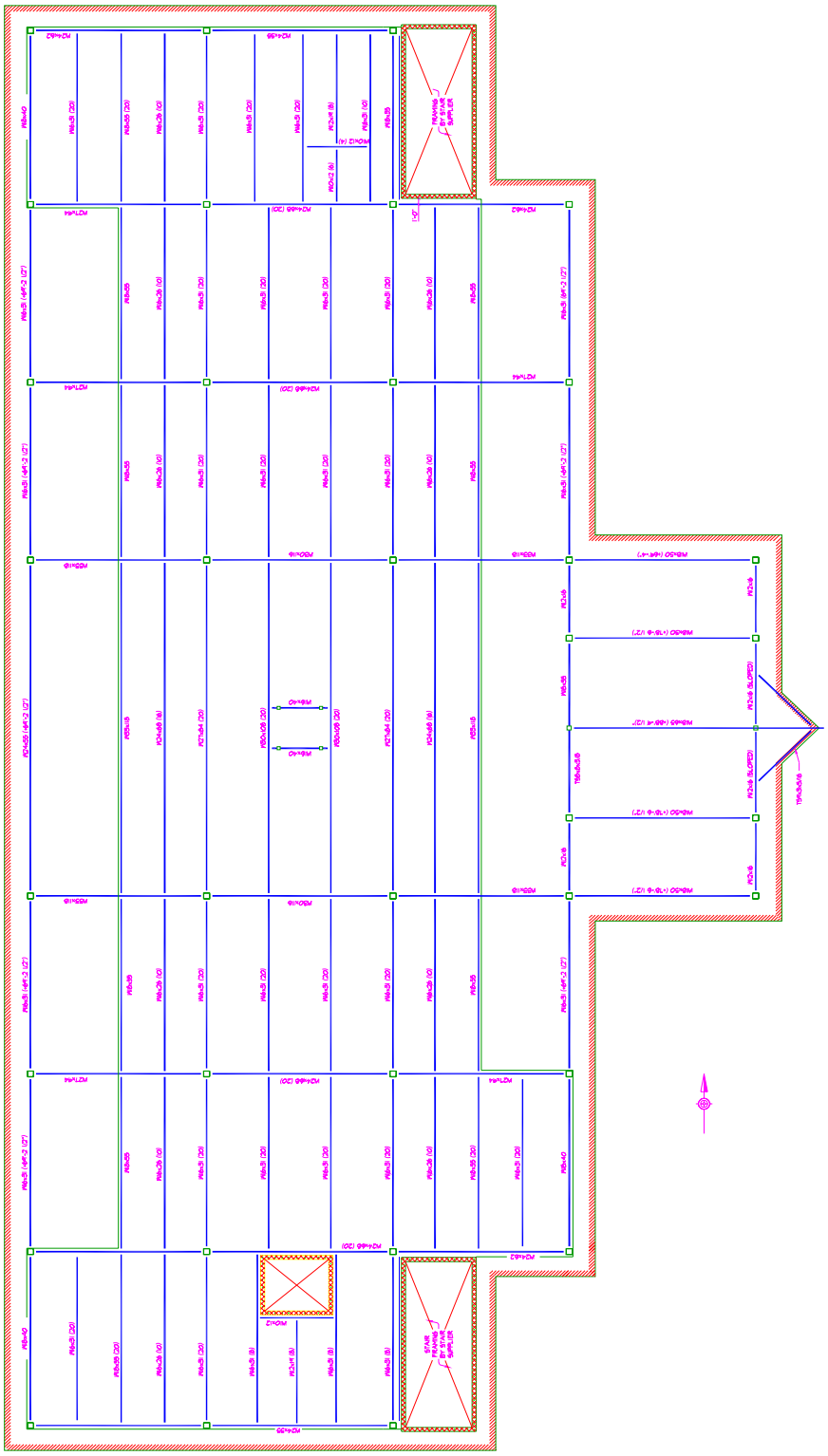
Boyds Bear Country
Pigeon Forge, TN



Original Steel Framing System – Third Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

