12620 Wilmot Rd.
Kenosha, WI 53142
phone: 877-857-6400
www.cordeck.com

Since the inception of metal deck in the late 1920's through 2014, HH Robertson manufactured a wide selection of floor and roof decks delivered to projects throughout North America and beyond.
On June 1, 2015 Cordeck acquired the HH Robertson Company and continues to furnish products supporting the **Q-Deck / Tapway In Floor Cellular Raceway System**.

We regularly receive requests for technical information relating to discontinued floor and roof deck. Attached is an exhaustive collection of HH Robertson metal deck technical information. Unfortunately, the attached is the **only information in existence** and much in imperfect condition. Throughout the years original / digital copy has either been lost or destroyed.

If you are reviewing this information and find the product you are researching great!
If you are not able to locate the type of deck you need, we would suggest using the specifications of a current comparable deck and possibly including a diminished safety factor in your calculations.

Sincerely,

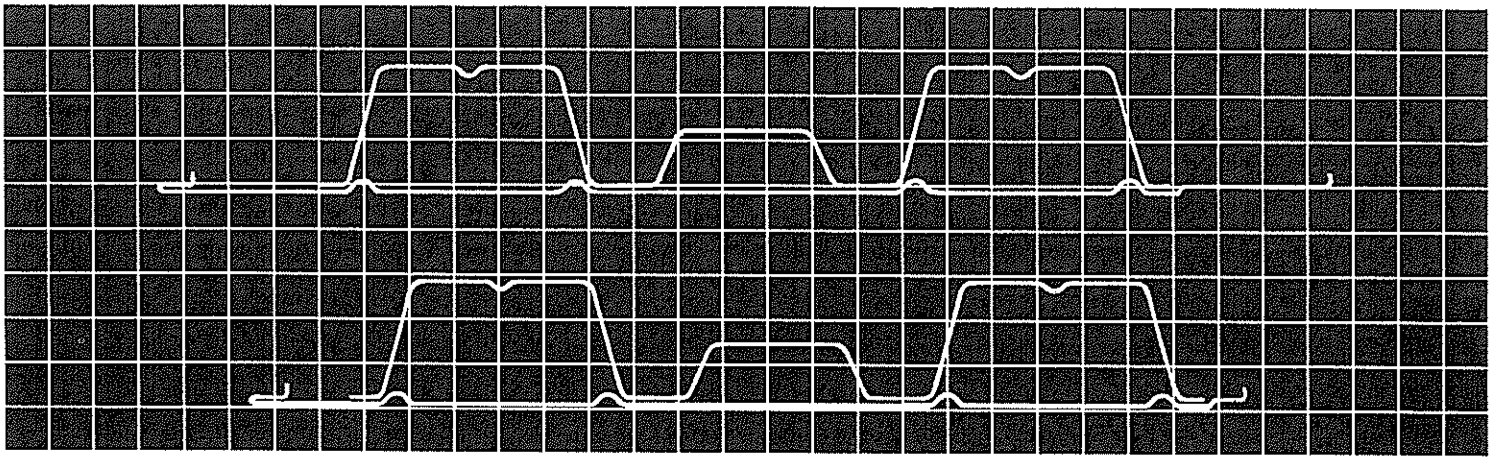
The Cordeck Team

Toll free: 877-857-6400

Fax: 844-857-3533

Q-Lock® Floors

Technical Data Book



H.H. Robertson.
Floor Systems

Design symbols

E = Modulus of elasticity of steel, psi

I_c = Moment of inertia of composite section, in⁴

I_s = Moment of inertia of steel unit, in⁴

M_{DL} = Moment for dead load (W_{DL}), in-lb.

M_{LL} = Simple span moment for live load (W_{LL}), in-lb.

N = Modulus of elasticity ratio—steel to concrete

$+S_b$ = Section modulus of steel section, bottom flange (Positive Bending), in³

$+S_t$ = Section modulus of steel section, top flange (Positive Bending), in³

$-S_b$ = Section modulus of steel section, bottom flange (Negative Bending), in³

$-S_t$ = Section modulus of steel section, top flange (Negative Bending), in³

S_{bc} = Section modulus of composite section, bottom of steel, in³

S_{cc} = Section modulus of composite section, top of concrete, in³

V_R = Resisting vertical shear capacity of slab, lbs.

Δ = Deflection of deck unit or composite slab, in

All section properties are expressed in units per foot of width. Steel properties and design information based on ASTM A 446, Grade A (minimum) steel, F_y = 33,000 psi.

Design notes

1. Composite slab design is based on a simple span analysis.
2. Various shading indicates one shore required at midspan.
3. Shoring requirements are determined as follows:
   a. Dead load of concrete and deck plus 20 psf construction load will not stress section greater than 20,000 psi. If the construction load exceeds 20 psf, the span and/or gauge must be changed at the discretion of the design engineer.
   b. Stress due to concrete load plus deck dead load plus 200# concentrated load for one foot width of construction shall not exceed 26,667 psi.
   c. Dead load of concrete and deck will not cause deflections greater than Span/180 or a maximum of ¾".
4. All concrete to be (f'c) = 3000 psi. For concrete of greater strength, contact the local Robertson representative.
5. Loads shown in the tables for unshored conditions represent the most critical condition of:
   a. Deflection—superimposed load will not deflect composite slab more than L/360.
   b. Bending, controlled by:
      (1) $M_{DL}/S_b + M_{LL}/S_{bc} \leq 27{,}000$ psi
      (2) $(M_{DL} + M_{LL})/S_{bc} \leq 20{,}000$ psi
   c. Compressive stress in the top fiber of the concrete slab cannot exceed 1350 psi.
   d. Horizontal shear load, based on a minimum safety factor of 2.0 on ultimate load. Certain approvals, such as ICBO, require a factor of safety of 3.0 on shear: thus for those applications, the loads shown in tables may need to be reduced depending on whether shear governs or not. Contact your Robertson representative for assistance.
6. Contact the local Robertson office for use of any of the following on Q-Lock slabs:
   a. Live loads in excess of 200 psf as shown in the tables above the heavy horizontal line. Such loads generally indicate "long term" conditions for which the effects of concrete creep must be considered.
   b. Heavy concentrated loads.
   c. Slabs subjected to vibration.
   d. Masonry walls or partitions.
   e. Spans containing electrical trench header.
7. A 6 × 6 welded wire fabric shrinkage mesh, located one inch from the top of the concrete slab, is recommended for all slab thicknesses. Listed below are the recommended wire sizes for respective slab thicknesses measured from top of deck to top of slab. These wire sizes apply to both stone and lightweight concrete. Wire mesh is required for U.L. fire rating.

Slab Thickness Inches	6 x 6 Welded Wire Mesh: Wire Size	Common Stock Style
3¼" or less	W1.5 x W1.5	W1.4 x W1.4
3½"	W2 x W2	W2.1 x W2.1
4"	W2 x W2	W2.1 x W2.1
4½"	W2.5 x W2.5	
5"	W3 x W3	W2.9 x W2.9
5½"	W3 x W3	W2.9 x W2.9
6"	W3.5 x W3.5	

8. For floor construction, the maximum Q-Lock span should not exceed 32 times the total composite assembly thickness.
9. **Superimposed loads = All loads except weight of slab and metal deck.**
10. Concrete slab thickness = Depth of concrete above top of deck, t.
11. **Concrete containing chlorides from any source *should not* be placed over galvanized cellular or fluted deck.**

Concrete Volume Table For 5½" Deep Slabs

Deck Unit or Blend	Concrete CF/SF	Volume CY/100 SF
3" Deep Wide Rib 24" Wide (Type-A) or 36" Wide (Type-B)	0.333	1.23
5'-0 Blend - 2'-0 QL-GKX + Type-B	0.333	1.23
5'-0 Full Cellular - 30" - QL-GKX	0.357	1.32
Full Cellular - 24" QL-GKX	0.333	1.23
4'-0 Blend - 2'-0 QL-GKX + Type-A	0.333	1.23
6'-0 Blend - 2'-0 QL-GKX + 2 Type-A	0.333	1.23

Note: For slab depths other than 5½" add or deduct the following for each 1/2" of slab thickness. (± .042 CF/SF or .16 cy/100SF)

The concrete volumes listed above are based on exact depths. No allowance has been made for frame or deck deflection.

DESIGN EXAMPLE

Check the shoring requirements and the allowable superimposed load for 3" QL-GKX-20/20 given the following conditions:

Span = 11'-0" c/c, 10'-6" clear, 3-span condition
Concrete = 2-1/2" regular weight (145 pcf) above top of floor unit (f'_c = 3000 psi)
Dead Load = 52.0 psf (steel floor plus concrete)
I_s = 1.440 in^4/ft
$S_{t(+)}$ = 0.637 in^3/ft
$S_{b(-)}$ = 1.200 in^3/ft

Part I – Check the deck as a concrete form

a. Limit the dead load deflection to the smaller of L/180 or .750"

$$\Delta = \frac{0.0069 \times W_{DL} \times L^4 \times 1728}{Es \times Is} = \frac{0.0069 \times 52.0 \times 10.5^4 \times 1728}{29{,}500{,}000 \times 1.440}$$

$\Delta = 0.177" < .750"$ OK

$\Delta = 0.177" < \frac{10.5 \times 12}{180} = 0.700"$ OK

b. Limit steel stress as a concrete form with 200# concentrated load to 26,667 psi:

$$+f_b = \frac{(0.96 \times W_{DL} \times L^2) + (485.2 \times L)}{S_{t(+)}} = \frac{(0.96 \times 52.0 \times 10.5^2) + (485.2 \times 10.5)}{0.637}$$

$+f_b$ = 16,600 psi < 26,667 psi OK

$$-f_b = \frac{(1.4 \times W_{DL} \times L^2) + (246.3 \times L)}{S_{b(-)}} = \frac{(1.4 \times 52.0 \times 10.5^2) + (246.3 \times 10.5)}{1.200}$$

$-f_b$ = 8,840 psi < 26,667 psi OK

c. Limit steel stress as a concrete form with 20 psf construction load to 20,000 psi:

$$+f_b = \frac{0.96 \times (W_{DL} + 20) \times L^2}{S_{t(+)}} = \frac{0.96 \times 72.0 \times 10.5^2}{0.637}$$

$+f_b$ = 12,200 psi < 20,000 psi OK

$$-f_b = \frac{1.4 \times (W_{DL} + 20) \times L^2}{S_{b(-)}} = \frac{1.4 \times 72.0 \times 10.5^2}{1.200}$$

$-f_b$ = 9,260 psi < 20,000 psi OK

Part II – Check the allowable listed load on the composite slab from the tables using:

I_c = 12.474 in^4/ft V_R = 1120 lbs
S_{cc} = 6.105 in^3/ft N = 9
S_{bc} = 3.535 in^3/ft

a. Limit live load deflection to the smaller of L/360 or .500"

$$\Delta = \frac{0.0130 \times W_{LL} \times L^4 \times 1728}{Es \times Ic} = \frac{0.0130 \times 213 \times 10.5^2 \times 1728}{29{,}500{,}000 \times 12.474}$$

$\Delta = 0.158" < .500"$ OK

$\Delta = 0.158" < \frac{10.5 \times 12}{360} = 0.350"$ OK

b. Limit bottom stress to 20,000 psi:

$$f_b = \frac{(W_{DL} + W_{LL}) \times L^2 \times 12}{8 \times S_{bc}} = \frac{(52.0 + 213) \times 10.5^2 \times 12}{8 \times 3.535}$$

f_b = 12,400 psi < 20,000 psi OK

c. Limit bottom stress to 27,000 psi:

$$f_b = \frac{0.08 \times W_{DL} \times L^2 \times 12}{S_b} + \frac{W_{LL} \times L^2 \times 12}{8 \times S_{bc}} = \frac{0.08 \times 52.0 \times 10.5^2 \times 12}{0.637} + \frac{213 \times 10.5^2 \times 12}{8 \times 3.535}$$

f_b = 18,600 psi < 27,000 psi OK

d. Limit concrete stress to $0.45f'_c$:

$$f_c = \frac{1.5 \times W_{LL} \times L^2}{N \times S_{cc}} = \frac{1.5 \times 213 \times 10.5^2}{9 \times 6.105}$$

f_c = 641 psi < 0.45 X 3,000 = 1350 psi OK

e. Limit shear, V_R, to 1120 lb (from tables):

$$V_R = \frac{W_{LL} \times L}{2} = \frac{213 \times 10.5}{2}$$

$V_R = 1120 \leq 1120$ lb (Governs the tabulated value) OK

For checking a 2-span condition the formulas in the example would be:

I.a. $\Delta = \frac{0.0054 \times W_{DL} \times L^4 \times 1728}{Es \times Is} = \frac{0.0054 \times 52.0 \times 10.5^4 \times 1728}{29{,}500{,}000 \times 1.440} = .139"$

I.b. $+f_b = \frac{(0.84 \times W_{DL} \times L^2) + (490 \times L)}{S_{t(+)}} = \frac{(0.84 \times 52.0 \times 10.5^2) + (490 \times 10.5)}{0.637} = 15{,}600$ psi OK

$-f_b = \frac{(1.5 \times W_{DL} \times L^2) + (230.9 \times L)}{S_{b(-)}} = \frac{(1.5 \times 52.0 \times 10.5^2) + (230.9 \times 10.5)}{1.200} = 9{,}190$ psi

I.c. $+f_b = \frac{0.84 \times (W_{DL} + 20) \times L^2}{S_{t(-)}} = \frac{0.84 \times 72.0 \times 10.5^2}{0.637} = 10{,}500$ psi OK

$-f_b = \frac{1.5 \times (W_{DL} + 20) \times L^2}{S_{b(-)}} = \frac{1.5 \times 72.0 \times 10.5^2}{1.200} = 9{,}920$ psi OK

II.a. Same as for 3-span

II.b. Same as for 3-span

II.c. $f_b = \frac{0.07 \times W_{DL} \times L^2 \times 12}{S_b} + \frac{W_{LL} \times L^2 \times 12}{8 \times S_{bc}} = \frac{0.07 \times 52.0 \times 10.5^2 \times 12}{0.637} + \frac{213 \times 10.5^2 \times 12}{8 \times 3.535} = 17{,}500$

II.d. Same as for 3-span

II.e. Same as for 3-span

TABLE A-1 **ALLOWABLE DIAPHRAGM SHEARS (plf) FOR QL-GKX-24" AND QL-GKX-30" SECTIONS WITH $2^1/_2$-INCH-THICK STONE-AGGREGATE CONCRETE FILL (145 pcf)[1,2,3,4,5]**

DECK TYPE	DECK GAGE	SPAN (Feet)									
		6		8		10		12		14	
QL-GKX-24"	16-16	2320	2830	2100	2480	1970	2260	1890	2120	1830	2020
	18-16	2260	2730	2060	2400	1950	2210	1870	2070	1810	1980
	16-18	2230	2680	2040	2360	1930	2180	1860	2050	1800	1960
	18-18	2180	2570	2010	2290	1900	2120	1840	2010	1790	1920
	20-18	2120	2470	1970	2220	1880	2060	1820	1960	1770	1890
	16-20	2150	2520	1990	2250	1890	2090	1830	1980	1780	1910
	18-20	2100	2420	1960	2180	1870	2040	1810	1940	1770	1870
	20-20	2050	2330	1930	2110	1850	1990	1800	1900	1760	1840
QL-GKX-30"	16-16	2420	2570	2170	2290	2030	2120	1930	2010	1860	1920
	18-16	2350	2490	2120	2230	1990	2070	1900	1970	1830	1900
	16-18	2320	2450	2100	2200	1970	2050	1880	1950	1820	1880
	18-18	2250	2370	2050	2150	1940	2010	1860	1920	1800	1860
	20-18	2190	2300	2010	2090	1990	1970	1830	1890	1780	1830
	16-20	2220	2340	2030	2120	1920	1990	1850	1910	1790	1840
	18-20	2160	2260	1990	2070	1890	1950	1820	1880	1770	1820
	20-20	2100	2190	1950	2020	1860	1920	1800	1850	1760	1800

[1]Sufficient seam attachment for above-deck sections consists of fastening at 5 feet 0 inches on center maximum between supports. Fastening may be by No. 12 self-tapping and self-drilling steel screws, $1^1/_4$ inch long, or by welds $1^1/_2$ inches long. Welds are illustrated under Table B-1, Figure B.1.b.

