Appendix A – Gravity Loads

A.1 Dead Loads

Dead Loads			
Component	Typical Floor	Roof	Mechanical Roof
Concrete Slab	38		38
Metal Decking		2	
Flooring/Ceiling	3	4	3
M/E/P	7	10	7
Rigid Insulation		9	
Membrane		2	
Total Dead Load	48	27	48

Figure 47 – Dead Loads

Mechanical Unit Surface Loads								
	2/3 Weight Over 1/3 Area				1/3 Weight Over 2/3 Area			
	With Opening		No Opening		With Opening		No Opening	
Total Weight (lb)	Area (ft^2)	Surface Load	Area (ft^2)	Surface Load	Area (ft^2)	Surface Load	Area (ft^2)	Surface Load
40000	122.5	217.69	225	118.52	272.5	48.93	450	29.63

Figure 48 – Mechanical Unit Surface Loads

Wall Loads

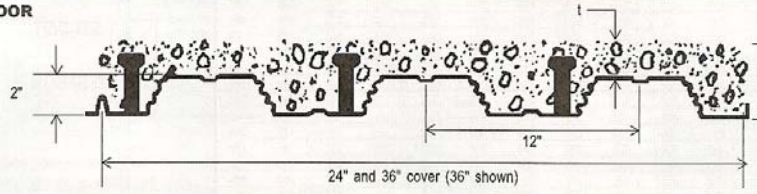
Curtain Walls	20 psf (specified in AEO:QIII General Notes)
8” CMU, grout/rein. 24” cc	51 psf
Partitions	20 psf (specified in AEO:QIII General Notes)

2 x 12" DECK F_y = 33ksi f'_c = 3 ksi 115 pcf concrete

United Steel Deck, Inc.

LRFD

2" LOK-FLOOR



The **Deck Section Properties** are per foot of width. The **I** value is for positive bending (in.⁴); **t** is the gage thickness in inches; **w** is the weight in pounds per square foot; S_p and S_n are the section moduli for positive and negative bending (in.³); R_b and ϕV_n. are the interior reaction and the shear in pounds (per foot of width); studs is the number of studs required per foot in order to obtain the full resisting moment, ϕM_n.

DECK PROPERTIES

Gage	t	w	As	I	S_p	S_n	R_b	ϕV_n	studs
22	0.0295	1.5	0.440	0.338	0.284	0.302	714	1990	0.43
20	0.0358	1.8	0.540	0.420	0.367	0.387	1010	2410	0.52
19	0.0418	2.1	0.630	0.490	0.445	0.458	1330	2810	0.61
18	0.0474	2.4	0.710	0.560	0.523	0.529	1680	3180	0.69
16	0.0598	3.1	0.900	0.700	0.654	0.654	2470	3990	0.87

The **Composite Properties** are a list of values for the composite slab. The **slab depth** is the distance from the bottom of the steel deck to the top of the slab in inches as shown on the sketch. U.L. ratings generally refer to the cover over the top of the deck so it is important to be aware of the difference in names. ϕM_{nf} is the factored resisting moment provided by the composite slab when the "full" number of studs as shown in the upper table are in place; inch kips (per foot of width). A_c is the area of concrete available to resist shear, in.² per foot of width. **Vol.** is the volume of concrete in ft.³ per ft.² needed to make up the slab; no allowance for frame or deck deflection is included. **W** is the concrete weight in pounds per ft.². S_c is the section modulus of the "cracked" concrete composite slab; in.³ per foot of width. I_{av} is the average of the "cracked" and "uncracked" moments of inertia of the transformed composite slab; in.⁴ per foot of width. The I_{av} transformed section analysis is based on steel; therefore, to calculate deflections the appropriate modulus of elasticity to use is 29.5 x 10^6 psi. ϕM_{no} is the factored resisting moment of the composite slab if there are no studs on the beams (the deck is attached to the beams or walls on which it is resting) inch kips (per foot of width). ϕV_{nt} is the factored vertical shear resistance of the composite system; it is the sum of the shear resistances of the steel deck and the concrete but is not allowed to exceed $\phi 4(f'_c)^{1/2}A_c$; pounds (per foot of width). The next three columns list the **maximum unshored spans** in feet; these values are obtained by using the construction loading requirements of the SDI; combined bending and shear, deflection, and interior reactions are considered in calculating these values. A_{wwf} is the minimum area of welded wire fabric recommended for temperature reinforcing in the composite slab; square inches per foot.