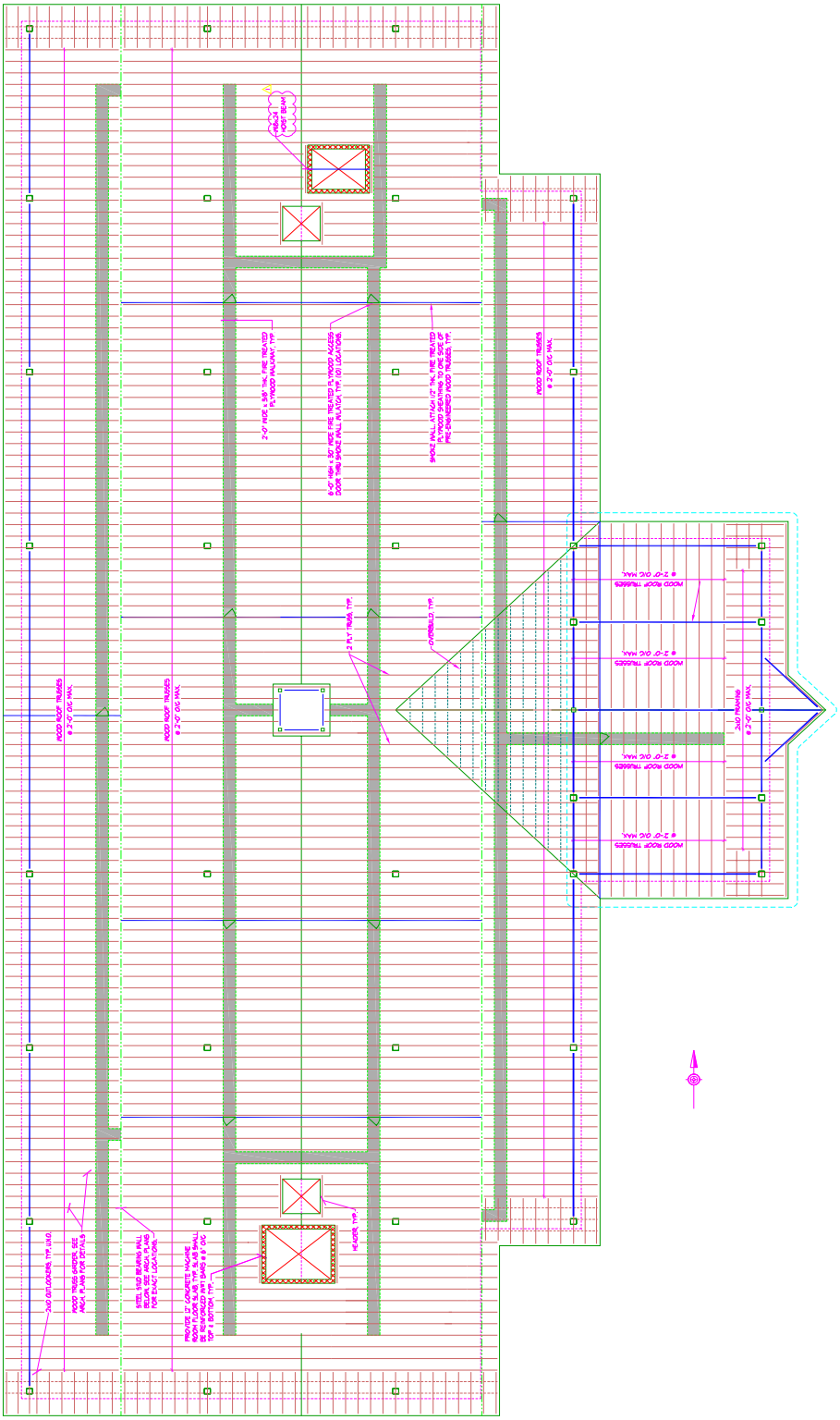
Boyds Bear Country
Pigeon Forge, TN



Original Steel Framing System – Fourth Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