[2]Values to left of vertical line for each span are for two spot welds at supports and values to right of vertical line are for four spot welds at supports for QL-GKX-24". Values to left vertical line for each span are for three spot welds at supports and values to right of vertical line are for four spot welds at supports for QL-GKX-30".

[3]The spacing of boundary spot welds at perimeter supports shall be determined in accordance with the values set forth in Table B-2.

[4]The concrete shall have a minimum depth of $2^1/_2$ inches above the top flute.

[5]See Table B-1 for size, type and location of welds.

TABLE A-2 **—DIAPHRAGM SHEAR RATIOS FOR DECK SECTIONS WITH KE-Q/TD TRENCH HEADER AND CONCRETE FILL[1,2,3,4,5,6,7,8,9]**

DECK TYPE	DECK GAGE	TRENCH HEADER WIDTH (Inches)	RATIO OF DIAPHRAGM SHEARS, q_{th}/q Span (Feet)				
			6	8	10	12	14
QL-GKX	16-16	12	0.94	0.92	0.88	0.83	0.77
		24	0.92	0.89	0.82	0.75	0.68
		36	0.91	0.86	0.78	0.70	0.62
	18-16	12	0.94	0.92	0.88	0.83	0.78
		24	0.92	0.89	0.82	0.75	0.69
		36	0.91	0.86	0.78	0.70	0.62
	18-18	12	0.92	0.89	0.85	0.80	0.72
		24	0.90	0.85	0.79	0.71	0.62
		36	0.88	0.82	0.73	0.65	0.57
	20-18	12	0.92	0.89	0.85	0.80	0.73
		24	0.90	0.85	0.79	0.71	0.63
		36	0.88	0.82	0.73	0.65	0.58
	18-20	12	0.92	0.89	0.84	0.79	0.72
		24	0.90	0.84	0.78	0.70	0.62
		36	0.88	0.81	0.72	0.64	0.56
	20-20	12	0.91	0.88	0.83	0.77	0.70
		24	0.89	0.83	0.76	0.68	0.60
		36	0.87	0.79	0.70	0.62	0.54

[1]Shear diaphragm values (q_{th}) for decks with trench headers equal above diaphragm shear ratios multiplied by diaphragm shear values (q) from Tables A-1

[2]Sufficient seam attachment for above-deck sections consists of fastening at 3 feet 0 inches on center between supports, one fastening to be approximately at trench header center line for each seam. Fastening may be by No. 12 self-tapping and self-drilling steel screws, $1^1/_4$ inches long, or by welds $1^1/_2$ inches long at top or side. Welds are illustrated under Table B-1, Figure B.1.b.

[3]Diaphragm shear ratios are applicable to two spot welds, three spot welds and four spot welds at supports.

[4]Notes 2 through 5 from Tables A-1 are applicable.

[5]To determine the diaphragm shear for blended systems of fluted and cellular deck:

1. Compute diaphragm shear for fluted deck using ratio q_{th}/q.
2. Compute diaphragm shear for cellular deck using ratio q_{th}/q.
3. Compute weighted average of fluted deck and cellular deck present by proportioning width of each deck type to overall width.
4. Diaphragm shear for blended system is computed by multiplying the diaphragm shear for fluted and cellular decks by the respective weighted average, and summing the results.

[6]For 9-inch trench header width, use ratio of diaphragm shear, q_{th}/q, for 12-inch trench header width.

[7]For 18-inch trench header width, use straight line interpolation based on trench header width between 12- and 24-inch trench header widths, to obtain ratio of diaphragm shear, q_{th}/q.

[8]For 27-inch and 30-inch trench header width, use straight line interpolation based on trench header width between 24- and 36-inch trench header widths, to obtain ratio of diaphragm shear, q_{th}/q.

[9]Where the steel deck and/or the concrete slab continues over the transverse support beam, the trench header can be located anywhere within that span, or the trench header can be located directly over the transverse support beam. Where the steel deck and the concret slab terminate at a transverse support beam, the minimum width of concrete between the edge of the trench header cover plate closest to the support member and the parallel center line of the transverse support member is 24 inches.

TABLE B-1—WELDING SCHEDULE FOR 3" QL-GKX SECTIONS

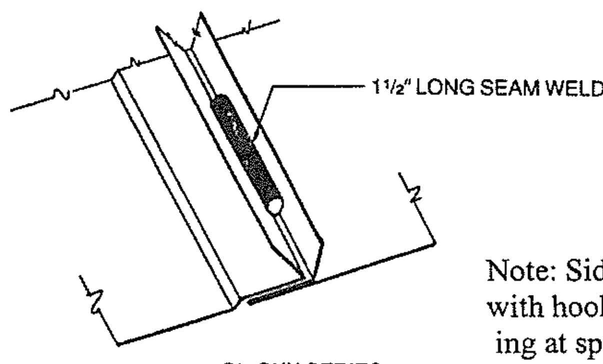
TYPE PANEL	AT TRANSVERSE SUPPORTS — Spot Welds — Effective Diameter (inches)	Number of Welds Per Unit Each Support	Location[2]	AT PERIMETER POINTS — Spot Welds — Effective Diameter (inches)	Spacing (inches)	SPACING OF SEAM WELDS AT SIDE LAPS[3] (inches)
QL-GKX-24"	1/2	2-	2 and 4	1/2	To be calculated based on allowable weld values. See Table B-2.	24 or 60[1]
	1/2	4	1, 2, 3 and 4	1/2		24 or 60[1]
QL-GKX-30"	1/2	3	1, 2 and 4	1/2		24 or 60[1]
	1/2	4	1, 2, 3 and 4	1/2		24 or 60[1]

[1]Sixty-inch spacing used only with structural concrete fill. Also, for structural concrete fill only, side lap connection may be No. 12 self-tapping and self-drilling screws, $1^1/_4$ inch long.

[2]See Figure B.1.a for flute members.

[3]See Figure B.1.b for welds at sidelap.

FIGURE B.1.a.—FLUTE NUMBERS FOR PUDDLE WELD LOCATIONS



Note: Sidelap attachment for QL-GKXH with hook lips consists of button punching at spacings shown for sidelap welds

FIGURE B.1.b.—WELD AT SIDELAP

TABLE B-2—ALLOWABLE SHEAR FOR BOUNDARY WELDS ON GALVANIZED DECK

A. MAXIMUM ALLOWABLE SHEAR ON MARGINAL PUDDLE WELDS (Pounds per Lineal Foot)[1]			
	Spacing[2]		
Gage[3]	1 Foot	2 Feet	3 Feet
16-16	3200	1600	1070
18-16	2940	1470	980
18-18	2560	1280	850
20-20	1920	960	640

B. MAXIMUM ALLOWABLE SHEAR ON BOUNDARY $1^1/_2$-INCH FILLET WELDS (Pounds per Lineal Foot)[4]		
Spacing		
1 Foot	2 Feet	3 Feet
720	360	240

[1]Values are based on the formula $q = \frac{32,000(t_1 + t'_2)}{S}$

where S = spacing in feet

t_1 = bottom sheet thickness in inches

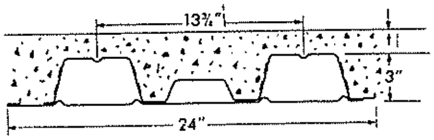
t_2 = effective thickness of upper sheet in inches ($t'_2 = 2/3t_2$).

[2]In no case shall the spacing of boundary welds exceed 3 feet.

[3]The first number represents the thickness of the fluted sheet and the second number represents the thickness of the flat sheet.

[4]Values are based on the formula $q = (480l_w)/S$, where l_w = length of fillet weld (not less than $1^1/_2$ inches). Where fillet welds attach the diaphragm to struts, ties or other collector elements, the values shall be reduced to 63 percent of those tabulated.

QL-GKX-24"-20/20



Section Properties Steel Unit Only

I_s = 1.440
$(+)S_t$ = .637
$(+)S_b$ = 1.533
$(-)S_t$ = .648
$(-)S_b$ = 1.200

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

▨ Denotes shoring required on simple and 2-span conditions only.

▩ Denotes shoring required on all span conditions.

__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	46.0	52.0	57.5
V_R Lbs.	1027	1120	1218
I_c	9.881	12.474	15.451
S_{cc}	5.204	6.105	7.084
S_{bc}	3.114	3.535	3.971

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
8.	256	280	304
8.5	241	263	286
9.	228	248	270
9.5	216	235	256
10.	205	224	243
10.5	195	213	195
11.	186	170	184
11.5	150	162	175
12.	142	154	166
12.5	136	146	158
13.	129	139	150
13.5	123	133	143
14.		127	137

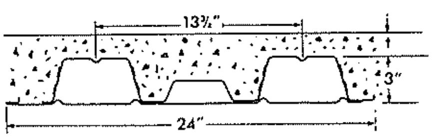
N=14 Concrete Weight=110 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	35.8	40.3	47.2
V_R Lbs.	1026	1111	1251
I_c	8.520	10.781	14.818
S_{cc}	3.869	4.532	5.638
S_{bc}	2.969	3.376	4.012

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
8.	256	277	312
8.5	241	261	294
9.	228	246	278
9.5	216	233	263
10.	205	222	250
10.5	195	211	238
11.	186	202	227
11.5	178	193	188
12.	171	160	178
12.5	142	153	170
13.	136	146	162
13.5	130	139	155
14.		134	149

QL-GKX-24"-18/20



Section Properties Steel Unit Only

I_s = 1.781
$(+)S_t$ = .872
$(+)S_b$ = 1.712
$(-)S_t$ = .839
$(-)S_b$ = 1.342

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

▨ Denotes shoring required on simple and 2-span conditions only.

▩ Denotes shoring required on all span conditions.

__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	46.7	52.8	58.2
V_R Lbs.	1016	1104	1198
I_c	10.611	13.436	16.697
S_{cc}	5.364	6.290	7.305
S_{bc}	3.417	3.897	4.396

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	225	245	266
9.5	214	232	252
10.	203	220	239
10.5	193	210	228
11.	184	200	217
11.5	176	192	208
12.	169	184	199
12.5	162	176	154
13.	156	137	147
13.5	122	130	140
14.		125	134
14.5		119	128
15.		114	123

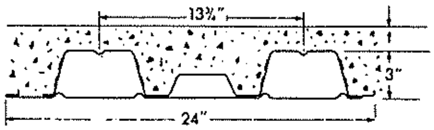
N=14 Concrete Weight=110 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	36.5	41.1	47.9
V_R Lbs.	1021	1100	1233
I_c	9.077	11.519	15.897
S_{cc}	3.981	4.661	5.797
S_{bc}	3.237	3.701	4.426

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	226	244	274
9.5	215	231	259
10.	204	220	246
10.5	194	209	234
11.	185	200	224
11.5	177	191	214
12.	170	183	205
12.5	163	176	197
13.	157	169	189
13.5	151	162	153
14.		132	146
14.5		127	140
15.		122	134

QL-GKX-24"-18/18



Section Properties Steel Unit Only

$I_s = 1.928$
$(+)S_t = .893$
$(+)S_b = 2.056$
$(-)S_t = .875$
$(-)S_b = 1.756$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.
▨ Denotes shoring required on simple and 2-span conditions only.
■ Denotes shoring required on all span conditions.
__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	47.4	53.4	58.8
V_R Lbs.	1028	1117	1211
I_c	12.076	15.253	18.910
S_{cc}	5.755	6.741	7.816
S_{bc}	4.028	4.576	5.143

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	228	248	269
9.5	216	235	255
10.	205	223	242
10.5	195	212	230
11.	187	203	220
11.5	178	194	210
12.	171	186	201
12.5	164	178	156
13.	158	138	149
13.5	123	132	142
14.		126	135
14.5		120	129
15.		115	124

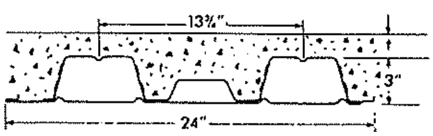
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	37.1	41.7	48.5
V_R Lbs.	1032	1112	1245
I_c	10.234	12.981	17.859
S_{cc}	4.245	4.974	6.175
S_{bc}	3.811	4.347	5.171

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	229	247	276
9.5	217	234	262
10.	206	222	249
10.5	196	211	237
11.	187	202	226
11.5	179	193	216
12.	172	185	207
12.5	165	177	199
13.	158	171	191
13.5	153	164	154
14.		133	148
14.5		128	141
15.		123	136

QL-GKX-24"-16/20



Section Properties Steel Unit Only

$I_s = 2.100$
$(+)S_t = 1.066$
$(+)S_b = 1.866$
$(-)S_t = 1.022$
$(-)S_b = 1.469$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.
▨ Denotes shoring required on simple and 2-span conditions only.
■ Denotes shoring required on all span conditions.
__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	47.5	53.5	58.9
V_R Lbs.	1009	1092	1183
I_c	11.299	14.339	17.865
S_{cc}	5.515	6.464	7.508
S_{bc}	3.708	4.245	4.807

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	224	242	262
9.5	212	230	249
10.	201	218	236
10.5	192	208	225
11.	183	198	215
11.5	175	190	205
12.	168	182	197
12.5	161	174	189
13.	155	168	182
13.5	149	161	138
14.		123	132
14.5		118	126
15.		113	120

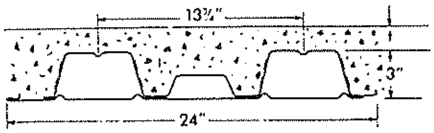
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	37.2	41.8	48.7
V_R Lbs.	1019	1092	1219
I_c	9.599	12.208	16.898
S_{cc}	4.088	4.782	5.944
S_{bc}	3.493	4.012	4.824

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	226	242	271
9.5	214	230	256
10.	203	218	243
10.5	194	208	232
11.	185	198	221
11.5	177	190	212
12.	169	182	203
12.5	163	174	195
13.	156	168	187
13.5	151	161	180
14.		156	174
14.5		150	138
15.		121	133

QL-GKX-24"-16/18



Section Properties Steel Unit Only

$I_s = 2.275$
$(+)S_t = 1.094$
$(+)S_b = 2.212$
$(-)S_t = 1.067$
$(-)S_b = 1.868$

▨ Denotes shoring required on simple spans, no shoring on multiple spans.

☐ Denotes shoring required on simple and 2-span conditions only.

