

233 North 1250 West #201
Centerville, Utah 84014

October 20, 2017

Utelite Corporation
Post Office Box 387
Coalville, Utah 84017

Attn: Darren Medeiros
Re: Five Story Commercial Building Study

Gentlemen:

At your request, a study has been completed comparing the cost of the structural portion of the building using normal weight and light weight concrete on metal deck, for a five story commercial building located in downtown Salt Lake City, Utah.

The following design criteria assumptions were used in the design:

1. The governing building code was the 2015 Uniform Building Code.
2. Load and Resistance Factor Design (LRFD) (Strength Design) was used for the study.
3. Site Class D was used for the soil, assuming a soil bearing capacity of 3,000 pounds per square foot.
4. The design was performed assuming a building 90 feet wide and 150 feet long. The bays were all 30 foot square, and the story height was 15 feet.
5. A two hour floor to floor fire rating was used for the light weight concrete system and a fire rating of 0 hour, 1 hour, and 2 hour was used for the normal weight concrete system for the comparison.

The following construction type assumptions were made in the design:

1. The roof was assumed to be steel beams supporting steel open web joists supporting 1.1/2" type B metal deck, no concrete.
2. The floors were assumed to be steel wide flange girders, steel wide flange joists, and type W2 metal deck. The light weight concrete on metal deck totaled 5.25" thick for 2 hour fire rating. The normal weight concrete on metal deck totaled 5" for 0 hour fire rating, 5.5" for 1 hour fire rating, and 6.25" for 2 hour fire rating. The floor joists and girders have shear studs to provide composite beam action.
3. The columns providing vertical support were wide flange columns at the "X" braces and hollow structural steel tube sections for the gravity columns.

233 North 1250 West #201
Centerville, Utah 84014

October 20, 2017

4. The lateral force resistance was provided by one bay of "X" braces on each side of the building.

The live and dead load criteria was as follows:

1. For dead loads, the computer program calculated the actual weight of the structure, including steel beams, joists, steel deck, and concrete deck. For miscellaneous loads, 10 pounds per square foot (psf) was added to the roof and 20 psf was added to the floors as partition load.
2. Live loads were based on the Salt Lake City area, typical 30 psf roof snow load, and 80 psf for the floor loads.

The only item not included in the design was the footings at the braced frames. If they were to be included, the difference in the costs would be slightly higher than the percentages shown on the attached study comparison.

As can be seen at the total comparison cost percentage at the end of the attached report, the normal weight slabs vary from 2.23 percent higher cost for the 0 hour protected slab, 3.35 percent higher cost for the 1 hour protected slab and 9.36 percent higher cost for the 2 hour slab. This relates to as much as \$236,672.00 over the 2 hour slab.

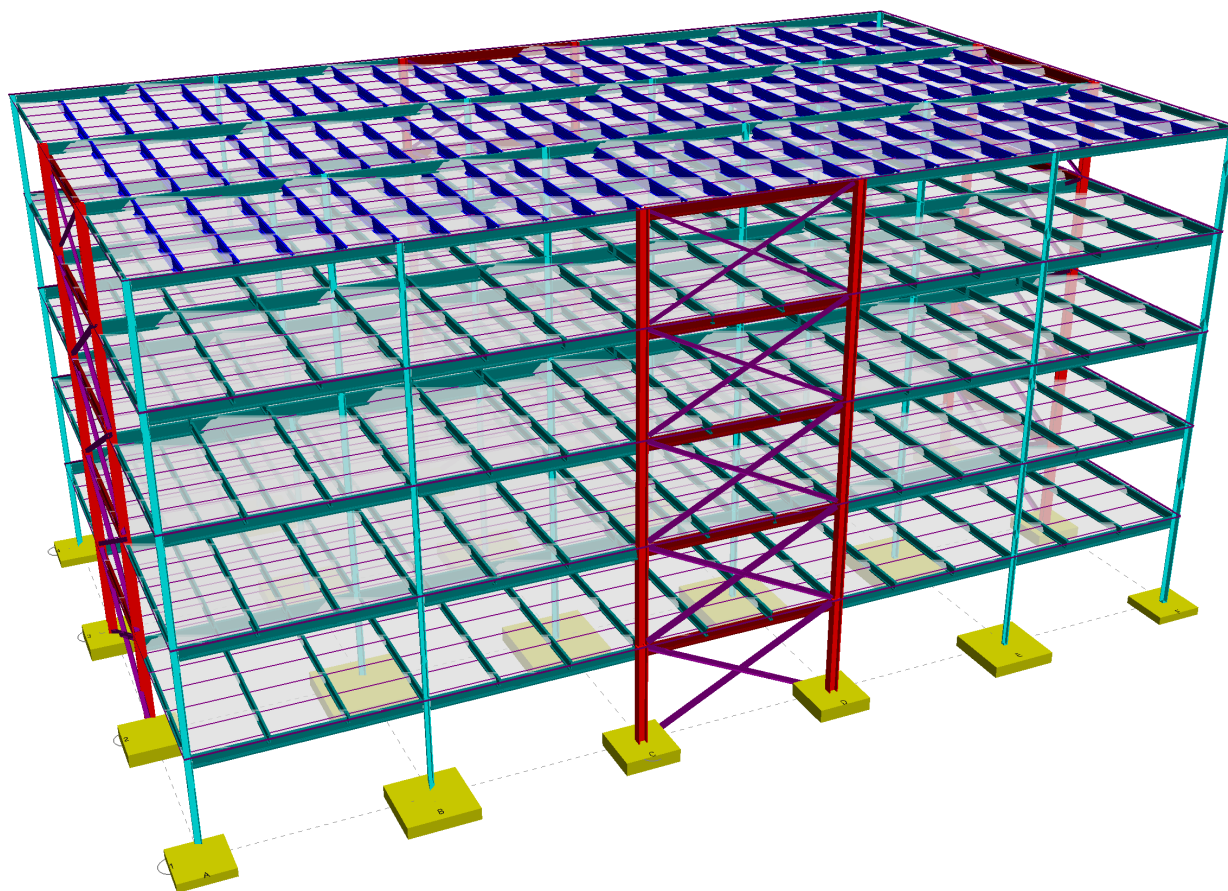
Please contact us with any questions.