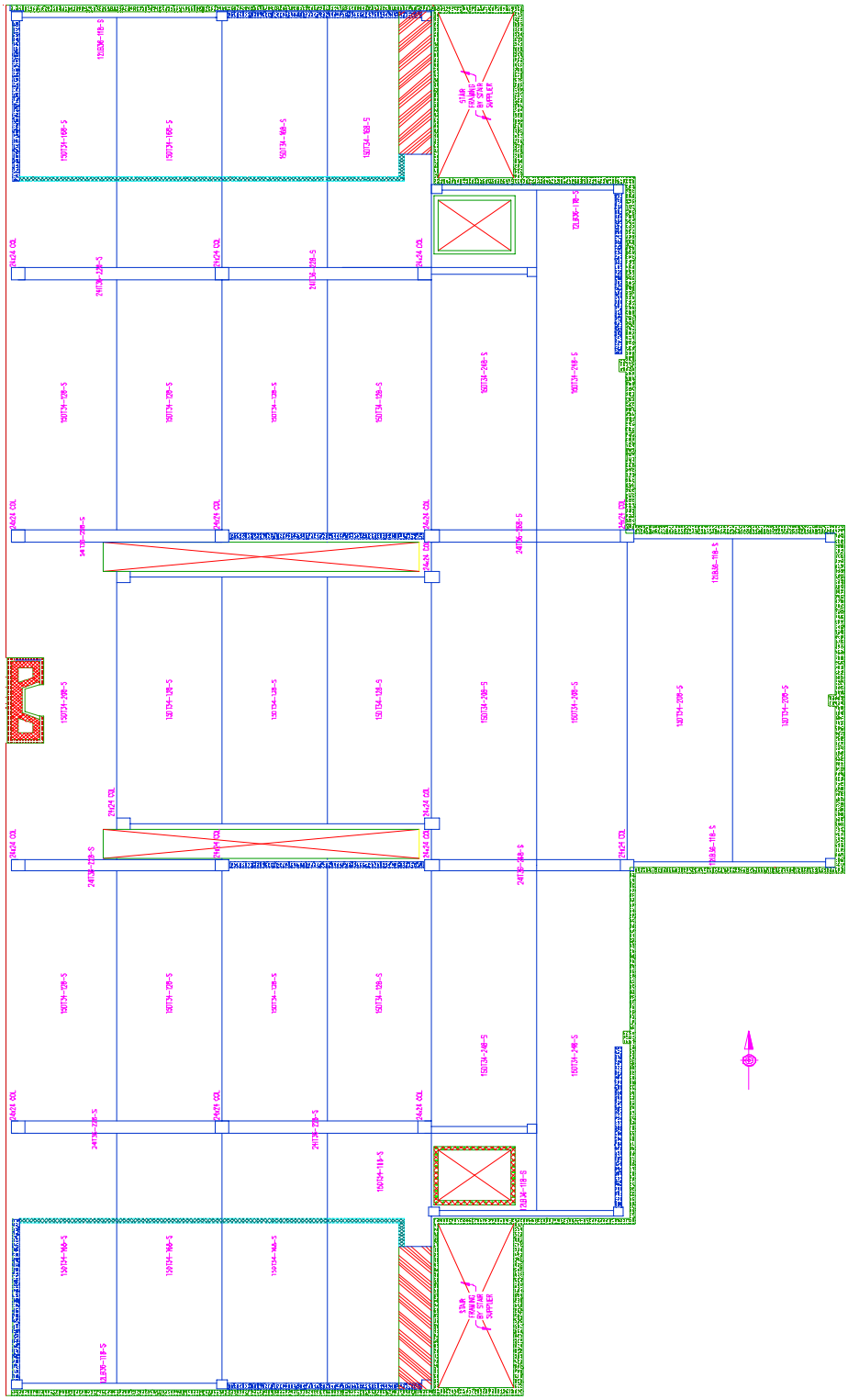


Original Steel Framing System – Roof Plan

Pre-Cast Concrete System
Floor Plans

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

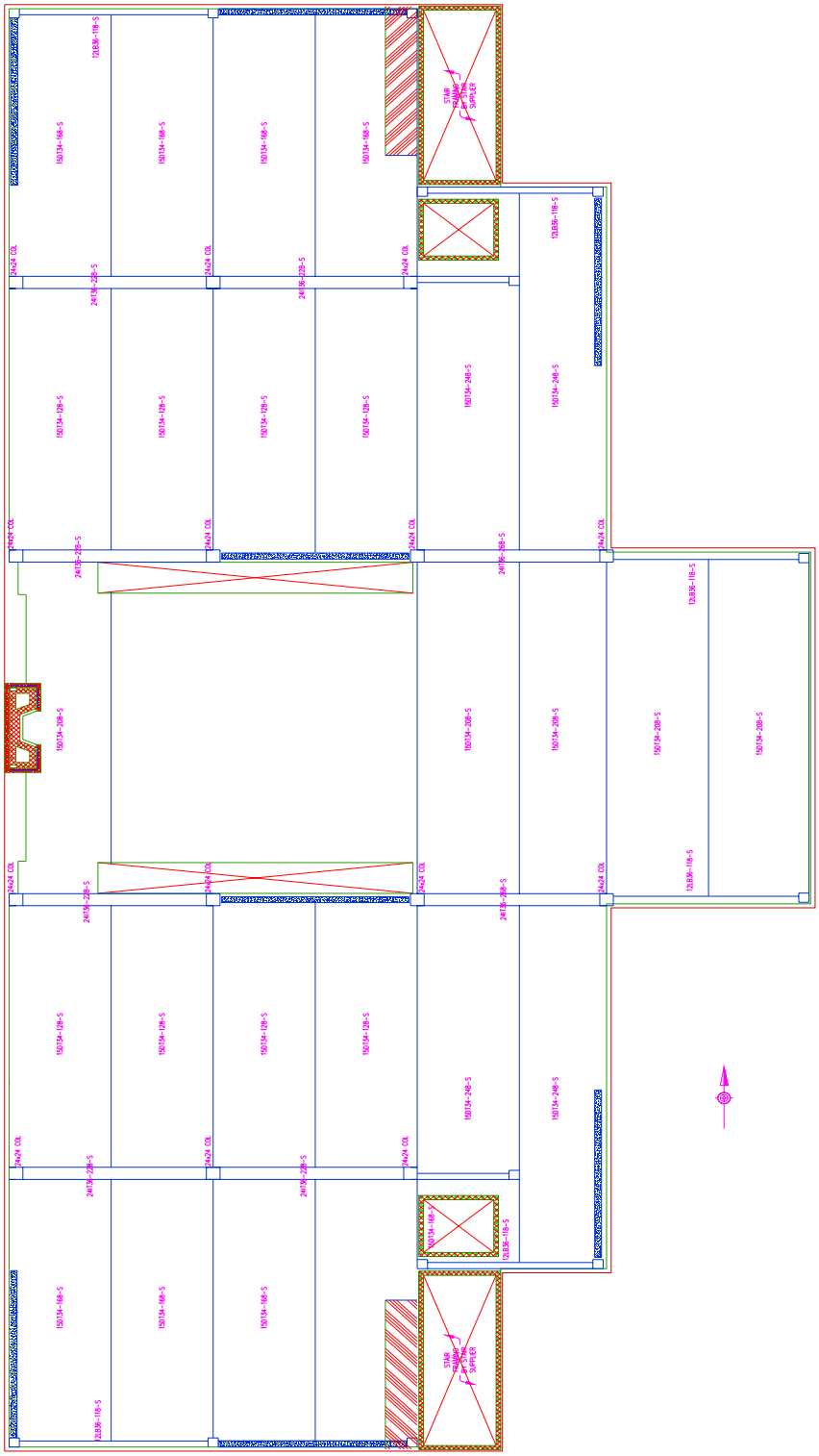
Boyds Bear Country
Pigeon Forge, TN



Pre-Cast Concrete Framing System – First Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