COMPOSITE PROPERTIES

	Slab Depth	ϕM_{nf} in.k	A_c in²	Vol. ft³/ft²	W psf	S_c in³	I_{av} in⁴	ϕM_{no} in.k	ϕV_{nt} lbs.	Max. unshored spans, ft. 1span	2span	3span	A_{wwf}
22 gage	4.50	40.27	32.6	0.292	34	1.00	4.4	28.13	4270	6.32	8.46	8.56	0.023
	5.00	46.44	37.5	0.333	38	1.18	6.0	33.12	4610	6.03	8.09	8.19	0.027
	5.25	49.53	40.0	0.354	41	1.27	6.9	35.69	4790	5.90	7.93	8.02	0.029
	5.50	52.61	42.6	0.375	43	1.36	7.9	38.29	4970	5.77	7.77	7.86	0.032
	6.00	58.78	48.0	0.417	48	1.55	10.1	43.58	5340	5.55	7.49	7.58	0.036
	6.25	61.87	50.8	0.438	50	1.65	11.3	46.26	5540	5.45	7.36	7.45	0.038
	6.50	64.95	53.6	0.458	53	1.75	12.7	48.97	5730	5.36	7.24	7.32	0.041
	7.00	71.12	59.5	0.500	58	1.94	15.7	54.44	6150	5.18	7.01	7.10	0.045
	7.25	74.21	61.9	0.521	60	2.04	17.4	57.20	6310	5.10	6.91	6.99	0.047
	7.50	77.29	64.3	0.542	62	2.14	19.2	59.97	6480	5.05	6.81	6.89	0.050
20 gage	4.50	48.60	32.6	0.292	34	1.20	4.8	33.77	4560	7.42	9.71	10.03	0.023
	5.00	56.18	37.5	0.333	38	1.42	6.5	39.80	5030	7.07	9.28	9.59	0.027
	5.25	59.96	40.0	0.354	41	1.53	7.4	42.91	5210	6.91	9.09	9.39	0.029
	5.50	63.75	42.6	0.375	43	1.64	8.5	46.05	5390	6.76	8.91	9.20	0.032
	6.00	71.32	48.0	0.417	48	1.87	10.9	52.47	5760	6.49	8.57	8.86	0.036
	6.25	75.11	50.8	0.438	50	1.99	12.2	55.73	5960	6.37	8.42	8.70	0.038
	6.50	78.90	53.6	0.458	53	2.10	13.7	59.02	6150	6.26	8.27	8.55	0.041
	7.00	86.47	59.5	0.500	58	2.34	16.9	65.67	6570	6.05	8.00	8.27	0.045
	7.25	90.26	61.9	0.521	60	2.46	18.7	69.03	6730	5.95	7.87	8.14	0.047
	7.50	94.05	64.3	0.542	62	2.58	20.6	72.41	6900	5.89	7.75	8.01	0.050
19gage	4.50	55.85	32.6	0.292	34	1.38	5.1	38.67	4560	8.35	10.55	10.91	0.023
	5.00	64.68	37.5	0.333	38	1.63	6.9	45.61	5240	7.94	10.10	10.43	0.027
	5.25	69.10	40.0	0.354	41	1.75	7.9	49.19	5590	7.76	9.89	10.22	0.029
	5.50	73.52	42.6	0.375	43	1.88	9.0	52.83	5790	7.59	9.69	10.01	0.032