Sincerely,



Donald L. Barfuss, S.E.
for TBSE, Inc.

Enclosures, 3D Model Drawing, Utelite Study, and Cost Comparison



Utelite Study

Building Information:

Bay Width	30 ft
Bay Length	30 ft
Building Width	90 ft
Building Length	150 ft
Stories	5
Floor Area	54000
Roof Area	13500

Loading Information:

DL/DLr misc	10 psf
DL/DLr const	10 psf
DL partition	20 psf
LL	80 psf
LLr	20 psf
SL	30 psf
DL	Self weight Slabs, Beams, Columns, etc.
DL Mass	DL + DL/DLr misc + 0.5*DL partition

Scenario	5¼ LW	5 NW	5½ NW	6½ NW	Notes
RAM Model	A	B	C	D	
Fire Rating	2	-	1	2	hours
Floor Deck Weight	2.1	2.4	2.4	2.7	psf
Roof Deck Weight	2.3	2.3	2.3	2.3	psf
Floor Deck Volume	1.312	1.235	1.389	1.698	yd/100sf
Seismic Mass	4875.07	5500.51	5997.19	6365.33	kips
Base Shear	782.79	870.31	886.96	994.22	kips
Weights:	715,995	761,147	763,544	799,734	
Compare	-	1.0631	1.0664	1.1170	
Joists	17,280	17,280	17,280	17,280	lbf
Beams	298,941	319,006	319,006	329,541	lbf
Columns	45,305	48,408	49,425	52,793	lbf
Frame Columns	106,369	109,268	109,268	112,412	lbf
Frame Beams	37,199	37,199	37,199	38,587	lbf
Frame Braces	59,211	61,156	61,156	62,251	lbf
Metal Deck	144,450	160,650	160,650	176,850	lbf
Footing Rebar	7,240	8,180	9,560	10,020	lbf
					Gravity Footings Only
Concrete Volume:	848.99	817.34	914.37	1109.53	
Compare	-	0.9627	1.0770	1.3069	
Deck	708.48	666.9	750.06	916.92	yd
Gravity Footings	140.51	150.44	164.31	192.61	yd
Lateral Footings					Gravity Footings Only
Number of Studs	6000	4720	4816	4896	
Worst Unities:	0.998	0.99	0.991	0.99	
Joists	0.84	0.84	0.84	0.84	
Beams	0.998	0.988	0.991	0.963	
Columns	0.95	0.99	0.95	0.93	
Frame Columns	0.49	0.5	0.53	0.56	
Frame Beams	0.85	0.88	0.91	0.87	
Frame Braces	0.96	0.87	0.93	0.99	

Cost Comparison

Material Costs:

Steel Cost	1 \$/lbf
LW Concrete Cost	160 \$/yd
NW Concrete Cost	115 \$/yd
Shear Studs Cost	5 \$/stud

Labor Costs:

Steel Cost	2 \$/lbf
LW Concrete Cost	100 \$/yd
NW Concrete Cost	100 \$/yd
Shear Studs Cost	25 \$/stud

Scenario	5¼ LW	5 NW	5½ NW	6½ NW
Material:	\$ 875,510	\$ 878,741	\$ 892,777	\$ 951,810
Comparison	-	1.0037	1.0197	1.0871
Steel	\$ 715,995	\$ 761,147	\$ 763,544	\$ 799,734
Floor Slabs	\$ 113,357	\$ 76,694	\$ 86,257	\$ 105,446
Footings	\$ 16,159	\$ 17,301	\$ 18,896	\$ 22,150
Studs	\$ 30,000	\$ 23,600	\$ 24,080	\$ 24,480
Labor:	\$ 1,652,409	\$ 1,705,668	\$ 1,719,805	\$ 1,812,781
Comparison	-	1.0322	1.0408	1.0971
Steel	\$ 1,417,510	\$ 1,505,934	\$ 1,507,968	\$ 1,579,428
Floor Slabs	\$ 70,848	\$ 66,690	\$ 75,006	\$ 91,692
Footings	\$ 14,051	\$ 15,044	\$ 16,431	\$ 19,261
Studs	\$ 150,000	\$ 118,000	\$ 120,400	\$ 122,400
Total	\$ 2,527,919	\$ 2,584,409	\$ 2,612,582	\$ 2,764,591
Comparison	-	1.0223	1.0335	1.0936
Difference	-	\$ 56,490	\$ 84,662	\$ 236,672