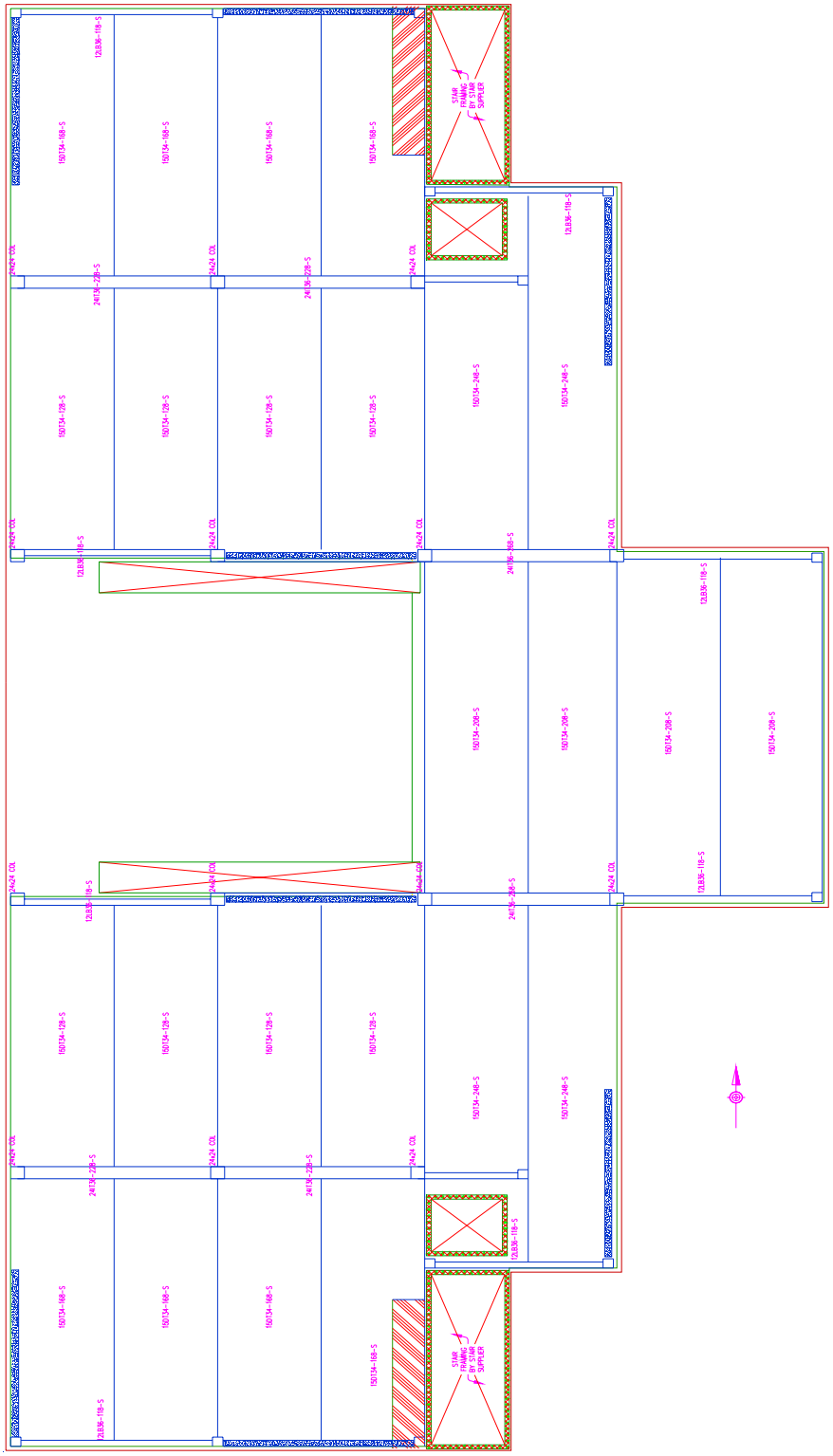
Boyds Bear Country
Pigeon Forge, TN



Pre-Cast Concrete Framing System – Second Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

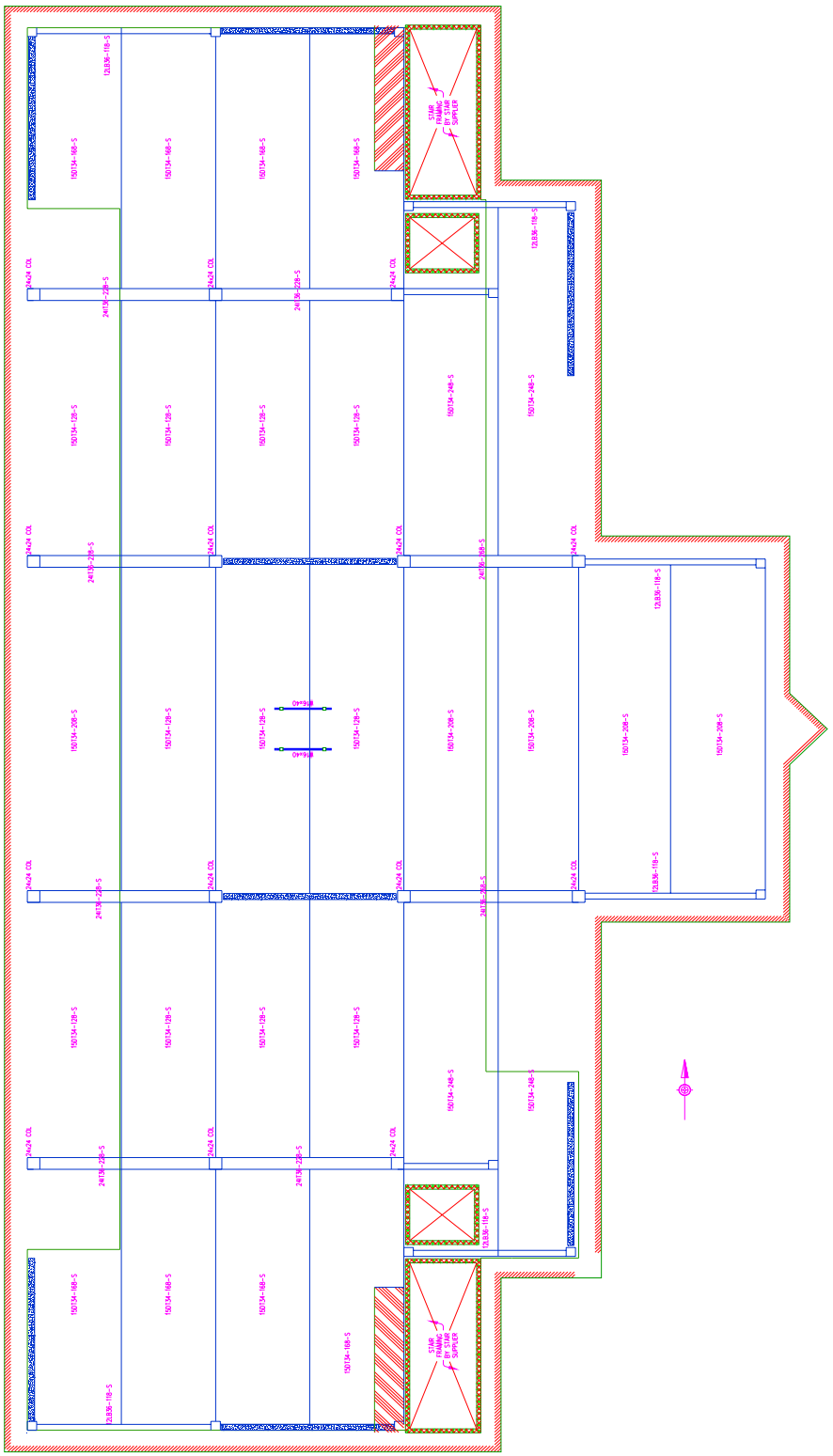
Boyds Bear Country
Pigeon Forge, TN



Pre-Cast Concrete Framing System – Third Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