	6.00	82.35	48.0	0.417	48	2.15	11.6	60.25	6160	7.29	9.33	9.64	0.036
	6.25	86.77	50.8	0.438	50	2.28	13.0	64.02	6360	7.15	9.16	9.47	0.038
	6.50	91.19	53.6	0.458	53	2.42	14.5	67.83	6550	7.02	9.00	9.30	0.041
	7.00	100.03	59.5	0.500	58	2.69	17.9	75.53	6970	6.78	8.71	9.00	0.045
	7.25	104.44	61.9	0.521	60	2.83	19.8	79.42	7130	6.67	8.57	8.86	0.047
	7.50	108.86	64.3	0.542	62	2.97	21.8	83.33	7300	6.59	8.44	8.72	0.050
18 gage	4.50	62.08	32.6	0.292	34	1.53	5.4	42.99	4560	9.20	11.33	11.71	0.023
	5.00	72.04	37.5	0.333	38	1.81	7.3	50.72	5240	8.75	10.84	11.20	0.027
	5.25	77.02	40.0	0.354	41	1.95	8.3	54.72	5590	8.54	10.62	10.97	0.029
	5.50	82.00	42.6	0.375	43	2.10	9.5	58.78	5950	8.35	10.41	10.76	0.032
	6.00	91.95	48.0	0.417	48	2.39	12.1	67.07	6530	8.01	10.02	10.36	0.036
	6.25	96.93	50.8	0.438	50	2.54	13.6	71.29	6730	7.86	9.84	10.17	0.038
	6.50	101.91	53.6	0.458	53	2.69	15.2	75.55	6920	7.71	9.68	10.00	0.041
	7.00	111.87	59.5	0.500	58	3.00	18.8	84.17	7340	7.44	9.36	9.67	0.045
	7.25	116.85	61.9	0.521	60	3.16	20.7	88.52	7500	7.32	9.21	9.52	0.047
	7.50	121.83	64.3	0.542	62	3.31	22.8	92.91	7670	7.24	9.07	9.38	0.050
16 gage	4.50	62.08	32.6	0.292	34	1.88	6.0	42.99	4560	10.49	12.57	12.99	0.023
	5.00	72.04	37.5	0.333	38	2.22	8.0	50.72	5240	9.96	12.03	12.43	0.027
	5.25	77.02	40.0	0.354	41	2.40	9.2	54.72	5590	9.72	11.78	12.18	0.029
	5.50	82.00	42.6	0.375	43	2.58	10.5	58.78	5950	9.50	11.55	11.94	0.032
	6.00	91.95	48.0	0.417	48	2.94	13.4	67.07	6700	9.11	11.13	11.50	0.036
	6.25	96.93	50.8	0.438	50	3.13	15.0	71.29	7090	8.93	10.94	11.30	0.038
	6.50	101.91	53.6	0.458	53	3.32	16.8	75.55	7490	8.76	10.75	11.11	0.041
	7.00	111.87	59.5	0.500	58	3.71	20.6	84.17	8150	8.45	10.40	10.75	0.045
	7.25	116.85	61.9	0.521	60	3.90	22.8	88.52	8310	8.31	10.24	10.59	0.047
	7.50	121.83	64.3	0.542	62	4.10	25.1	92.91	8480	8.22	10.09	10.43	0.050