▩ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	48.1	54.1	59.5
V_R Lbs.	1022	1106	1197
I_c	12.707	16.086	19.988
S_{cc}	5.885	6.890	7.989
S_{bc}	4.309	4.914	5.543

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	227	245	266
9.5	215	232	252
10.	204	221	239
10.5	194	210	228
11.	185	201	217
11.5	177	192	208
12.	170	184	199
12.5	163	177	191
13.	157	170	184
13.5	151	163	177
14.		158	133
14.5		119	128
15.		114	122

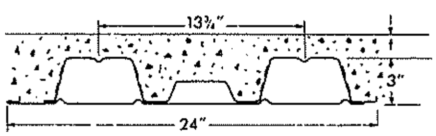
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	37.8	42.4	49.3
V_R Lbs.	1033	1106	1233
I_c	10.708	13.604	18.769
S_{cc}	4.340	5.078	6.300
S_{bc}	4.055	4.645	5.555

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	229	245	274
9.5	217	232	259
10.	206	221	246
10.5	196	210	234
11.	187	201	224
11.5	179	192	214
12.	172	184	205
12.5	165	177	197
13.	158	170	189
13.5	153	163	182
14.		158	176
14.5		152	170
15.		147	134

QL-GKX-24"-16/16



Section Properties Steel Unit Only

$I_s = 2.422$
$(+)S_t = 1.116$
$(+)S_b = 2.549$
$(-)S_t = 1.102$
$(-)S_b = 2.313$

▨ Denotes shoring required on simple spans, no shoring on multiple spans.

☐ Denotes shoring required on simple and 2-span conditions only.

▩ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	48.7	54.8	60.2
V_R Lbs.	1032	1116	1207
I_c	14.023	17.735	21.996
S_{cc}	6.207	7.267	8.417
S_{bc}	4.902	5.578	6.273

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	229	248	268
9.5	217	235	254
10.	206	223	241
10.5	196	212	230
11.	187	203	219
11.5	179	194	210
12.	172	186	201
12.5	165	178	193
13.	158	171	185
13.5	152	165	178
14.		159	134
14.5		120	129
15.		115	123

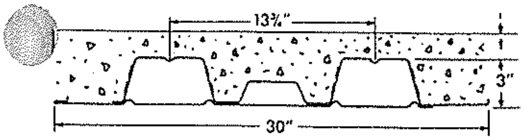
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	38.4	43.0	49.9
V_R Lbs.	1042	1116	1243
I_c	11.728	14.895	20.520
S_{cc}	4.555	5.333	6.613
S_{bc}	4.608	5.269	6.281

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	231	248	276
9.5	219	234	261
10.	208	223	248
10.5	198	212	236
11.	189	202	226
11.5	181	194	216
12.	173	186	207
12.5	166	178	198
13.	160	171	191
13.5	154	165	184
14.		159	177
14.5		153	171
15.		148	135

QL-GKX-30"-20/20



Section Properties Steel Unit Only

$I_s = 1.216$
$(+)S_t = .518$
$(+)S_b = 1.423$
$(-)S_t = .526$
$(-)S_b = 1.052$

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	49.3	55.4	61.1
V_R Lbs.	1038	1134	1235
I_c	9.356	11.779	14.549
S_{cc}	5.091	5.970	6.922
S_{bc}	2.893	3.273	3.664

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
8.	259	283	308
8.5	244	266	290
9.	230	252	274
9.5	218	238	220
10.	176	191	207
10.5	167	180	195
11.	158	171	185
11.5	149	162	175
12.	142	153	166
12.5	135	146	158
13.	129	139	150
13.5	123	132	140
14.		126	137

N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	38.2	42.8	49.6
V_R Lbs.	1033	1123	1267
I_c	8.119	10.245	14.029
S_{cc}	3.791	4.441	5.521
S_{bc}	2.770	3.138	3.710

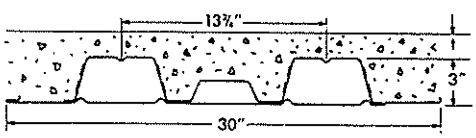
Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
8.	258	280	316
8.5	243	264	298
9.	229	249	281
9.5	217	236	266
10.	206	224	221
10.5	196	187	209
11.	164	177	198
11.5	156	168	188
12.	148	160	179
12.5	142	153	171
13.	135	146	163
13.5	129	139	156
14.		133	149

▨ Denotes shoring required on simple spans, no shoring on multiple spans.
☐ Denotes shoring required on simple and 2-span conditions only.
▩ Denotes shoring required on all span conditions.
— For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

QL-GKX-30"-18/20



Section Properties Steel Unit Only

$I_s = 1.508$
$(+)S_t = .710$
$(+)S_b = 1.571$
$(-)S_t = .679$
$(-)S_b = 1.153$

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	50.0	56.0	61.7
V_R Lbs.	1027	1118	1215
I_c	9.977	12.598	15.611
S_{cc}	5.228	6.130	7.113
S_{bc}	3.142	3.570	4.014

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
8.	256	279	303
8.5	241	263	286
9.	228	248	270
9.5	216	235	255
10.	205	223	243
10.5	195	213	231
11.	186	203	181
11.5	178	159	172
12.	140	151	163
12.5	133	143	155
13.	127	136	147
13.5	121	130	140
14.		124	134

N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	38.8	43.4	50.2
V_R Lbs.	1026	1110	1249
I_c	8.597	10.878	14.957
S_{cc}	3.887	4.551	5.660
S_{bc}	2.993	3.406	4.052

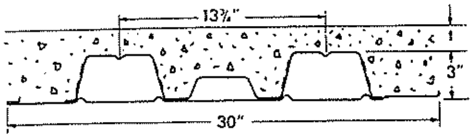
Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
8.	256	277	312
8.5	241	261	293
9.	228	246	277
9.5	216	233	262
10.	205	222	249
10.5	195	211	237
11.	186	201	227
11.5	178	193	217
12.	171	185	176
12.5	164	151	168
13.	134	144	160
13.5	129	138	153
14.		132	146

▨ Denotes shoring required on simple spans, no shoring on multiple spans.
☐ Denotes shoring required on simple and 2-span conditions only.
▩ Denotes shoring required on all span conditions.
— For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

QL-GKX-30"-18/18



Section Properties
Steel Unit Only

$I_s = 1.629$
$(+)S_t = .727$
$(+)S_b = 1.907$
$(-)S_t = .706$
$(-)S_b = 1.546$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.
▨ Denotes shoring required on simple and 2-span conditions only.
■ Denotes shoring required on all span conditions.
___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9

Concrete Weight=145 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	50.6	56.6	62.3
V_R Lbs.	1037	1130	1227
I_c	11.477	14.458	17.877
S_{cc}	5.636	6.601	7.649
S_{bc}	3.751	4.245	4.756

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
8.	259	282	306
8.5	244	265	288
9.	230	251	272
9.5	218	237	258
10.	207	226	245
10.5	197	215	233
11.	188	205	183
11.5	180	160	173
12.	141	152	164
12.5	134	145	156
13.	128	138	149
13.5	122	131	142
14.		125	135

N=14

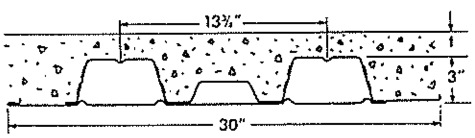
Concrete Weight=110 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	39.4	44.0	50.9
V_R Lbs.	1036	1121	1259
I_c	9.791	12.386	16.982
S_{cc}	4.164	4.879	6.056
S_{bc}	3.567	4.051	4.794

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
8.	259	280	314
8.5	243	263	296
9.	230	249	279
9.5	218	236	265
10.	207	224	251
10.5	197	213	239
11.	188	203	229
11.5	180	194	219
12.	172	186	178
12.5	165	152	169
13.	136	145	161
13.5	130	139	154
14.		133	148

QL-GKX-30"-16/20



Section Properties
Steel Unit Only

$I_s = 1.799$
$(+)S_t = .879$
$(+)S_b = 1.714$
$(-)S_t = .828$
$(-)S_b = 1.254$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.
▨ Denotes shoring required on simple and 2-span conditions only.
■ Denotes shoring required on all span conditions.
___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9

Concrete Weight=145 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	50.6	56.6	62.3
V_R Lbs.	1020	1107	1201
I_c	10.593	13.402	16.645
S_{cc}	5.369	6.292	7.303
S_{bc}	3.392	3.867	4.361

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	226	246	266
9.5	214	233	252
10.	204	221	240
10.5	194	210	228
11.	185	201	218
11.5	177	192	208
12.	170	184	160
12.5	163	142	152
13.	126	135	145
13.5	120	129	138
14.		123	132
14.5		117	126
15.		112	120

N=14

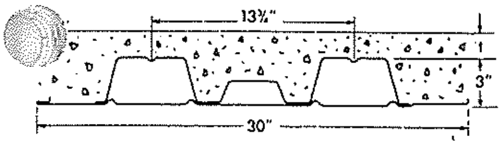
Concrete Weight=110 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	39.4	44.0	50.8
V_R Lbs.	1024	1103	1236
I_c	9.072	11.500	15.856
S_{cc}	3.988	4.665	5.797
S_{bc}	3.216	3.673	4.391

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	227	245	274
9.5	215	232	260
10.	204	220	247
10.5	195	210	235
11.	186	200	224
11.5	178	191	215
12.	170	183	206
12.5	163	176	197
13.	157	169	158
13.5	151	163	151
14.		131	145
14.5		125	139
15.		120	133

QL-GKX-30"-16/18



Section Properties Steel Unit Only

I_s = 1.926
$(+)S_t$ = .891
$(+)S_b$ = 2.035
$(-)S_t$ = .867
$(-)S_b$ = 1.654

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

▨ Denotes shoring required on simple and 2-span conditions only.

▩ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	51.2	57.3	62.9
V_R Lbs.	1030	1119	1213
I_c	12.028	15.185	18.818
S_{cc}	5.750	6.732	7.804
S_{bc}	3.988	4.529	5.091

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	229	248	269
9.5	217	235	255
10.	206	223	242
10.5	196	213	231
11.	187	203	220
11.5	179	194	211
12.	171	186	162
12.5	164	143	154
13.	127	136	146
13.5	121	130	140
14.		124	133
14.5		118	127
15.		113	122

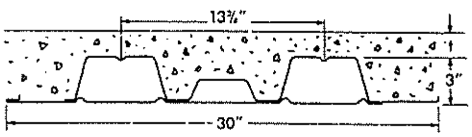
N= 14 Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	40.0	44.6	51.5
V_R Lbs.	1034	1114	1247
I_c	10.207	12.934	17.783
S_{cc}	4.245	4.970	6.167
S_{bc}	3.775	4.303	5.118

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	229	247	277
9.5	217	234	262
10.	206	222	249
10.5	197	212	237
11.	188	202	226
11.5	179	193	216
12.	172	185	207
12.5	165	178	199
13.	159	171	160
13.5	153	165	152
14.		132	146
14.5		126	140
15.		121	134

QL-GKX-30"-16/16



Section Properties Steel Unit Only

I_s = 2.048
$(+)S_t$ = .909
$(+)S_b$ = 2.365
$(-)S_t$ = .898
$(-)S_b$ = 2.136

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

▨ Denotes shoring required on simple and 2-span conditions only.

▩ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	51.8	57.9	63.5
V_R Lbs.	1039	1128	1222
I_c	13.382	16.876	20.880
S_{cc}	6.086	7.125	8.250
S_{bc}	4.581	5.190	5.818

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	230	250	271
9.5	218	237	257
10.	207	225	244
10.5	197	214	232
11.	188	205	222
11.5	180	196	212
12.	173	188	203
12.5	166	144	155
13.	128	137	147
13.5	122	131	140
14.		125	134
14.5		119	128
15.		114	122

N= 14 Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	40.6	45.2	52.1
V_R Lbs.	1041	1122	1255
I_c	11.262	14.271	19.593
S_{cc}	4.470	5.237	6.495
S_{bc}	4.330	4.929	5.843

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	231	249	279
9.5	219	236	264
10.	208	224	251
10.5	198	213	239
11.	189	204	228
11.5	181	195	218
12.	173	187	209
12.5	166	179	200
13.	160	172	161
13.5	154	166	155
14.		133	147
14.5		127	141
15.		122	135

U.L. Listed Assemblies - Fire Ratings

Robertson's steel floor units have been tested by Underwriters' Laboratories, Inc., and are listed in a wide variety of Designs in the U.L. "Fire Resistance Directory." Cellular sections are approved as "cellular metal raceway," since they comply with all of the requirements of U.L. 209. Following is a list of Robertson's floor and ceiling approvals involving the most economical and popular assemblies. **D-900 Series floor assemblies should not be employed if the floor will be electrified. Instead, an appropriate spr. fireproofed assembly should be used.**

FIRE RESISTANCE - UNDERWRITERS' LABORATORIES LISTINGS - TABLE OF RESTRAINED RATINGS

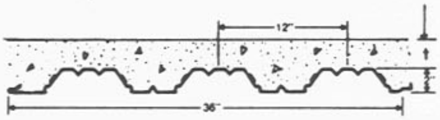
Hourly Rating	UL Design NO.	Listed Floor units	Concrete Type	Bottomless Trench Header	Tapmate IV or V Preset Outlets	Composite Beam	Slab Fireproofing
1, 2, 3 hr.	D216	24" Wide GKX, GKXH	R.W., L.W.	No	TMIV	Yes	Exposed Grid
1, 2, 3 hr.	D703	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMIV	Yes	Sprayed Cementitions
1, 2 hr.	D712	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMIV	No	Sprayed Cementitions
1, 2 hr.	D722	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMIV	Yes	Sprayed Cementitions
1, 2, 3 hr.	D739	24" or 30" GKX	R.W., L.W.	Yes	TMIV, V	Yes	Sprayed Cementitions
1, 2, 3 hr.	D743	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMII, III	Yes	Sprayed Cementitions
2, 3 hr.	D755	24" or 30" GKX	R.W., L.W.	Yes	TMIV	Yes	Sprayed Cementitions
1, 2, 3 hr.	D759	24" or 30" GKX	R.W., L.W.	Yes	TMIV, V	Yes	Sprayed Cementitions
2 hr.	D764	24" or 30" GKX	R.W., L.W.	No	No	Yes	Sprayed Cementitions
1, 2, 3 hr.	D767	24" or 30" GKX	R.W., L.W.	Yes	TMIV	Yes	Sprayed Cementitio
1, 2, 3 hr.	D832	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMIV	Yes	Sprayed Fiber
1, 2, 3 hr.	D858	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMIV, V	Yes	Sprayed Fiber
1, 2, 3 hr.	D859	24" or 30" GKX, GKXH	R.W., L.W.	Yes	TMII, III	Yes	Sprayed Fiber
1, 2, 3 hr.	D871	24" or 30" GKX	R.W., L.W.	Yes	TMIV, V	Yes	Sprayed Fiber
1, 2, 3 hr.	D902	24" or 30" GKX, GKXH	R.W., L.W.	No	No	Yes	None on Deck
1, 2, 3 hr.	D916	24" or 30" GKX, GKXH	R.W., L.W.	No	No	Yes	None on Deck
1, 2, 3 hr.	D922	24" or 30" GKX	R.W., L.W.	No	No	Yes	None on Deck
1, 2, 3 hr.	D923	24" or 30" GKX	R.W., L.W.	No	No	Yes	None on Deck
1, 2, 3 hr.	D925	24" or 30" GKX	R.W., L.W.	No	No	Yes	None on Deck
1, 2, 3 hr.	D927	24" or 30" GKX, GKXH	R.W., L.W.	No	No	Yes	None on Deck
1, 2 hr.	D929	24" or 30" GKX	R.W., L.W.	No	No	Yes	None on Deck

H H Robertson Floor Systems
450 19th Street
Ambridge, PA 15003
412-299-8070
412-299-8083 (fax)
www.hhrobertson.com

SC-202-2/00
Printed in U.S.A.