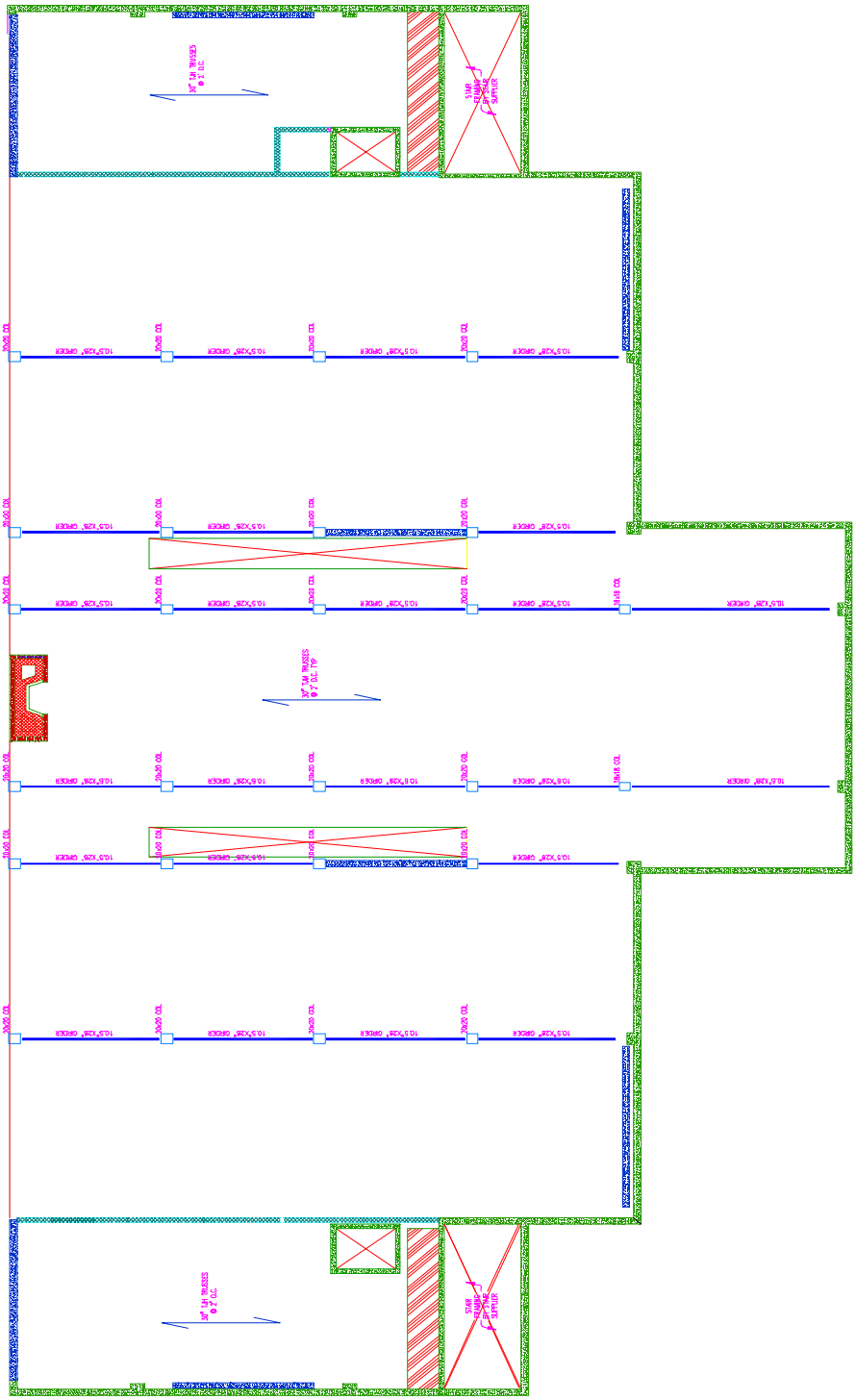


Pre-Cast Concrete Framing System – Fourth Floor Plan

Engineered Wood System
Floor Plans

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

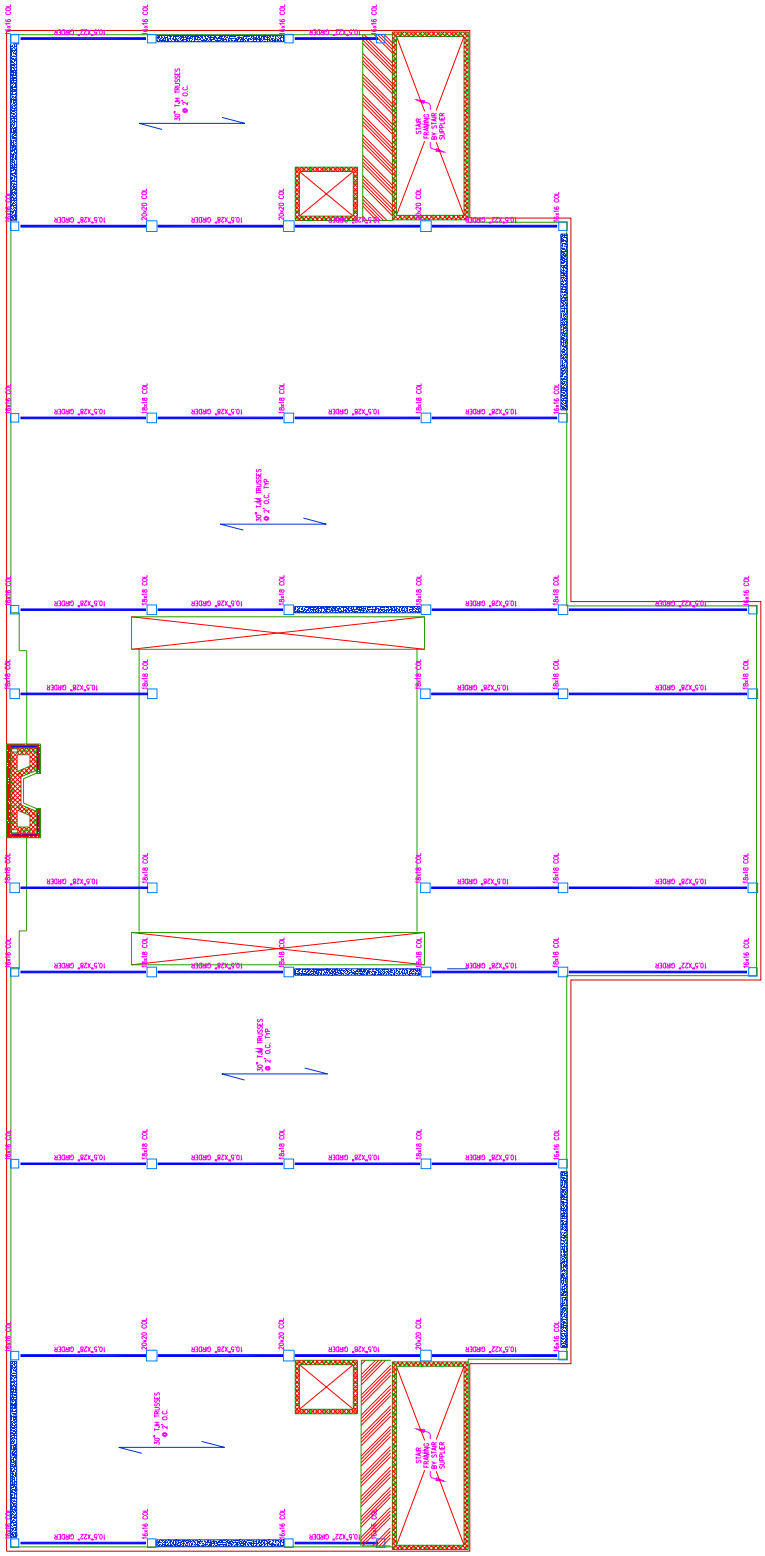
Boyds Bear Country
Pigeon Forge, TN