2" LOK-FLOOR

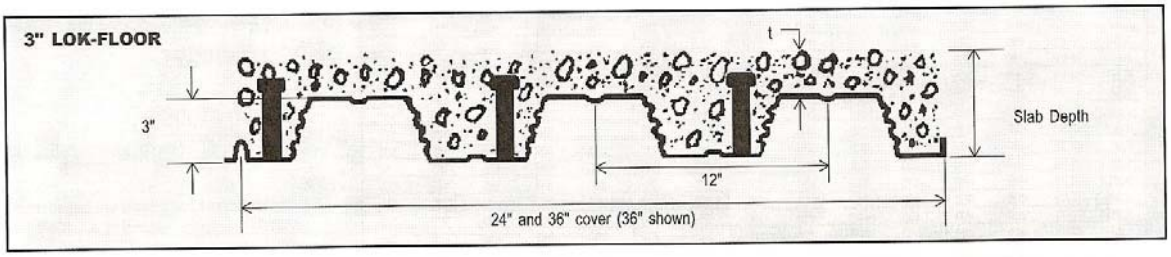
38

Figure 49 – Roof Composite Roof Deck
(United Steel Deck, 2003)

USD **United Steel Deck, Inc.**

LRFD

3" LOK-FLOOR



The **Deck Section Properties** are per foot of width. The **I** value is for positive bending (in.⁴); **t** is the gage thickness in inches; **w** is the weight in pounds per square foot; S_p and S_n are the section moduli for positive and negative bending (in.³); R_b and ϕV_n. are the interior reaction and the shear in pounds (per foot of width); studs is the number of studs required per foot in order to obtain the full resisting moment, ϕM_{nf}.

DECK PROPERTIES

Gage	t	w	As	I	S_p	S_n	R_b	ϕV_n	studs
22	0.0295	1.7	0.505	0.797	0.454	0.500	718	2190	0.49
20	0.0358	2.1	0.610	0.993	0.583	0.620	1020	3220	0.59
19	0.0418	2.4	0.710	1.158	0.708	0.726	1350	4310	0.69
18	0.0474	2.8	0.810	1.324	0.832	0.832	1720	4880	0.79
16	0.0598	3.5	1.020	1.666	1.045	1.045	2540	6130	0.99

The **Composite Properties** are a list of values for the composite slab. The **slab depth** is the distance from the bottom of the steel deck to the top of the slab in inches as shown on the sketch. U.L. ratings generally refer to the cover over the top of the deck so it is important to be aware of the difference in names. ϕM_{nf} is the factored resisting moment provided by the composite slab when the "full" number of studs as shown in the upper table are in place; inch kips (per foot of width). A_c is the area of concrete available to resist shear, in.² per foot of width. **Vol.** is the volume of concrete in ft.³ per ft.² needed to make up the slab; no allowance for frame or deck deflection is included. **W** is the concrete weight in pounds per ft.². S_c is the section modulus of the "cracked" concrete composite slab; in.³ per foot of width. I_{av} is the average of the "cracked" and "uncracked" moments of inertia of the transformed composite slab; in.⁴ per foot of width. The I_{av} transformed section analysis is based on steel; therefore, to calculate deflections the appropriate modulus of elasticity to use is 29.5 x 10^6 psi. ϕM_{no} is the factored resisting moment of the composite slab if there are no studs on the beams (the deck is attached to the beams or walls on which it is resting) inch kips (per foot of width). ϕV_{nt} is the factored vertical shear resistance of the composite system; it is the sum of the shear resistances of the steel deck and the concrete but is not allowed to exceed $\phi 4(f'_c)^{1/2}A_c$; pounds (per foot of width). The next three columns list the **maximum unshored spans** in feet; these values are obtained by using the construction loading requirements of the SDI; combined bending and shear, deflection, and interior reactions are considered in calculating these values. A_{wwf} is the minimum area of welded wire fabric recommended for temperature reinforcing in the composite slab; square inches per foot.