CENTRIA

2"-QL-99-20



Section Properties Steel Unit Only

$I_s = .419$
$(+)S_t = .397$
$(+)S_b = .427$
$(-)S_t = .386$
$(-)S_b = .363$

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	38.4	44.5	50.5
V_R Lbs.	759	856	959
I_c	3.177	4.331	5.705
S_{cc}	2.537	3.146	3.821
S_{bc}	1.141	1.371	1.610

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
6.5	233	263	295
7.0	217	244	274
7.5	202	228	255
8.0	189	214	239
8.5	172	194	205
9.0	147	161	180
9.5	130	151	169
10.0	113	142	159
10.5	102	125	149
11.0	89	109	130
11.5		96	114
12.0		84	100
12.5			87

N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	29.6	34.2	41.1
V_R Lbs.	755	847	996
I_c	2.784	3.805	5.723
S_{cc}	1.898	2.351	3.127
S_{bc}	1.083	1.304	1.656

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
6.5	232	260	306
7.0	215	242	284
7.5	201	225	265
8.0	188	211	249
8.5	170	199	234
9.0	148	180	204
9.5	130	152	183
10.0	114	139	172
10.5	101	123	163
11.0	89	112	145
11.5		99	129
12.0		88	115
12.5			102

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

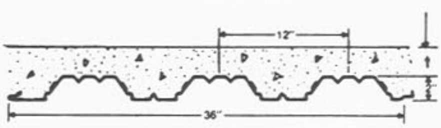
☐ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

2"-QL-99-18



Section Properties Steel Unit Only

$I_s = .558$
$(+)S_t = .525$
$(+)S_b = .567$
$(-)S_t = .519$
$(-)S_b = .531$

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	39.2	45.2	51.3
V_R Lbs.	757	851	951
I_c	3.921	5.353	9.066
S_{cc}	2.814	3.487	5.053
S_{bc}	1.477	1.777	2.415

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
7.0	216	243	271
7.5	201	227	253
8.0	189	212	237
8.5	178	200	223
9.0	168	189	211
9.5	159	179	200
10.0	151	170	157
10.5	136	133	148
11.0	113	126	140
11.5		119	132
12.0		113	125
12.5			119
13.0			113

N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	30.4	35	41.8
V_R Lbs.	755	843	987
I_c	3.386	4.633	6.987
S_{cc}	2.094	2.588	3.440
S_{bc}	1.393	1.680	2.139

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
7.0	215	240	282
7.5	201	224	263
8.0	188	210	246
8.5	177	198	232
9.0	167	187	219
9.5	159	177	207
10.0	148	168	197
10.5	128	160	187
11.0	111	143	152
11.5		124	145
12.0		117	137
12.5			131
13.0			125

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

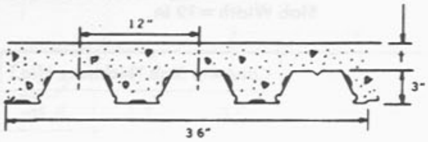
☐ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

3″-QL-99-22



Section Properties Steel Unit Only

$I_s = .731$
$(+)S_t = .439$
$(+)S_b = .465$
$(-)S_t = .49$
$(-)S_b = .383$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

☐ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

N=9

Concrete Weight=145 pcf
Concrete Strength (f′c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	44.4	50.5	56.5
V_R Lbs.	1295	1414	1542
I_c	4.646	5.943	7.446
S_{cc}	3.471	4.102	4.795
S_{bc}	1.247	1.443	1.650

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
8.5	185	198	205
9.0	154	159	215
9.5	139	162	195
10.0	126	148	170
10.5	110	129	148
11.0	96	112	129
11.5	83	98	113
12.0	73	85	98
12.5	63	74	85
13.0	54	64	73
13.5	47	55	63
14.0		46	53
14.5		39	45

N=14

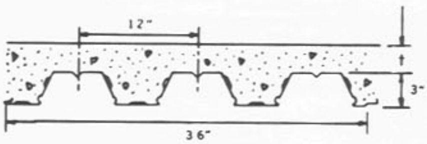
Concrete Weight=110 pcf
Concrete Strength (f′c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	34.1	38.7	45.6
V_R Lbs.	1296	1407	1593
I_c	4.161	5.325	7.434
S_{cc}	2.635	3.106	3.904
S_{bc}	1.193	1.383	1.685

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
8.5	186	216	249
9.0	162	188	204
9.5	142	157	203
10.0	124	145	186
10.5	110	133	164
11.0	100	117	145
11.5	88	104	128
12.0	78	91	113
12.5	69	81	100
13.0	61	71	88
13.5	53	63	78
14.0		55	68
14.5		48	60

3″-QL-99-20



Section Properties Steel Unit Only

$I_s = .913$
$(+)S_t = .561$
$(+)S_b = .566$
$(-)S_t = .594$
$(-)S_b = .486$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.

☐ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

N=9

Concrete Weight=145 pcf
Concrete Strength (f′c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	44.9	50.9	57
V_R Lbs.	1296	1412	1538
I_c	5.359	6.855	8.594
S_{cc}	3.729	4.402	5.144
S_{bc}	1.474	1.708	1.952

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
9.0	197	221	231
9.5	172	182	187
10.0	145	150	203
10.5	120	155	186
11.0	117	142	164
11.5	107	125	145
12.0	94	110	127
12.5	82	97	112
13.0	72	85	99
13.5	63	75	86
14.0		65	75
14.5		57	66
15.0		49	57
15.5			

N=14

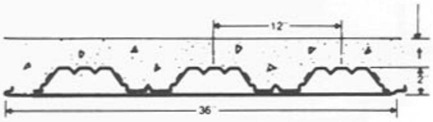
Concrete Weight=110 pcf
Concrete Strength (f′c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	34.6	39.1	46
V_R Lbs.	1300	1407	1588
I_c	4.763	6.093	8.512
S_{cc}	2.824	3.322	4.171
S_{bc}	1.407	1.630	1.988

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.0	197	229	274
9.5	173	201	230
10.0	152	177	196
10.5	135	150	163
11.0	120	126	173
11.5	103	125	160
12.0	95	115	142
12.5	87	102	127
13.0	77	91	113
13.5	69	81	101
14.0		72	90
14.5		64	80
15.0		57	71
15.5			63

QL-AKX-20/20



Section Properties Steel Unit Only

$I_s = .654$
$(+)S_t = .448$
$(+)S_b = 1.067$
$(-)S_t = .423$
$(-)S_b = .613$

N=9

Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	40.0	46.1	52.1
V_R Lbs.	820	918	1020
I_c	5.841	7.789	10.084
S_{cc}	3.575	4.368	5.239
S_{bc}	2.395	2.793	3.204

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
7.5	218	244	272
8.0	205	229	255
8.5	193	216	240
9.0	182	204	226
9.5	172	193	181
10.0	139	154	170
10.5	131	145	160
11.0	124	137	151
11.5		130	143
12.0		123	136
12.5			129
13.0			123
13.5			117

N=14

Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	31.2	35.8	42.6
V_R Lbs.	814	906	1054
I_c	4.984	6.667	9.785
S_{cc}	2.638	3.218	4.205
S_{bc}	2.284	2.667	3.268

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
7.5	217	241	281
8.0	203	226	263
8.5	191	213	248
9.0	180	201	234
9.5	171	190	221
10.0	162	181	183
10.5	155	150	173
11.0	129	142	164
11.5		135	155
12.0		128	148
12.5			141
13.0			134
13.5			128

▢ Denotes shoring required on simple spans, no shoring on multiple spans.

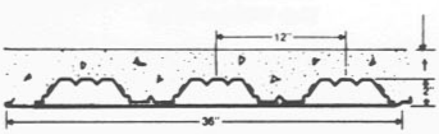
▢ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

QL-AKX-18/20



Section Properties Steel Unit Only

$I_s = .821$
$(+)S_t = .585$
$(+)S_b = 1.203$
$(-)S_t = .553$
$(-)S_b = .744$

N=9

Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	40.0	46.8	52.9
V_R Lbs.	811	905	1004
I_c	6.393	8.558	11.122
S_{cc}	3.719	4.546	5.459
S_{bc}	2.703	3.168	3.651

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
7.5	216	241	267
8.0	202	226	251
8.5	190	213	236
9.0	180	201	223
9.5	170	190	211
10.0	162	181	200
10.5	154	172	157
11.0	147	135	148
11.5		127	140
12.0		121	133
12.5			126
13.0			120
13.5			114

N=14

Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	31.9	36.5	43.4
V_R Lbs.	808	895	1038
I_c	5.405	7.250	10.696
S_{cc}	2.738	3.337	4.364
S_{bc}	2.562	3.007	3.711

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
7.5	215	238	276
8.0	202	223	259
8.5	190	210	244
9.0	179	199	230
9.5	170	188	218
10.0	161	179	207
10.5	154	170	197
11.0	147	162	188
11.5		155	152
12.0		126	145
12.5			138
13.0			132
13.5			126

▢ Denotes shoring required on simple spans, no shoring on multiple spans.

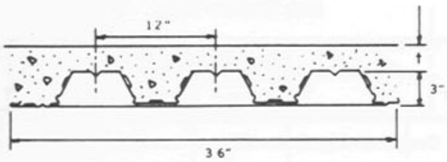
▢ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

QL-WKX-20/20



Section Properties Steel Unit Only

$I_s = 1.505$
$(+)S_t = .649$
$(+)S_b = 1.538$
$(-)S_t = .668$
$(-)S_b = .899$

Denotes shoring required on simple spans, no shoring on multiple spans.

Denotes shoring required on simple and 2-span conditions only.

Denotes shoring required on all span conditions.

__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	46.5	52.5	58.6
V_R Lbs.	1404	1525	1654
I_c	9.966	12.512	15.430
S_{cc}	5.294	6.183	7.149
S_{bc}	3.09	3.491	3.907

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
9.5	295	321	348
10.0	280	305	330
10.5	267	290	277
11.0	255	244	263
11.5	215	232	250
12.0	205	221	238
12.5	196	211	227
13.0	187	201	217
13.5	177	193	207
14.0		185	199
14.5		172	190
15.0		156	180
15.5			165
16.0			151
16.5			138

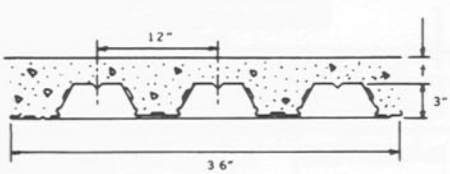
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	36.1	40.7	47.6
V_R Lbs.	1405	1516	1699
I_c	8.638	10.864	14.830
S_{cc}	3.949	4.604	5.696
S_{bc}	2.957	3.344	3.950

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.5	295	319	357
10.0	281	303	339
10.5	267	288	323
11.0	255	275	309
11.5	244	263	265
12.0	218	227	253
12.5	193	217	242
13.0	172	208	231
13.5	153	193	221
14.0		173	212
14.5		156	204
15.0		141	192
15.5			174
16.0			158
16.5			144

QL-WKX-18/20



Section Properties Steel Unit Only

$I_s = 1.894$
$(+)S_t = .929$
$(+)S_b = 1.754$
$(-)S_t = .872$
$(-)S_b = 1.076$

Denotes shoring required on simple spans, no shoring on multiple spans.

Denotes shoring required on simple and 2-span conditions only.

Denotes shoring required on all span conditions.

__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 10.

Refer to Design Notes (page 10) for technical elaboration.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
Dead Load (psf)	47.3	53.3	59.3
V_R Lbs.	1394	1508	1632
I_c	10.973	13.805	17.070
S_{cc}	5.535	6.458	7.468
S_{bc}	3.498	3.965	4.452

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.0
9.5	293	317	343
10.0	278	301	326
10.5	265	287	310
11.0	253	274	296
11.5	242	262	283
12.0	232	251	272
12.5	223	241	223
13.0	214	199	213
13.5	195	190	204
14.0		182	195
14.5		175	187
15.0		165	173
15.5			162
16.0			148
16.5			

N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	36.9	41.5	48.3
V_R Lbs.	1403	1505	1679
I_c	9.424	11.881	16.268
S_{cc}	4.12	4.798	5.930
S_{bc}	3.327	3.780	4.486

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.5	295	316	353
10.0	280	301	335
10.5	267	286	319
11.0	255	273	305
11.5	244	261	292
12.0	233	250	279
12.5	211	240	268
13.0	187	231	258
13.5	167	211	218
14.0		189	210
14.5		170	201
15.0		154	194
15.5			186
16.0			173
16.5			158

2½″
Lightweight aggregate

PROPERTIES and LOAD TABLES
DC, ADC AND #5 SECTION COMPOSITE DECK

PROPERTY TABLES
Lightweight aggregate
2½″ concrete slab

Symbol identity

Wt./PSF = Wt. of deck section + 2½″ concrete and concrete in ribs of deck.

Depth = Depth of deck + 2½″ concrete.

I—moment of inertia of composite section for L/360 deflection.

S_{cc}—section modulus of composite section, top of concrete.

S_{bc}—section modulus of composite section, bottom of steel.

V_R = resisting vertical shear—applies to all section depths—function of shear lug.

Composite Properties for n = 14. (2½″ Concrete Cover f′c = 3000 psi, concrete density 110 pcf.)

	Section	Wt./PSF	Depth	I	S_{cc}	S_{bc}	V_R
4.5 	5-4.5-18	37.4	7.05	11.20	5.12	2.48	1090
	5-4.5-16	38.4	7.06	13.12	5.59	3.01	1110
	5-4.5-14	39.9	7.07	15.29	6.11	3.63	1136
	5-4.5-13	41.2	7.09	17.31	6.57	4.22	1164
	4.5 20/18 DC	38.0	7.08	19.39	7.21	4.80	1252
	4.5 18/18 DC	38.8	7.10	20.37	7.39	5.11	1255
	4.5 18/16 DC	39.3	7.11	22.80	7.86	5.92	1275
	4.5 18/14 DC	39.7	7.12	25.56	8.35	6.89	1293
	4.5 20/18 ADC	38.0	7.08	18.22	6.97	4.43	1243
	4.5 18/18 ADC	38.8	7.10	19.23	7.15	4.75	1243
	4.5 18/16 ADC	39.3	7.11	21.48	7.61	5.47	1265
	4.5 18/14 ADC	39.7	7.12	24.06	8.09	6.34	1284
6.0 	5-6.0-18	41.3	8.55	18.53	7.39	3.30	1373
	5-6.0-16	42.5	8.56	21.80	8.10	4.01	1408
	5-6.0-14	44.0	8.57	25.52	8.88	4.84	1454
	5-6.0-13	45.4	8.59	29.00	9.59	5.65	1502
	6.0 18/18 DC	42.8	8.60	32.69	10.42	6.50	1574
	6.0 18/16 DC	43.3	8.61	36.50	11.06	7.49	1601
	6.0 16/16 DC	44.2	8.62	38.15	11.35	7.90	1622
	6.0 18/14 DC	43.7	8.62	40.85	11.73	8.68	1625
	6.0 18/18 ADC	42.8	8.60	30.92	10.10	6.06	1559
	6.0 18/16 ADC	43.3	8.61	34.43	10.71	6.94	1587
	6.0 16/16 ADC	44.2	8.62	36.14	11.02	7.36	1606
	6.0 18/14 ADC	43.7	8.62	37.70	11.24	7.79	1607
7.5 	5-7.5-18	45.3	10.05	28.45	10.05	4.24	1663
	5-7.5-16	46.6	10.06	33.52	11.03	5.14	1716
	5-7.5-14	48.1	10.07	39.35	12.11	6.22	1783
	5-7.5-13	49.7	10.09	44.80	13.10	7.27	1850
	7.5 18/18 DC	46.9	10.10	48.56	13.82	7.99	1897
	7.5 18/16 DC	47.2	10.11	54.04	14.64	9.14	1930
	7.5 16/16 DC	48.3	10.12	56.78	15.08	9.71	1963
	7.5 18/14 DC	47.8	10.12	60.34	15.50	10.54	1959
	7.5 18/18 ADC	46.9	10.10	46.00	13.42	7.47	1878
	7.5 18/16 ADC	47.2	10.11	51.06	14.20	8.50	1913
	7.5 16/16 ADC	48.3	10.12	53.87	14.66	9.07	1944
	7.5 18/14 ADC	47.8	10.12	56.92	15.04	9.76	1944

LOAD TABLES
Allowable superimposed loads in pounds per square foot

Design notes

Shaded areas indicate span-load conditions requiring mid-span shoring during pouring and curing of concrete.