Engineered Wood Framing System – First Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

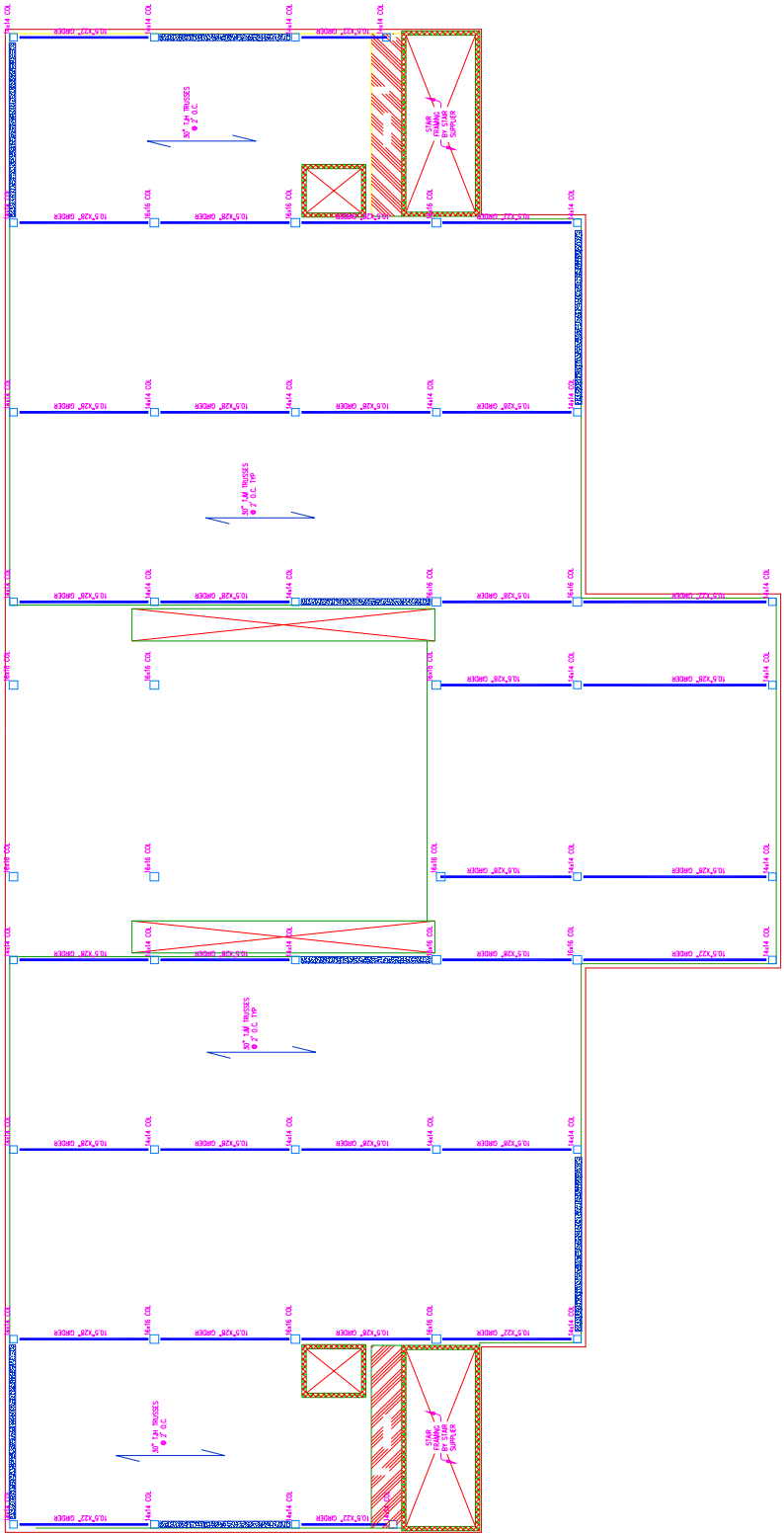
Boyds Bear Country
Pigeon Forge, TN



Engineered Wood Framing System – Second Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