COMPOSITE PROPERTIES

	Slab Depth	ϕM_{nf} in.k	A_c in²	Vol. ft³/ft²	W psf	S_c in³	I_{av} in³	ϕM_{no} in.k	ϕV_{nt} lbs.	Max. unshored spans, ft. 1span	2span	3span	A_{wwf}
22 gage	5.50	52.60	37.6	0.333	38	1.27	7.6	35.57	4810	8.06	10.49	10.83	0.023
	6.00	59.89	42.0	0.375	43	1.46	9.7	40.92	5120	7.70	10.06	10.39	0.027
	6.25	63.43	44.3	0.396	46	1.56	10.9	43.68	5280	7.54	9.86	10.18	0.029
	6.50	66.97	46.6	0.417	48	1.66	12.1	46.49	5440	7.39	9.67	9.99	0.032
	7.00	74.05	51.3	0.458	53	1.86	15.0	52.24	5770	7.11	9.33	9.63	0.036
	7.25	77.59	53.8	0.479	55	1.97	16.6	55.17	5950	6.99	9.17	9.47	0.038
	7.50	81.13	56.3	0.500	58	2.07	18.3	58.14	6120	6.87	9.02	9.31	0.041
	8.00	88.22	61.3	0.542	62	2.29	22.0	64.15	6470	6.68	8.73	9.02	0.045
	8.25	91.76	63.9	0.563	65	2.40	24.1	67.20	6660	6.61	8.60	8.88	0.047
	8.50	95.30	66.6	0.583	67	2.50	26.3	70.27	6840	6.54	8.47	8.75	0.050
20 gage	5.50	62.81	37.6	0.333	38	1.51	8.1	42.29	5250	9.35	11.75	12.14	0.023
	6.00	71.37	42.0	0.375	43	1.73	10.4	48.61	5870	8.92	11.27	11.65	0.027
	6.25	75.65	44.3	0.396	46	1.85	11.7	51.89	6180	8.73	11.06	11.43	0.029
	6.50	79.92	46.6	0.417	48	1.97	13.0	55.23	6470	8.55	10.85	11.21	0.032
	7.00	88.48	51.3	0.458	53	2.21	16.1	62.07	6800	8.23	10.48	10.82	0.036
	7.25	92.76	53.8	0.479	55	2.34	17.8	65.57	6980	8.08	10.30	10.64	0.038
	7.50	97.03	56.3	0.500	58	2.46	19.6	69.10	7150	7.94	10.13	10.47	0.041
	8.00	105.59	61.3	0.542	62	2.72	23.6	76.28	7500	7.72	9.82	10.15	0.045
	8.25	109.87	63.9	0.563	65	2.85	25.7	79.92	7690	7.64	9.67	9.99	0.047
	8.50	114.15	66.6	0.583	67	2.98	28.0	83.59	7870	7.56	9.53	9.85	0.050
19gage	5.50	72.04	37.6	0.333	38	1.72	8.7	48.35	5250	10.47	12.73	13.16	0.023
	6.00	82.00	42.0	0.375	43	1.98	11.0	55.60	5870	9.98	12.23	12.64	0.027
	6.25	86.97	44.3	0.396	46	2.12	12.4	59.36	6180	9.77	11.99	12.40	0.029
	6.50	91.95	46.6	0.417	48	2.25	13.8	63.20	6510	9.56	11.78	12.17	0.032
	7.00	101.91	51.3	0.458	53	2.53	17.0	71.08	7170	9.19	11.37	11.75	0.036
	7.25	106.89	53.8	0.479	55	2.68	18.8	75.10	7510	9.02	11.18	11.56	0.038
	7.50	111.87	56.3	0.500	58	2.82	20.7	79.17	7860	8.87	11.00	11.37	0.041
	8.00	121.83	61.3	0.542	62	3.12	24.9	87.46	8570	8.62	10.67	11.02	0.045
	8.25	126.81	63.9	0.563	65	3.27	27.2	91.65	8780	8.52	10.51	10.86	0.047
	8.50	131.78	66.6	0.583	67	3.42	29.6	95.89	8960	8.43	10.36	10.71	0.050
18 gage	5.50	80.96	37.6	0.333	38	1.94	9.1	54.28	5250	11.48	13.61	14.07	0.023
	6.00	92.32	42.0	0.375	43	2.23	11.6	62.43	5870	10.94	13.07	13.51	0.027
	6.25	98.00	44.3	0.396	46	2.38	13.0	66.67	6180	10.70	12.83	13.26	0.029
	6.50	103.68	46.6	0.417	48	2.53	14.5	70.99	6510	10.48	12.59	13.01	0.032
	7.00	115.04	51.3	0.458	53	2.85	17.9	79.88	7170	10.07	12.16	12.57	0.036
	7.25	120.72	53.8	0.479	55	3.01	19.8	84.42	7510	9.88	11.96	12.36	0.038
	7.50	126.40	56.3	0.500	58	3.17	21.8	89.03	7860	9.71	11.77	12.16	0.041
	8.00	137.76	61.3	0.542	62	3.51	26.2	98.39	8570	9.43	11.42	11.80	0.045
	8.25	143.44	63.9	0.563	65	3.68	28.6	103.15	8930	9.33	11.25	11.62	0.047
	8.50	149.12	66.6	0.583	67	3.85	31.1	107.94	9300	9.23	11.09	11.46	0.050
16 gage	5.50	80.96	37.6	0.333	38	2.36	10.1	54.28	5250	13.04	15.20	15.71	0.023
	6.00	92.32	42.0	0.375	43	2.72	12.8	62.43	5870	12.43	14.61	15.10	0.027
	6.25	98.00	44.3	0.396	46	2.90	14.3	66.67	6180	12.15	14.34	14.82	0.029
	6.50	103.68	46.6	0.417	48	3.09	16.0	70.99	6510	11.89	14.08	14.55	0.032
	7.00	115.04	51.3	0.458	53	3.48	19.7	79.88	7170	11.42	13.60	14.06	0.036
	7.25	120.72	53.8	0.479	55	3.68	21.7	84.42	7510	11.21	13.38	13.83	0.038
	7.50	126.40	56.3	0.500	58	3.89	23.9	89.03	7860	11.01	13.17	13.61	0.041
	8.00	137.76	61.3	0.542	62	4.30	28.7	98.39	8570	10.69	12.78	13.20	0.045
	8.25	143.44	63.9	0.563	65	4.51	31.3	103.15	8930	10.57	12.59	13.01	0.047
	8.50	149.12	66.6	0.583	67	4.72	34.1	107.94	9300	10.46	12.41	12.83	0.050