Concrete to be 3,000 psi light weight aggregate. 6 x 6 #10 wire mesh for shrinkage is recommended.

All loads shown are based on horizontal shear values governing—except those with asterisk(*) which are governed by steel stress of 20,000 psi. Those designated by a (†) are governed by L/360th deflection.

Allowable live loads given are the lesser of the DC or ADC value for the same gauge combination in the 4.5″ and 6″ depths. Generally, the DC value is 1 to 3% greater than the ADC value. In the 7.5″ depth, the variation between DC and ADC is sufficient to warrant separate tables.

Loads for other gauge combinations in DC or ADC sections are available; however, the gauges published are generally the most efficient from a weight standpoint.

Strength/deflection tests to develop the exact behavior of all of these composite sections—#5, DC and ADC—were conducted and witnessed by Pittsburgh Testing Laboratory. Copies of results are available upon request. In these tests, all steel deck sections were greased prior to pouring of concrete to insure against any chemical bond contribution. Loads governed by horizontal shear are entirely mechanical bonding action.

5 DECK TYPE — Concrete Slab Thickness 2½″ f′c = 3,000 (110 pcf)

BEAM SPACING

5 DECK TYPE	15′-0″	16′-0″	17′-0″	18′-0″	19′-0″	20′-0″	21′-0″	22′-0″	23′-0″	24′-0″		
5-4.5-18	110*	92*	77*	64*	54*	43*	35*	28*				
5-4.5-16	140*	118*	100*	85*	70*	60*	50*	42*	35*			
5-4.5-14	151	142	127*	109*	94*	77*	66*	56*	48*	40*		
5-4.5-13	155	146	137	129	111†	95†	82†	71*	61*	52*		

#5	18′-0″	19′-0″	20′-0″	21′-0″	22′-0″	23′-0″	24′-0″	25′-0″	26′-0″	27′-0″		
5-6.0-18	94*	81*	67*	57*	48*	40*	33*					
5-6.0-16	122*	105*	91*	79*	64*	55*	47*	39*	33*			
5-6.0-14	155*	135*	117*	102*	89*	74*	64*	55*	47*	40*		
5-6.0-13	167	158	143*	125*	110*	97*	80*	70*	60*	50*		

#5	22′-0″	23′-0″	24′-0″	25′-0″	26′-0″	27′-0″	28′-0″	29′-0″	30′-0″	31′-0″	32′-0″	33′-0″	
5-7.5-18	69*	59*	50*	42*	36*	29*							
5-7.5-16	95*	83*	69*	59*	51*	44*	37*	31*	26*				
5-7.5-14	123*	109*	96*	79*	69*	60*	52*	45*	39*	33*	26*		
5-7.5-13	150*	133*	119*	105*	88*	77*	68*	60*	52*	45*	39*	33*	

Recommended Span Limit → Floor Loading | Roof Construction Only →

DC ADC DECK TYPE — Concrete Slab Thickness 2½″ f′c = 3,000 psi (110 pcf)

BEAM SPACING

DC ADC DECK TYPE	15′-0″	16′-0″	17′-0″	18′-0″	19′-0″	20′-0″	21′-0″	22′-0″	23′-0″	24′-0″		
4.5-20/18	165	135	125	117	110	100†	86†	75†	66†	58†		
4.5-18/18	166	155	146	138	110	104	90†	79†	69†	60†		
4.5-18/16	169	158	149	141	133	106	100	88†	77†	68†		
4.5-18/14	171	161	151	142	135	108	102	96	87†	76†		

DC-ADC	18′-0″	19′-0″	20′-0″	21′-0″	22′-0″	23′-0″	24′-0″	25′-0″	26′-0″	27′-0″		
6.0-18/18	173	164	155	140*	120	106*	94*	83*	73*	65*		
6.0-18/16	176	167	158	151	141†	116	109†	97†	86†	77†		
6.0-16/16	178	169	160	153	146	130†	112†	101†	90†	80†		
6.0-18/14	178	169	160	153	146	118	112	106†	94†	84†		

DC	24′-0″	25′-0″	26′-0″	27′-0″	28′-0″	29′-0″	30′-0″	31′-0″	32′-0″	33′-0″	34′-0″	35′-0″	36′-0″
7.5-18/18	138*	119*	106*	95*	85*	75*	67*	60*	53*	47*	41*	36*	31*
7.5-18/16	160	131	125	115*	104*	93*	84*	75*	67*	60*	54*	48*	42*
7.5-16/16	163	157	128	123	111*	100*	90*	81*	73*	65*	58*	52*	46*
7.5-18/14	163	133	127	121	116	108†	97†	88†	80†	73†	67†	61†	56†

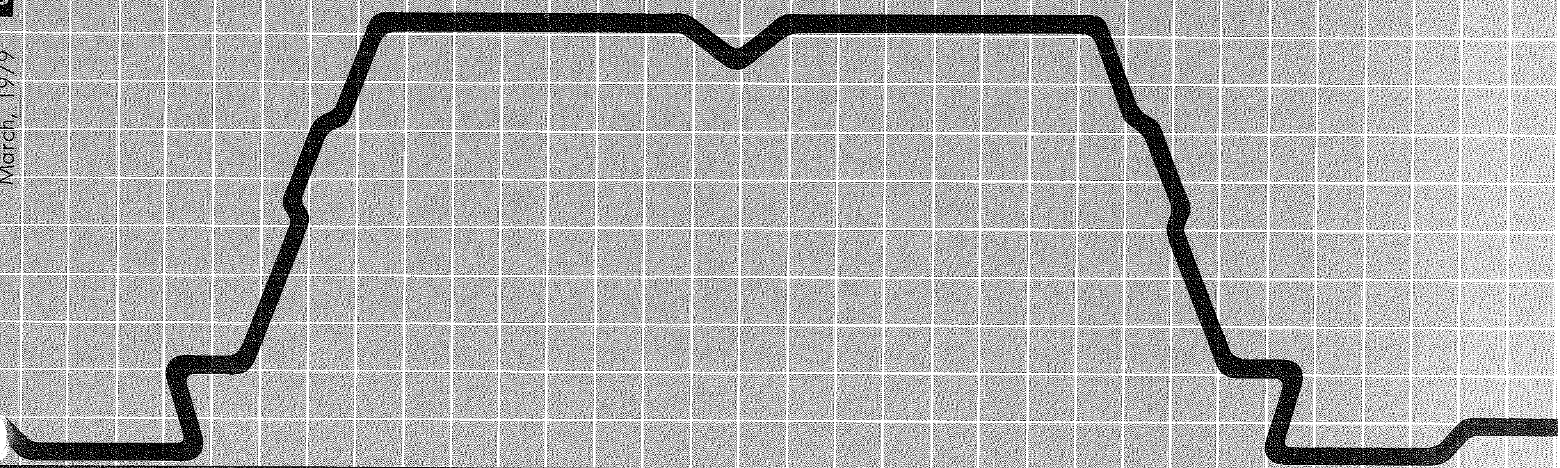
Recommended Span Limit → Heavy Floor Traffic | Normal Floor → Traffic | Roof Construction Only →

ADC	24′-0″	25′-0″	26′-0″	27′-0″	28′-0″	29′-0″	30′-0″	31′-0″	32′-0″	33′-0″	34′-0″	35′-0″	36′-0″
7.5-18/18	122*	109*	97*	86*	76*	68*	60*	53*	47*	41*	35*		
7.5-18/16	149*	130*	116*	104*	93*	83*	74*	66*	59*	52*	46*	41*	36*
7.5-16/16	162*	145*	125*	112*	101*	90*	81*	72*	65*	58*	51*	45*	40*
7.5-18/14	162	132	126*	121	113*	102*	92*	83*	75*	67*	60*	54*	48*

Recommended Span Limit → Heavy Floor Traffic | Normal Floor → Traffic | Roof Construction Only →

H. H. Robertson Co.
March, 1979

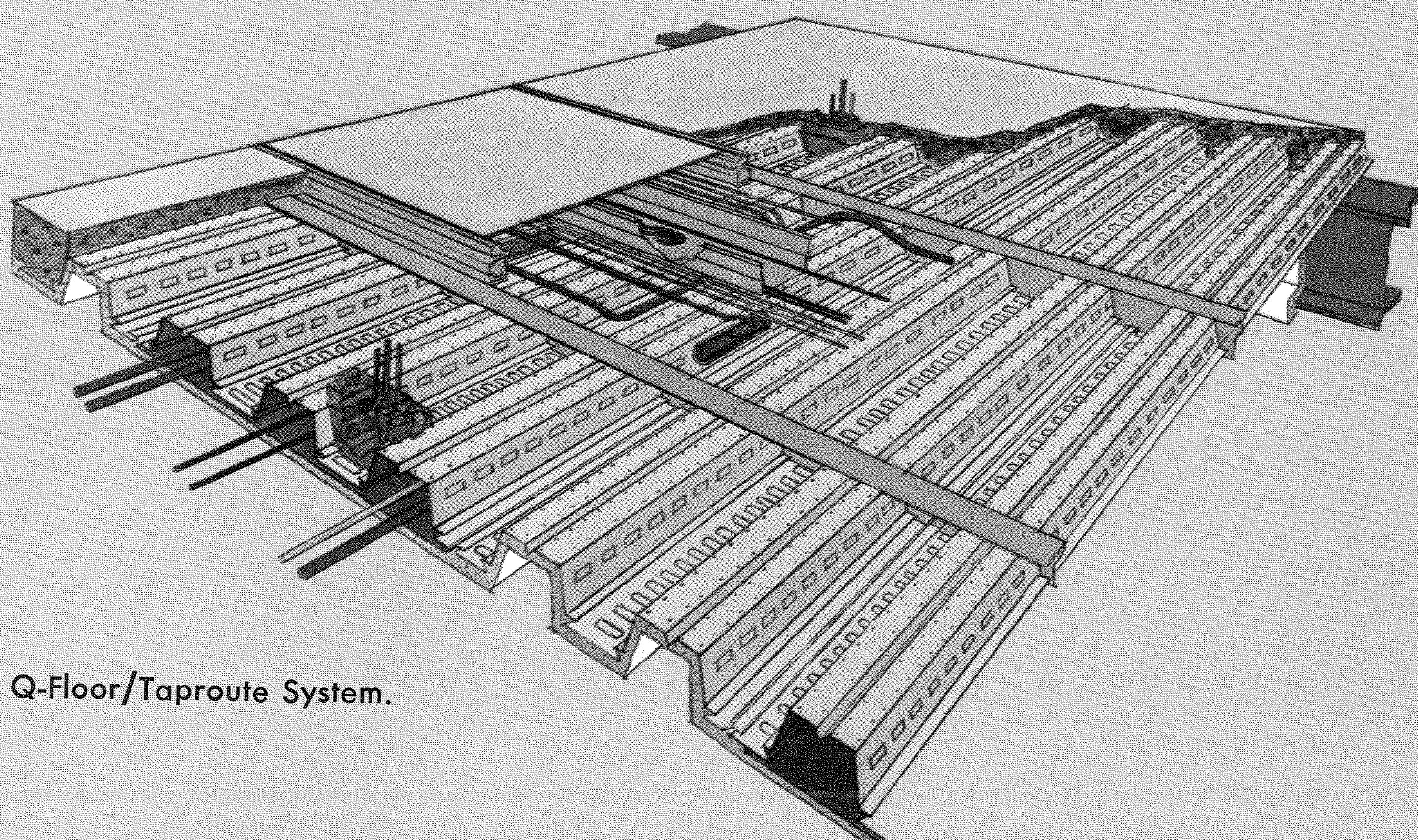
5 METAL DECKING
fluted & cellular



Q-Floor systems: Technical data guide

Robertson

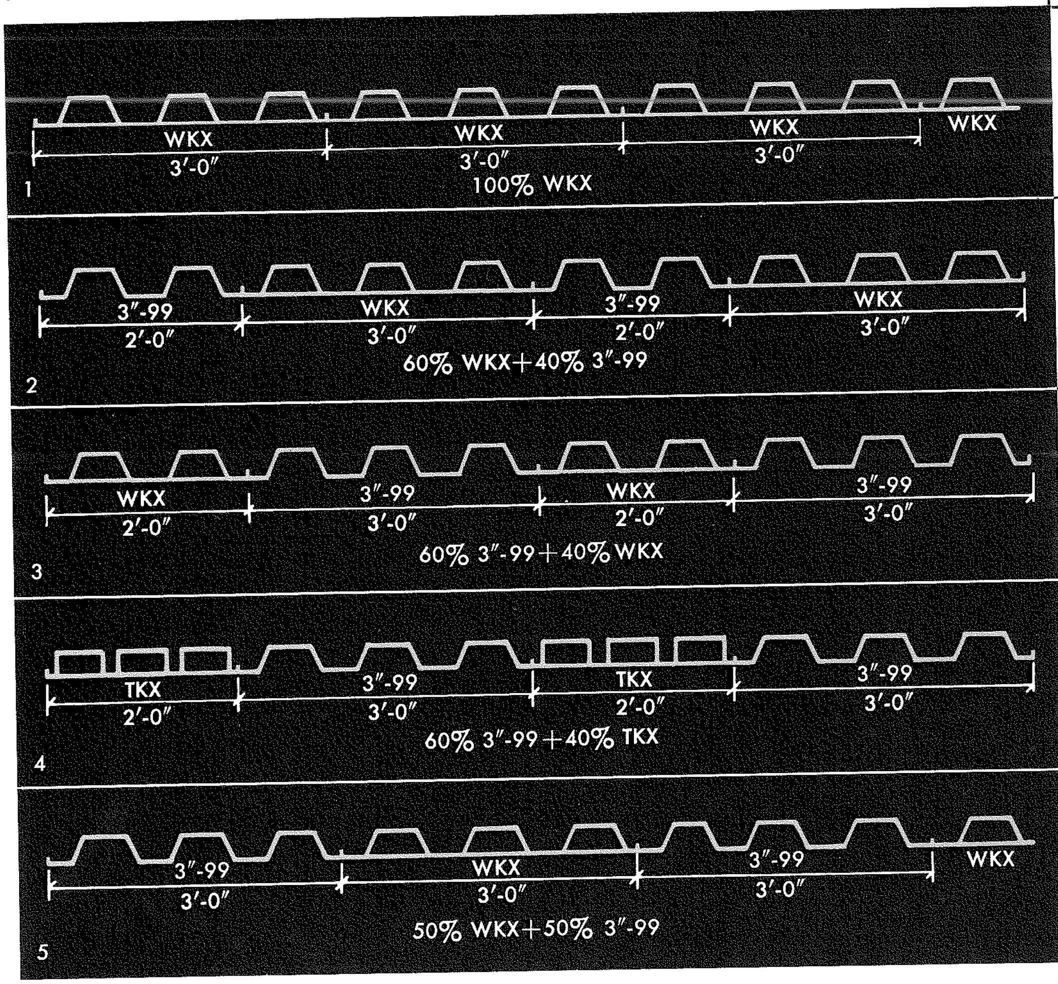
Table of contents



Q-Floor/Taproute System.