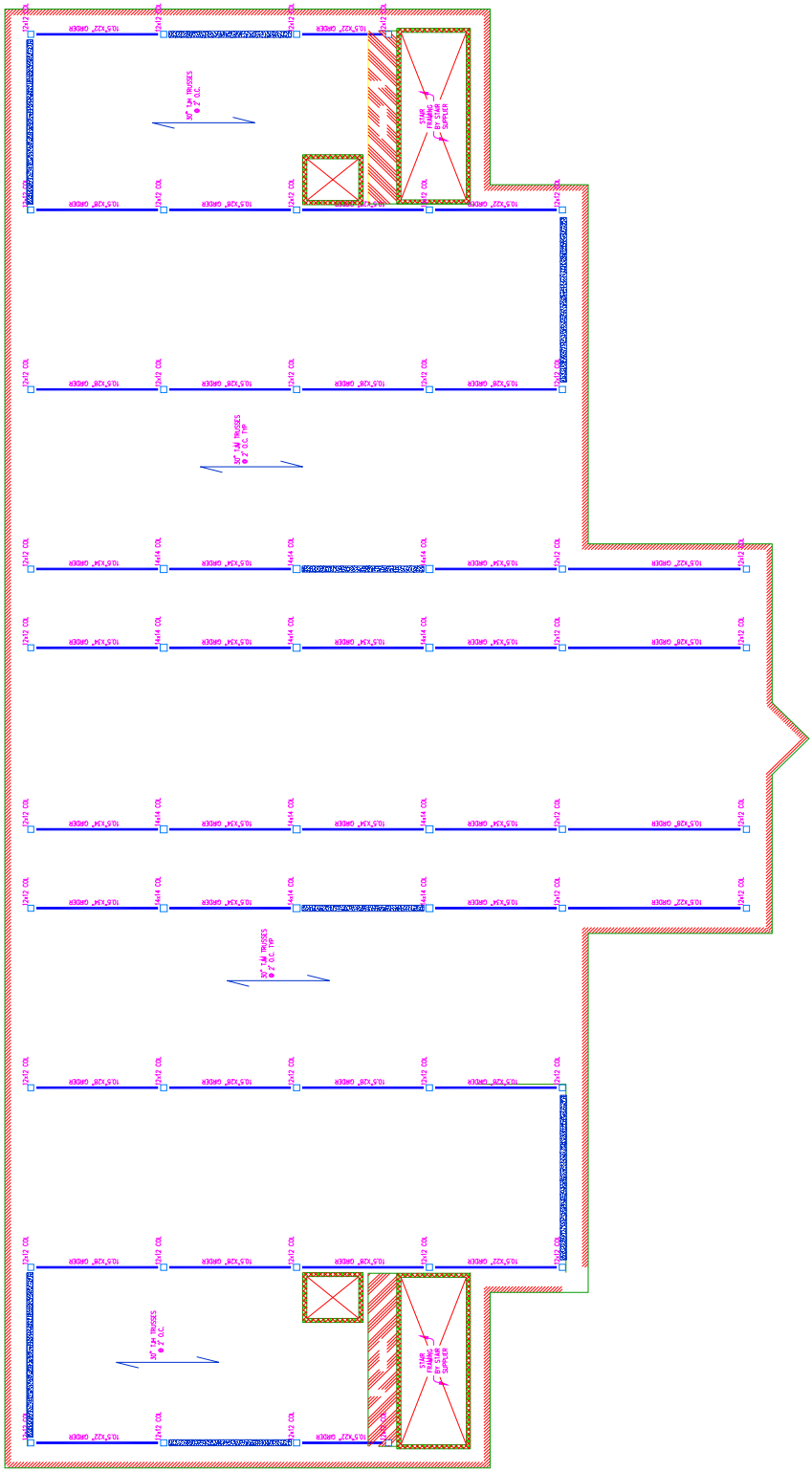
Boyds Bear Country
Pigeon Forge, TN



Engineered Wood Framing System – Third Floor Plan

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN

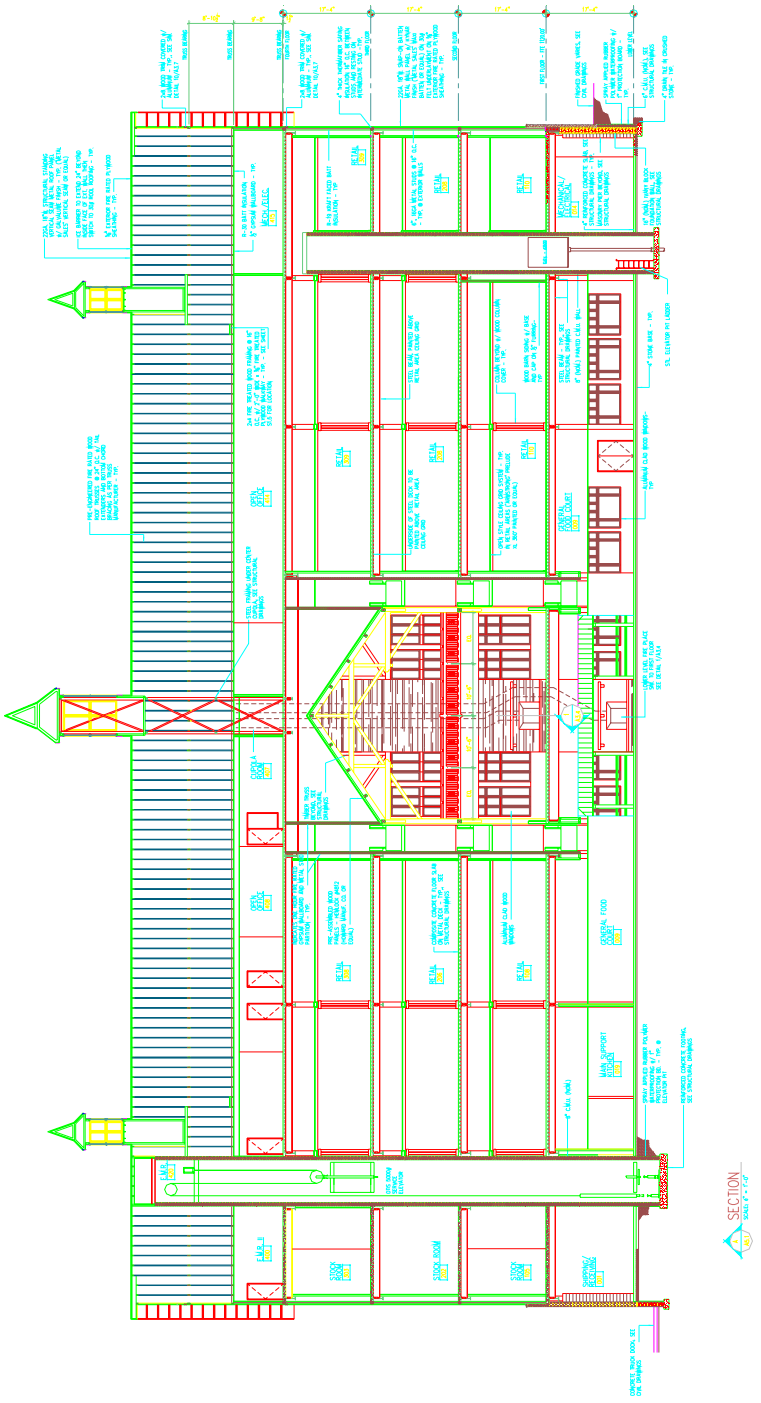


Engineered Wood Framing System – Fourth Floor Plan

Original Steel System Sections