3" LOK-FLOOR

Figure 50 – Typical Floor Composite Deck
(United Steel Deck, 2003)

A.2 Live Loads

Location	Load (psf)	Description
Roof	20 **18**	A_t = 10' x 30' = 300 ft^2 $\therefore R_1 = 1.2 - 0.001A_t = 1.2 - 0.001 * (300\ ft^2) = 0.9$ F = 0, the roof pitch is small enough to be negligible $\therefore R_2 = 1$ $\therefore L_r = R_1 * R_2 * L = 0.9 \times 1.0 * 20 =$ **18 psf**
Offices and corridors above the first floor	80 **54.6** **48.3**	Offices require only 50 psf but since the building is designed to be flexible for tenant fit out, the location of corridors is not currently known, and the conservative corridor load is applied over the entire plan K_{LL} = 4 : Interior Beams $A_{t,\ beam}$ = 300 ft^2 $A_{t,\ girder}$ = 15 ft x 30 ft = 450 ft^2 $L = L_o \times \left(0.25 + \frac{15}{(K_{LL} \times A_t)^{0.5}}\right) =$ $= 80 \times \left(0.25 + \frac{15}{(4 \times 300\ ft^2)^{0.5}}\right) =$ **54.6 psf** $L = L_o \times \left(0.25 + \frac{15}{(K_{LL} \times A_t)^{0.5}}\right) =$ $= 80 \times \left(0.25 + \frac{15}{(4 \times 450\ ft^2)^{0.5}}\right) =$ **48.3 psf**
Lobbies and first floor corridors	100	Irreducible per ASCE 7-05 Section 4.8.2
Stairs	100	