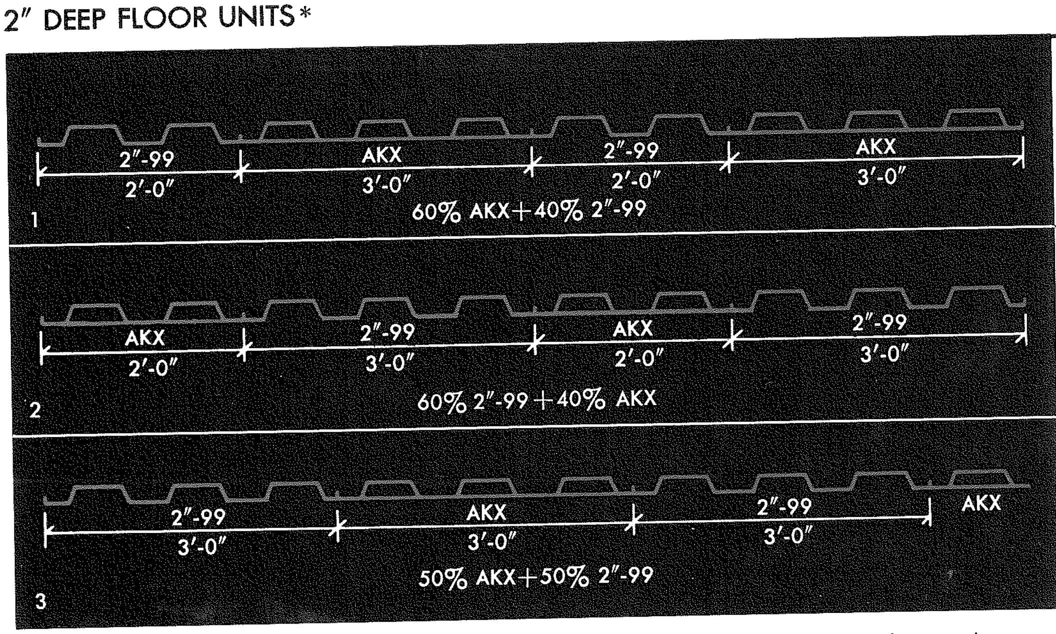
Module selection chart

3″ DEEP FLOOR UNITS*



	Basic Module	Compatible with Comp. Beam
1	3′-0″	YES
2	5′-0″	YES
3	5′-0″	YES
4	5′-0″	YES
5	6′-0″	YES

2″ DEEP FLOOR UNITS*



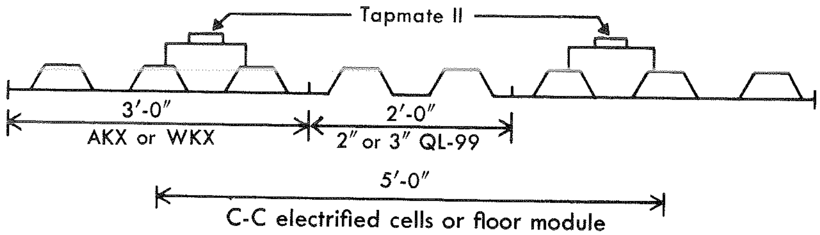
	Basic Module	Compatible with Comp. Beam
1	5′-0″	YES
2	5′-0″	YES
3	6′-0″	YES

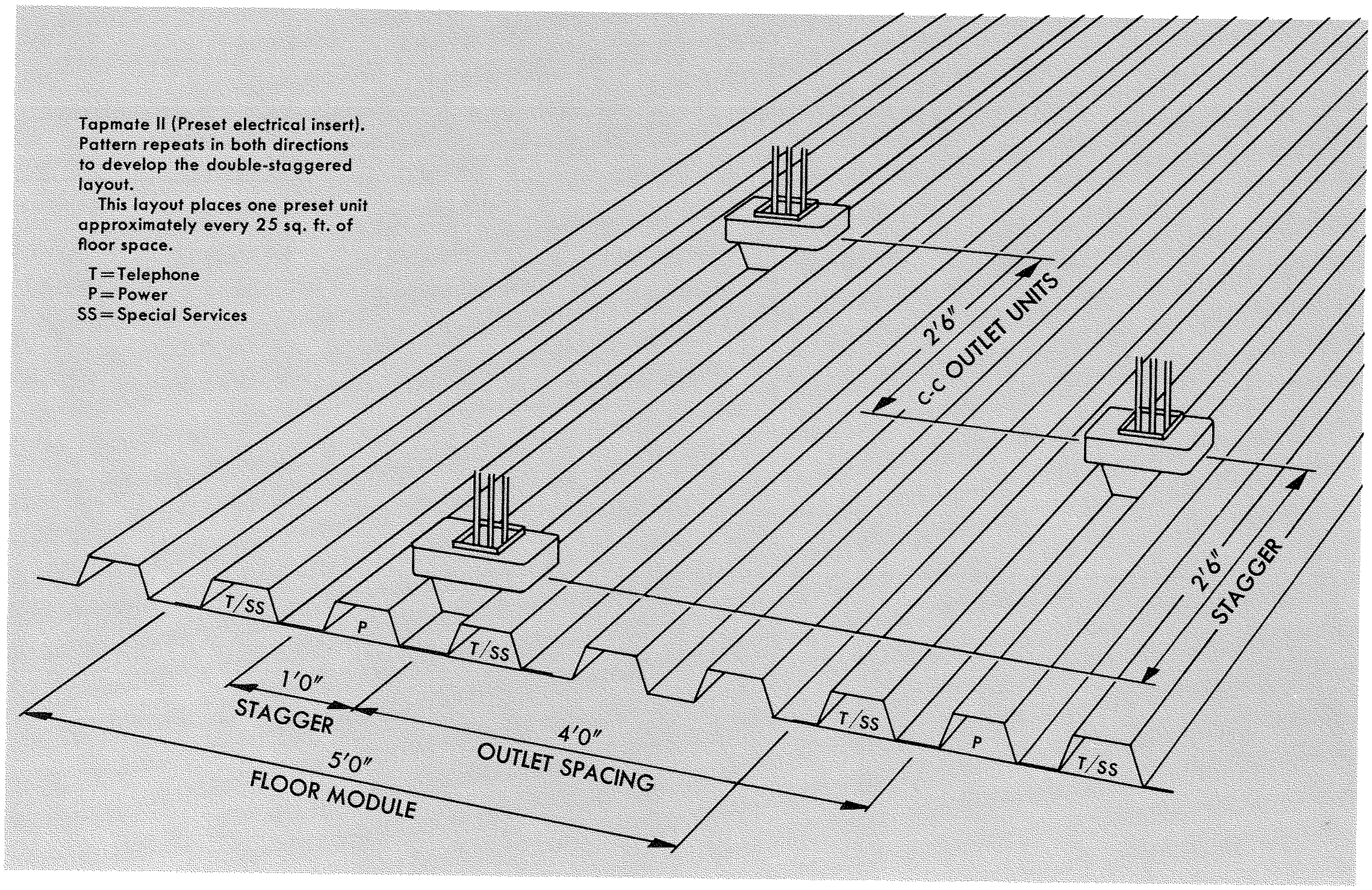
Note: Many other modules are possible but these are the most popular and economical.

*Nominal depth

Electrical flexibility

Ideally, a cellular floor system should provide power and telecommunication access for a standard 5′-0″ long desk at any location on the floor. This result is achieved most readily with a 100% cellular system. However, more economical blends of cellular and non-cellular units can accomplish very satisfactory results. An appropriate blend system can provide the required wiring access, either beneath the desk or within a very few inches of any desk, thus requiring only a very minor adjustment in desk location.





DOUBLE STAGGERED LAYOUT

The most efficient layout of preset outlets is attained by "staggering" successive outlet units along the cellular floor section centered on the power cell. If the outlet pattern in the adjacent floor module is then positioned midway between the first pattern, a "double-staggered" layout pattern of outlets will then result.

The "double-staggered" layout pattern can be overlaid on an office partition layout, or can be coordinated with modern office landscape arrangements to ensure electrical services at each work station.

Simple and economical changes in activating and deactivating outlets for future requirements is one of the inherent economies of the Q-Floor®/Taproute® System. Life cycle costing will establish that the more changes made, the sooner the initial investment for this total system is amortized.

New Dimensions-New Savings with Robertson 2+2 and 3+2 Q-Floor/Taproute System.

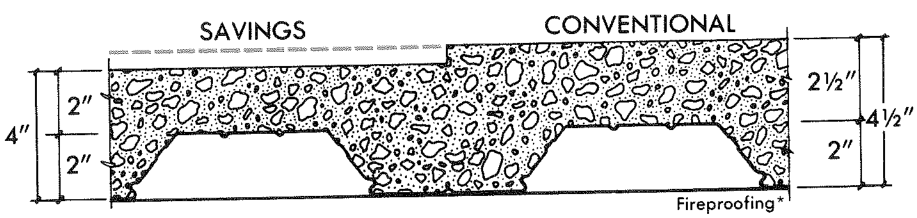
Major building codes make it mandatory for all floors in a building to have fire rated construction.

Fire tests requested by Robertson were conducted recently by Underwriters' Laboratories on floor assemblies involving 2″ of concrete fill over the top of the floor cells. These tests have resulted in approval for use of 2″ concrete fill over 2″ and 3″ depth steel deck, where formerly 2½″ of concrete, minimum, was required for a fire rated assembly. This reduction in concrete thickness can result in appreciable savings in building construction costs.

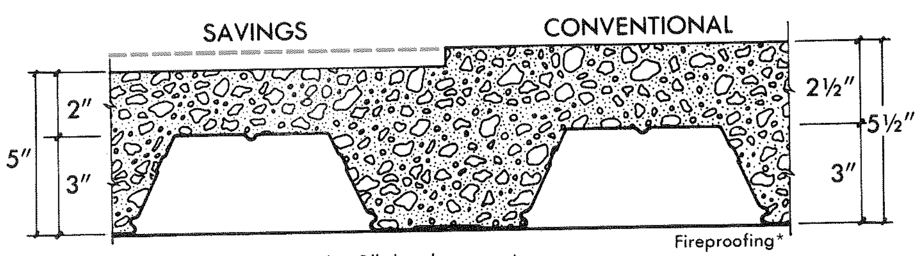
Called 2+2 and 3+2 the approved floor/deck designs reduce the floor slab depth by ½″, with a consequent reduction in building height and dead load. Structural integrity is not affected, and Robertson Tapmate preset outlets fit comfortably into the reduced depth, insuring electrical wiring capacity and flexibility.

In addition to the UL fire rating, all components of the system also have a UL electrical rating. 2+2 and 3+2 designs meet the requirements of all major building codes and comply with OSHA and the latest National Electric Code.

New Dimensions



2+2—2″ depth floor plus 2″ depth concrete.



3+2—3″ depth floor plus 2″ depth concrete.

*Fireproofing requirements vary with the type of concrete and required hourly rating. Refer to latest U.L. Fire resistance Index. Use design D859 for 2″ fill system.

New Savings

Slab Depth

9% to 11% less vertical height means corresponding savings in walls and other vertical structural, electrical and mechanical components.

Dead Load

12% to 14% less dead load—a reduction of ½″ regular weight concrete saves 6 lbs. per square foot.

Fill

12% to 14% less concrete fill required

Mass

Less mass—most economical design to meet seismic conditions.

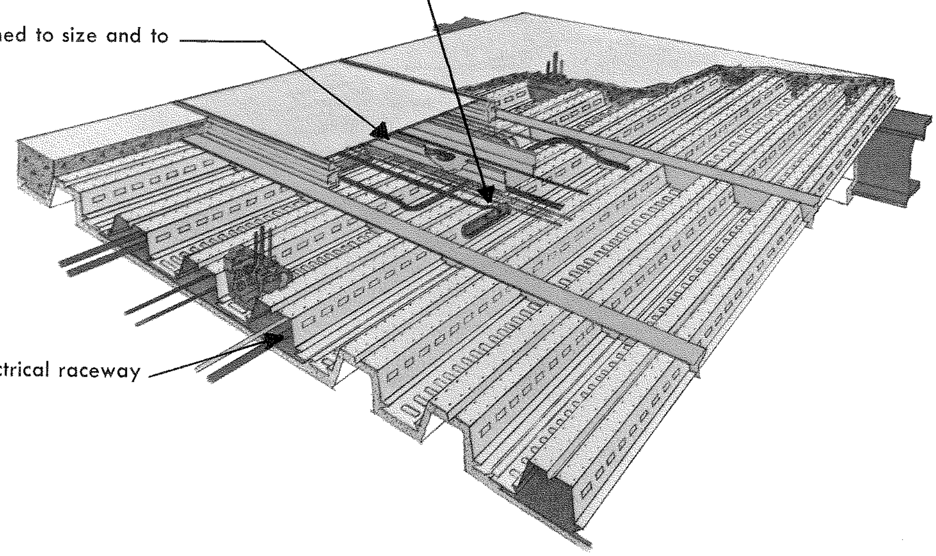
Note: All dimensions are nominal.

Q-Floor/Taproute System

Electrical Design Components

Side entry cell access holes for greater cell strength, ease of wiring and pulling telephone and special service cable.

The Tapway trench is designed to size and to meet system requirements.



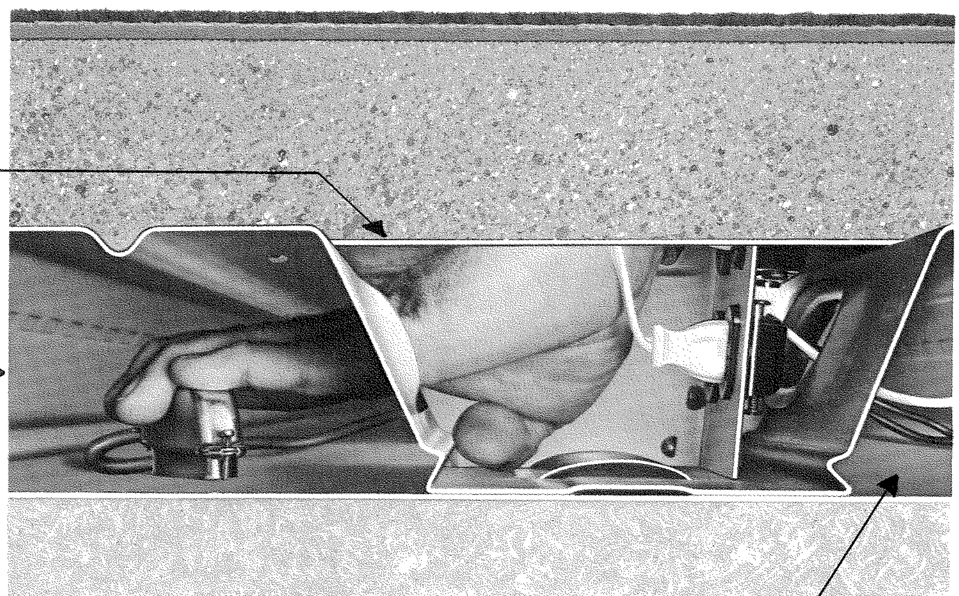
Large cells for maximum electrical raceway capacity.
2" cell provides 12 sq. in.
3" cell provides 18 sq. in.

Tapmate

Tapmate II preset outlet provides full workability in the field; note the "hand space".

Tapmate II preset insert

Telephone and Special Services Cell

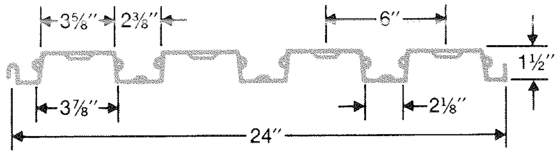


Power Cell

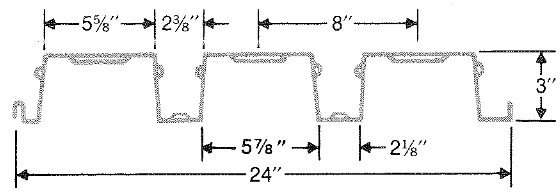
Profiles and Dimensions (Sections in same color may be blended together.)