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

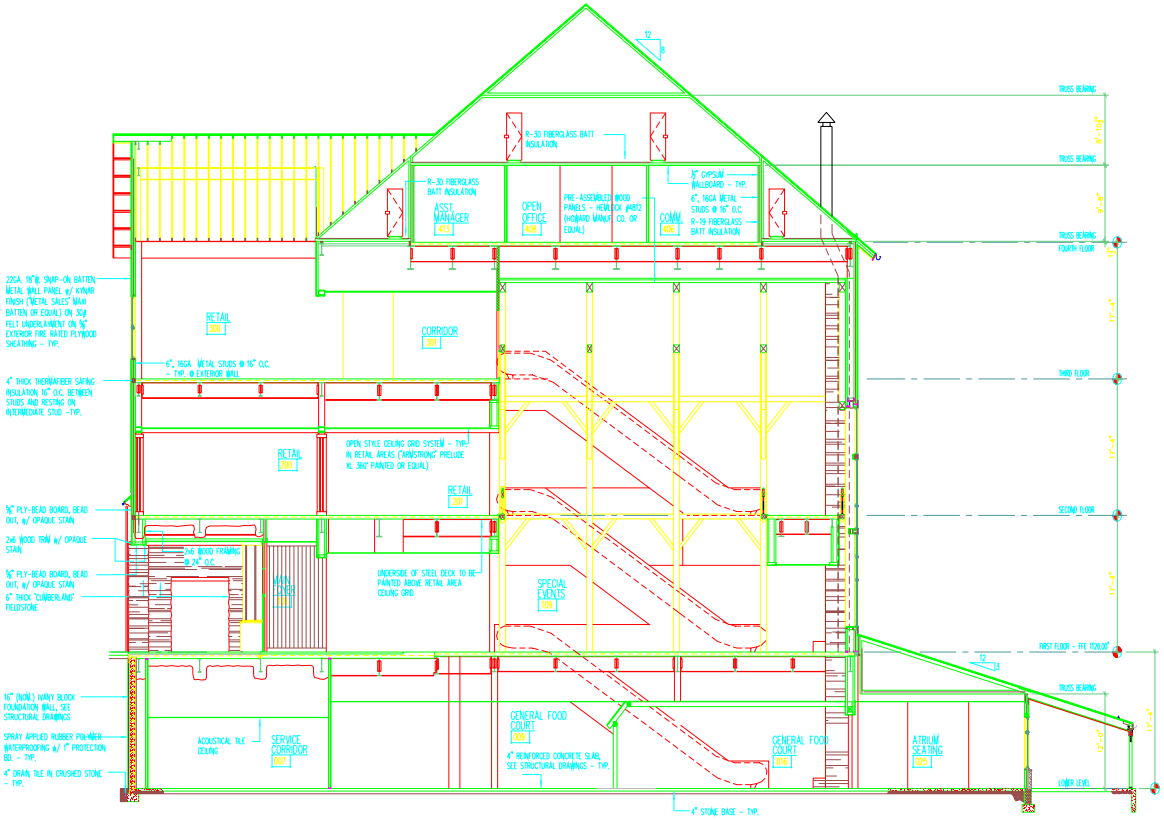
Boyds Bear Country
Pigeon Forge, TN



Original Steel Framing System – Longitudinal Section

Lauren Wilke
Structural Option
Advisor: M.K. Parfitt

Boyds Bear Country
Pigeon Forge, TN



Original Steel Framing System – Transverse Section