COMPOSITE

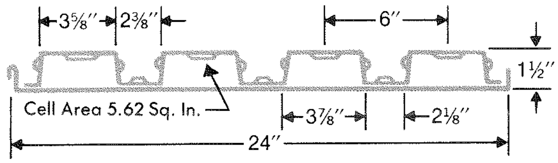
QL-3



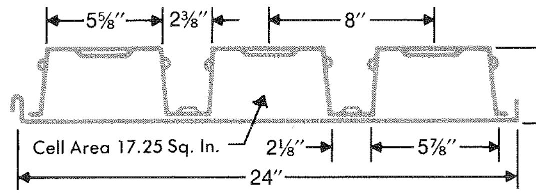
QL-21



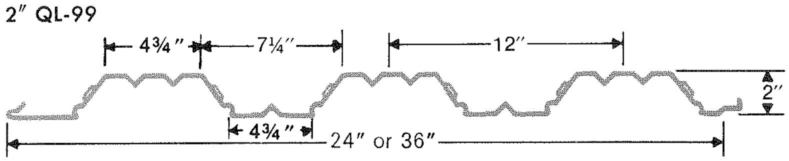
QL-UKX



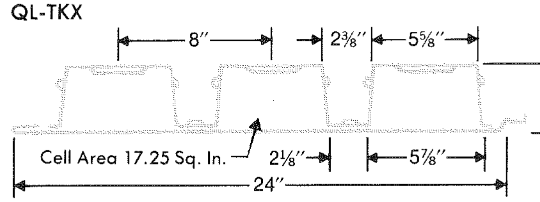
QL-NKX



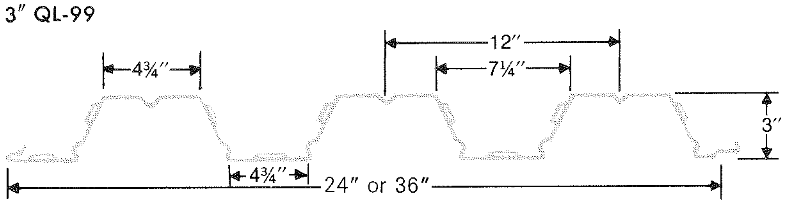
2″ QL-99



QL-TKX

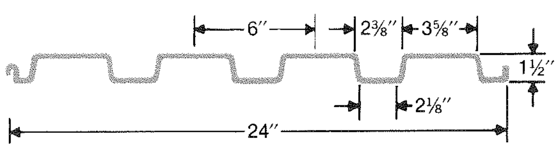


3″ QL-99

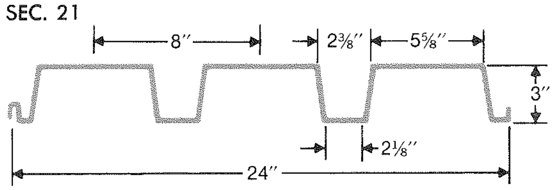


NON-COMPOSITE

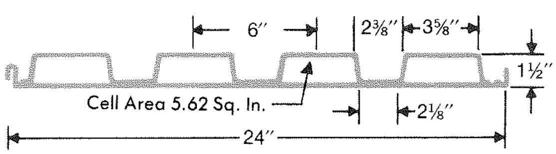
SEC. 3



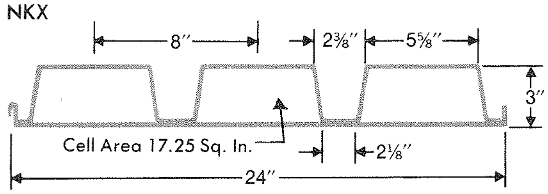
SEC. 21



UKX

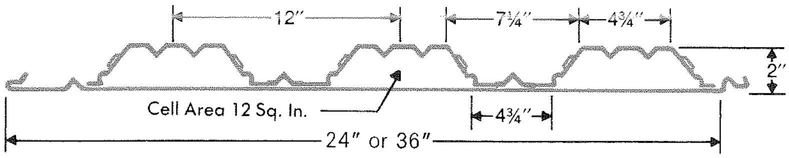


NKX

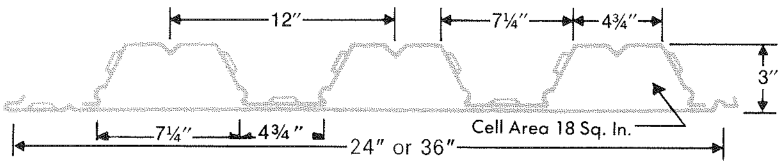


Note: All dimensions are nominal.

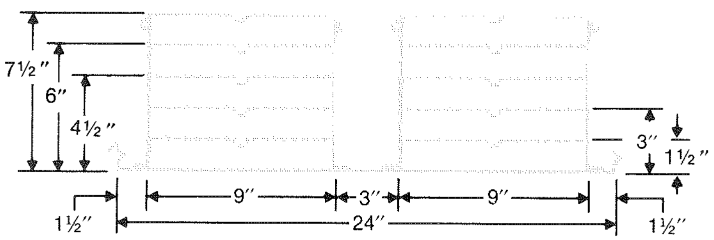
QL-AKX



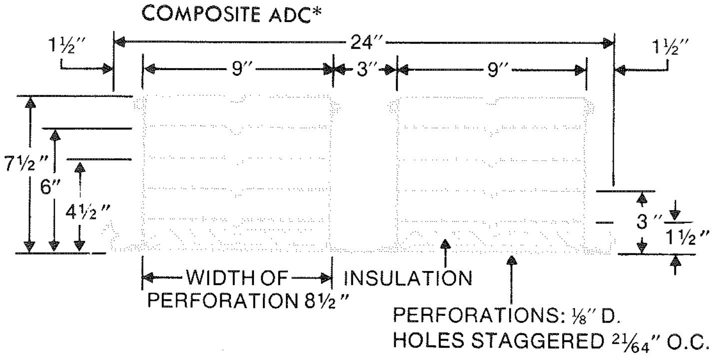
QL-WKX



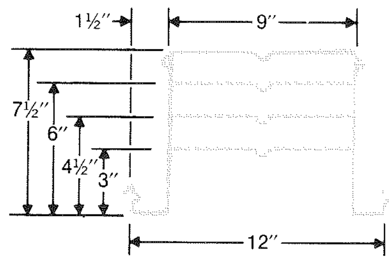
COMPOSITE DC*



COMPOSITE ADC*

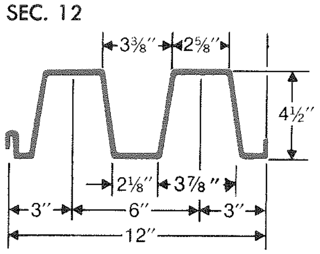


COMPOSITE SEC. 5*



*Self-aligning lips available only from Connersville, Indiana plant. Only hook-type lips are produced at Stockton, California plant.

SEC. 12



FKX

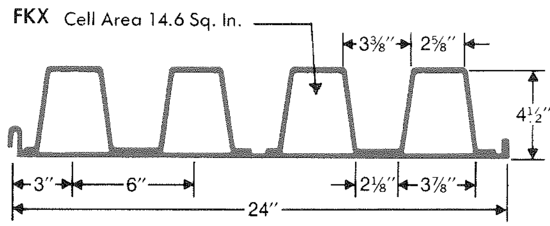


Table of properties

COMPOSITE

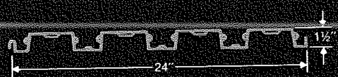
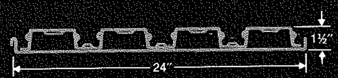
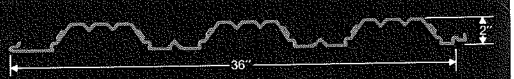
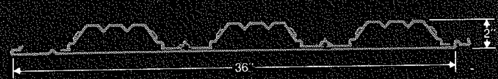
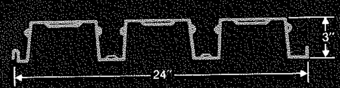
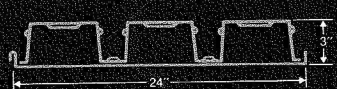
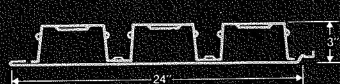
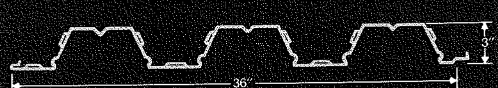
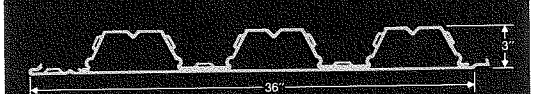
Deck	Section and Gauge	Actual Wt./Sq. Ft. Lbs.	I In.⁴	S In.³ +Moment	S In.³ —Moment
QL-3 	3-22	1.8	.180	.203	.209
	3-20	2.2	.230	.265	.261
	3-18	2.9	.337	.398	.363
	3-16	3.5	.442	.506	.459
QL-UKX 	UKX 20-20	3.8	.381	.310	.344
	UKX 20-18	4.3	.411	.317	.358
	UKX 18-20	4.4	.520	.462	.446
	UKX 18-18	4.8	.566	.472	.463
	UKX 18-16	5.3	.603	.481	.478
	UKX 16-16	5.8	.763	.654	.584
	UKX 16-14	6.5	.820	.667	.603
2" QL-99 NOTE: 24" width available 	2" 99-20	2.0	.419	.397	.363
	2" 99-18	2.7	.558	.525	.519
	2" 99-16	3.4	.698	.651	.647
QL-AKX NOTE: 2 cell, 24" width available 	AKX 20-20	3.4	.654	.448	.423
	AKX 20-18	3.9	.698	.455	.438
	AKX 18-20	4.1	.821	.585	.553
	AKX 18-18	4.5	.876	.596	.570
	AKX 18-16	5.0	.924	.604	.588
	AKX 16-16	5.7	1.104	.745	.723
QL-21 	21-22	2.1	.675	.386	.424
	21-20	2.6	.855	.500	.521
	21-18	3.5	1.258	.755	.714
	21-16	4.2	1.703	.982	.898
QL-NKX  QL-TKX 	NKX 20-20	4.2	1.431	.600	.654
	NKX 20-18	4.7	1.542	.613	.685
	NKX 18-20	5.0	1.951	.884	.843
	NKX 18-18	5.4	2.125	.909	.885
	NKX 18-16	5.8	2.226	.923	.919
	NKX 16-16	6.5	2.888	1.260	1.122
	NKX 16-14	7.2	3.084	1.285	1.165
3" QL-99 NOTE: 24" width available 	3" 99-22	1.8	.731	.439	.383
	3" 99-20	2.2	.913	.561	.486
	3" 99-18	2.9	1.221	.769	.712
	3" 99-16	3.7	1.531	.964	.964
QL-WKX NOTE: 2 cell, 24" width available 	WKX 20-20	3.6	1.505	.649	.668
	WKX 20-18	4.0	1.614	.660	.693
	WKX 18-20	4.5	1.894	.929	.872
	WKX 18-18	4.8	2.033	.946	.901
	WKX 18-16	5.2	2.150	.960	.928
	WKX 16-16	6.0	2.557	1.183	1.139

TABLE OF PROPERTIES NOTES:

1. Section properties for all sections have been computed in accordance with the A.I.S.I. "Specification For The Design of Cold-Formed Steel Structural Members" (Latest Edition).
2. All values given in the table are for one foot widths of units.
3. To find the total allowable uniformly distributed load per square foot for any floor section, divide the coefficient of bending for the proper deck span condition by the square of the deck span length in feet.
4. To find the allowable load per square foot which would cause a deck deflection no greater than 1/180th of the span, divide the coefficient of deflection for the appropriate span condition by the cube of the deck span length in feet. (For L/360 deflection limitation divide the listed coefficient by 2.0.)
5. It is generally considered good practice to limit the span of non-composite floor units to 25 times their depth and composite floor slabs to 32 times their depth. For composite units the depth should be considered as the total depth of concrete and deck.

Note: All dimensions are nominal.

Coefficient of Strength in Bending Simple Span	Coefficient of Strength in Bending 2 Spans	Coefficient of Strength in Bending 3 Spans	Coefficient of Deflection at 1/180 Simple Span	Coefficient of Deflection at 1/180 2 Spans	Coefficient of Deflection at 1/180 3 Spans
2,710 3,530 5,310 6,750	2,790 3,480 4,840 6,120	3,480 4,350 6,050 7,650	15,730 20,100 29,460 38,630	37,900 48,430 70,960 93,060	29,690 37,940 55,590 72,910
4,130 4,230 6,160 6,290 6,410 8,720 8,890	4,590 4,770 5,950 6,170 6,370 7,790 8,040	5,730 5,970 7,430 7,720 7,970 9,730 10,050	33,300 35,920 45,450 49,470 52,710 66,690 71,670	80,220 86,540 109,490 119,170 126,960 160,650 172,650	62,840 67,790 85,770 93,360 99,460 125,850 135,250
5,290 7,000 8,680	4,840 6,920 8,630	6,050 8,650 10,780	36,620 48,770 61,010	88,220 117,490 146,970	69,110 92,040 115,130
5,970 6,070 7,800 7,950 8,050 9,930	5,640 5,840 7,370 7,600 7,840 9,640	7,050 7,300 9,220 9,500 9,800 12,050	57,160 61,010 71,760 76,570 80,760 96,500	137,700 146,970 172,860 184,440 194,550 232,450	107,870 115,130 135,420 144,490 152,410 182,100
5,150 6,670 10,070 13,090	5,650 6,950 9,520 11,970	7,070 8,680 11,900 14,970	59,000 74,730 109,960 148,850	142,120 180,020 264,870 358,570	111,340 141,030 207,500 280,900
8,000 8,170 11,790 12,120 12,310 16,800 17,130	8,720 9,130 11,240 11,800 12,250 14,960 15,530	10,900 11,420 14,050 14,750 15,320 18,700 19,420	125,080 134,780 170,520 185,740 194,570 252,430 269,560	301,300 324,670 410,790 447,420 468,690 608,070 649,340	236,030 254,340 321,810 350,510 367,170 476,360 508,690
5,850 7,480 10,250 12,850	5,110 6,480 9,490 12,850	6,380 8,100 11,870 16,070	63,890 79,800 106,720 133,820	153,910 192,230 257,080 322,360	120,570 150,590 201,400 252,530
8,650 8,800 12,390 12,610 12,800 15,770	8,910 9,240 11,630 12,010 12,370 15,190	11,130 11,550 14,530 15,020 15,470 18,980	131,550 141,070 165,550 177,700 187,930 223,500	316,880 339,830 398,790 428,050 452,690 538,380	248,240 266,220 312,400 335,330 354,630 421,760

6. Coefficients of Strength in Bending and Coefficients of Deflection were determined from the appropriate "Beam Diagrams and Formulas for Various Static Loading Conditions" as presented in the AISC "Manual of Steel Construction," Seventh Edition. In determining the above coefficients, all spans are considered to be uniformly loaded and of equal length for multi-span conditions.

7. The coefficient of strength values shown above are based upon an allowable deck stress of 20,000 psi.

8. For load-span tables using these sections, see H. H. Robertson catalog "Q-Lock® Floors—Technical Data Book" (Q-115) latest edition.

Table of properties

NON-COMPOSITE

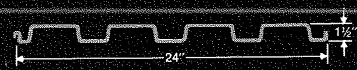
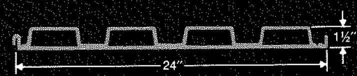
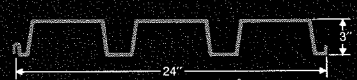
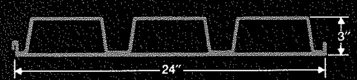
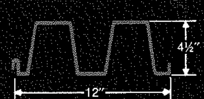
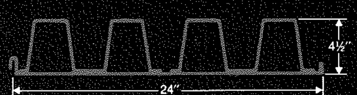
	Section and Gauge	Actual Wt./Sq. Ft. Lbs.	I In.^{4}	S In.^{3} +Moment	S In.^{3} −Moment
SEC. 3 	3-22	1.8	.180	.203	.219
	3-20	2.2	.230	.265	.273
	3-18	2.9	.337	.398	.380
	3-16	3.5	.442	.506	.480
	3-14	4.4	.562	.633	.592
	3-12	5.9	.756	.880	.880
UKX 	UKX 20-20	3.8	.381	.310	.439
	UKX 20-18	4.3	.411	.317	.456
	UKX 18-20	4.4	.520	.462	.570
	UKX 18-18	4.8	.566	.472	.591
	UKX 18-16	5.3	.603	.481	.609
	UKX 16-16	5.8	.763	.654	.745
	UKX 16-14	6.5	.820	.667	.769
	UKX 14-14	7.3	1.011	.893	.939
	UKX 12-12	9.9	1.373	1.353	1.330
SEC. 21 	21-22	2.1	.675	.386	.467
	21-20	2.6	.855	.500	.575
	21-18	3.5	1.258	.755	.787
	21-16	4.2	1.703	.982	.991
	21-14	5.2	2.264	1.261	1.230
	21-12	6.9	3.381	1.823	1.699
NKX 	NKX 20-20	4.2	1.431	.600	1.025
	NKX 20-18	4.7	1.542	.613	1.091
	NKX 18-20	5.0	1.951	.884	1.185
	NKX 18-18	5.4	2.125	.909	1.391
	NKX 18-16	5.8	2.226	.923	1.443
	NKX 16-16	6.5	2.888	1.260	1.760
	NKX 16-14	7.2	3.084	1.285	1.827
	NKX 14-14	8.1	3.903	1.746	2.226
	NKX 12-12	11.1	6.049	2.833	3.178
SEC. 12 	12-20	3.6	2.933	1.126	1.062
	12-18	4.9	4.078	1.610	1.534
	12-16	5.9	5.195	2.107	2.038
	12-14	7.3	6.180	2.694	2.570
	12-12	10.0	8.587	3.433	3.604
FKX 	FKX 18-18	6.5	5.93	1.90	1.834
	FKX 18-16	7.0	6.30	1.94	2.392
	FKX 16-16	7.9	7.57	2.49	2.491
	FKX 16-14	8.5	8.06	2.54	3.068
	FKX 14-14	9.8	9.02	3.18	3.140
	FKX 12-12	13.4	12.59	4.10	4.375

TABLE OF PROPERTIES NOTES:

1. Section properties for all sections have been computed in accordance with the A.I.S.I. "Specification For The Design of Cold-Formed Steel Structural Members" (Latest Edition).
2. All values given in the table are for one foot widths of units.
3. To find the total allowable uniformly distributed load per square foot for any floor section, divide the coefficient of bending for the proper deck span condition by the square of the deck span length in feet.
4. To find the allowable load per square foot which would cause a deck deflection no greater than 1/360th of the span, divide the coefficient of deflection for the appropriate span condition by the cube of the deck span length in feet. (For L/180 or L/240 deflection limitation, multiply the listed coefficient by 360/180 or 360/240.)

Note: All dimensions are nominal.

Coefficient of Strength in Bending Simple Span	Coefficient of Strength in Bending 2 Spans	Coefficient of Strength in Bending 3 Spans	Coefficient of Deflection at 1/360 Simple Span	Coefficient of Deflection at 1/360 2 Spans	Coefficient of Deflection at 1/360 3 Spans
2,710	2,920	3,650	7,870	18,950	14,840
3,530	3,640	4,550	10,050	24,210	18,970
5,310	5,070	6,330	14,730	35,480	27,790
6,750	6,400	8,000	19,320	46,530	36,450
8,440	7,890	9,870	24,560	59,170	46,350
11,730	11,730	14,670	33,040	79,590	62,350
4,130	5,850	6,460	16,650	40,110	31,420
4,230	6,080	6,600	17,960	43,270	33,900
6,160	7,600	9,500	22,730	54,740	42,890
6,290	7,880	9,830	24,740	59,590	46,680
6,410	8,120	10,020	26,350	63,480	49,730
8,720	9,930	12,420	33,350	80,330	62,930
8,890	10,250	12,820	35,840	86,330	67,630
11,910	12,520	15,650	44,180	106,430	83,380
18,040	17,730	22,170	60,000	144,540	113,230
5,150	6,230	7,780	29,500	71,060	55,670
6,670	7,670	9,580	37,370	90,010	70,510
10,070	10,490	13,120	54,980	132,440	103,750
13,090	13,210	16,520	74,430	179,290	140,450
16,810	16,400	20,500	98,940	238,340	186,720
24,310	22,650	28,320	147,760	355,940	278,840
8,000	13,670	12,500	62,540	150,650	118,020
8,170	14,530	12,770	67,390	162,340	127,170
11,790	15,800	18,420	85,270	205,390	160,900
12,120	18,550	18,940	92,870	223,710	175,250
12,310	19,240	19,230	97,280	234,340	183,580
16,800	23,470	26,250	126,220	304,040	238,180
17,130	24,360	26,770	134,780	324,670	254,340
23,280	29,680	36,380	170,570	410,890	321,890
37,770	42,370	52,960	264,360	636,810	498,870
15,010	14,160	17,700	128,180	308,770	241,890
21,470	20,450	25,570	178,220	429,320	336,320
28,090	27,170	33,970	227,040	546,910	428,440
35,920	34,270	42,830	270,090	650,610	509,680
45,770	48,050	60,070	375,280	904,010	708,190
25,330	24,450	30,570	259,160	624,290	489,060
25,870	31,890	39,870	275,330	663,240	519,570
33,200	33,210	41,520	330,840	796,940	624,310
33,870	40,910	51,130	352,250	848,520	664,720
42,400	41,870	52,330	394,210	949,590	743,900
54,670	58,330	72,920	550,230	1,325,420	1,038,320

5. It is generally considered good practice to limit the span of non-composite floor units to 25 times their depth.

6. The coefficient of strength values shown above are based upon an allowable deck stress of 20,000 psi.

7. Coefficients of Strength in Bending and Coefficients of Deflection were determined from the appropriate "Beam Diagrams and Formulas for Various Static Loading Conditions" as presented in the AISC "Manual of Steel Construction," Seventh Edition. In determining the above coefficients, all spans are considered to be uniformly loaded and of equal length for multi-span conditions.

Table of properties

COMPOSITE SECTIONS DC AND 5*

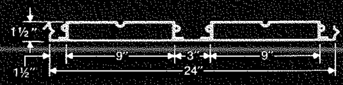
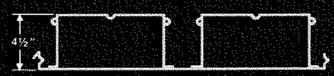
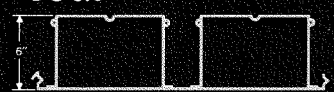
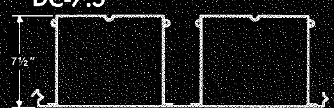
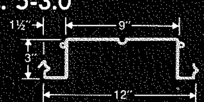
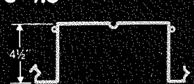
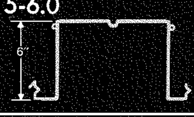
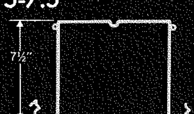
	Section and Gauge	Actual Wt./Sq. Ft. Lbs.	I In.^{4}	S In.^{3} +Moment	S In.^{3} —Moment
DC-1.5 	DC 1.5—20/18	4.0	0.356	0.256	0.479
	DC 1.5—18/18	4.6	0.519	0.425	0.534
	DC 1.5—18/16	5.1	0.558	0.433	0.643
	DC 1.5—16/16	5.8	0.732	0.640	0.721
DC-3.0 	DC 3.0—20/18	4.4	1.555	0.598	1.040
	DC 3.0—18/18	5.1	2.220	0.971	1.349
	DC 3.0—18/16	5.7	2.381	0.986	1.394
	DC 3.0—16/16	6.4	3.085	1.440	1.621
DC-4.5 	DC 4.5—20/18	4.6	3.799	1.027	1.664
	DC 4.5—18/18	5.4	5.319	1.621	1.974
	DC 4.5—18/16	5.9	5.708	1.649	2.232
	DC 4.5—16/16	6.8	7.315	2.367	2.628
DC-6.0 	DC 6.0—18/18	6.0	10.000	2.365	2.814
	DC 6.0—18/16	6.4	10.738	2.412	3.147
	DC 6.0—16/16	7.3	13.642	3.407	3.729
	DC 6.0—16/14	8.0	14.697	3.476	3.980
DC-7.5 	DC 7.5—18/18	6.6	16.439	3.198	3.729
	DC 7.5—18/16	6.9	17.659	3.268	4.136
	DC 7.5—16/16	8.0	22.280	4.558	4.922
	DC-7.5—16/14	9.2	23.994	4.658	5.233
SEC. 5-3.0 	5-3.0-20	2.7	0.851	0.487	0.595
	5-3.0-18	3.6	1.296	0.735	0.788
	5-3.0-16	4.5	1.748	0.945	0.980
	5-3.0-14	5.4	2.260	1.196	1.216
SEC. 5-4.5 	5-4.5-20	3.1	2.198	0.855	1.032
	5-4.5-18	4.1	3.250	1.269	1.369
	5-4.5-16	5.1	4.382	1.636	1.707
	5-4.5-14	6.5	5.682	2.077	2.122
SEC. 5-6.0 	5-6.0-18	4.6	6.295	1.878	2.038
	5-6.0-16	5.7	8.469	2.426	2.542
	5-6.0-14	7.2	10.992	3.087	3.164
SEC. 5-7.5 	5-7.5-18	5.1	10.591	2.561	2.788
	5-7.5-16	6.4	14.209	3.311	3.480
	5-7.5-14	7.9	18.441	4.217	4.333
	5-7.5-13	9.4	22.360	5.110	5.186
	5-7.5-12	10.9	26.352	6.026	6.026

TABLE OF PROPERTIES NOTES:

1. Section properties for all sections have been computed in accordance with the A.I.S.I. "Specification For The Design of Cold-Formed Steel Structural Members" (Latest Edition).

2. All values given in the table are for one foot widths of units.

3. To find the total allowable uniformly distributed load per square foot for any floor section, divide the coefficient of bending by the square of the deck span length in feet.

4. To find the allowable load per square foot which would cause a deck deflection no greater than 1/180th of the span, divide the coefficient of deflection by the cube of the deck span length in feet. (For L/240 or L/360 deflection limitation, multiply the listed coefficient by 180/240 or 180/360.)

5. It is generally considered good practice to limit the span of these floor units to 30 times their depth when acting non-compositely and 36 times their depth when acting compositely. (Consider depth as total depth of concrete and deck for composite units.)

6. The Coefficient of Strength values shown above are based upon an allowable deck stress of 20,000 psi.

Note: All dimensions are nominal.

	Coefficient of Strength in Bending Simple Span	Coefficient of Strength in Bending 2 Spans	Coefficient of Strength in Bending 3 Spans	Coefficient of Deflection at 1/180 Simple Span	Coefficient of Deflection at 1/180 2 Spans	Coefficient of Deflection at 1/180 3 Spans
	3,410 5,670 5,770 8,530	6,070 7,120 8,570 9,610	5,330 8,850 9,020 12,020	31,120 45,360 48,770 63,980	74,960 109,280 117,490 154,120	58,720 85,610 92,040 120,740
	7,970 12,950 13,150 19,200	13,870 17,990 18,590 21,610	12,460 20,230 20,540 27,020	135,920 194,040 208,120 269,650	327,410 467,430 501,320 649,550	256,490 366,180 392,730 508,850
	13,690 21,610 21,990 31,560	22,190 26,320 29,760 35,040	21,400 32,900 34,350 43,800	332,060 464,920 498,920 639,380	799,890 1,119,930 1,201,830 1,540,190	626,620 877,340 941,500 1,206,570
	31,530 32,160 45,430 46,350	37,520 41,960 49,720 53,070	46,900 50,250 62,150 66,330	874,070 938,580 1,192,410 1,284,620	2,105,520 2,260,910 2,872,350 3,094,480	1,649,440 1,771,170 2,250,170 2,424,180
	42,640 43,570 60,770 62,110	49,720 55,150 65,630 69,770	62,150 68,080 82,030 87,220	1,436,880 1,543,520 1,947,430 2,097,240	3,461,260 3,718,140 4,691,100 5,051,980	2,711,510 2,912,750 3,674,950 3,957,670
	6,490 9,800 12,600 15,950	7,930 10,510 13,070 16,210	9,920 13,130 16,330 20,270	74,380 113,280 152,790 197,540	179,180 272,880 368,040 475,850	140,370 213,770 288,320 372,770
	11,400 16,920 21,810 27,690	13,760 18,250 22,760 28,290	17,200 22,820 28,450 35,370	192,120 284,070 383,020 496,650	462,790 684,290 922,640 1,196,360	362,550 536,070 722,780 937,210
	25,040 32,350 41,160	27,170 33,890 42,190	33,970 42,370 52,730	550,230 740,250 960,780	1,325,420 1,783,160 2,314,390	1,038,320 1,396,910 1,813,060
	34,150 44,150 56,230 68,130 80,350	37,170 46,400 57,770 69,150 80,350	46,470 58,000 72,220 86,430 100,430	925,730 1,241,970 1,611,870 1,954,420 2,303,350	2,229,960 2,991,730 3,882,790 4,707,940 5,548,470	1,746,920 2,343,690 3,041,730 3,688,150 4,346,600

7. Coefficients of Strength in Bending and Coefficients of Deflection were determined from the appropriate "Beam Diagrams and Formulas for Various Static Loading Conditions" as presented in the AISC "Manual of Steel Construction," Seventh Edition. In determining the above coefficients, all spans are considered to be uniformly loaded and of equal length for multi-span conditions.

GENERAL NOTES:

1. Other gauge combinations are available—but these are the most efficient in composite design.

2. Properties for non-composite sections are the same as the above composite sections.

3. For load-span tables using the above sections and various concrete slabs, see H. H. Robertson long-span floor/ceiling systems catalog Q-132 (latest edition).

*Self-aligning lips available only from Connersville, Indiana plant. Only hook-type lips are produced at Stockton, California plant.

Table of properties

COMPOSITE SECTION ADC*

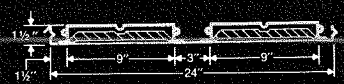
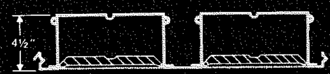
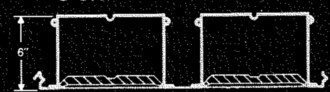
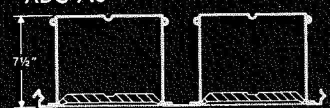
	Section and Gauge	Actual Wt./Sq. Ft. Lbs.	I $In.^4$	S $In.^3$ +Moment	S $In.^3$ —Moment
ADC 1.5 	ADC 1.5—20/18	3.8	0.345	0.254	0.437
	ADC 1.5—18/18	4.4	0.499	0.422	0.486
	ADC 1.5—18/16	4.9	0.538	0.430	0.597
	ADC 1.5—16/16	5.5	0.702	0.634	0.647
ADC 3.0 	ADC 3.0—20/18	4.1	1.505	0.594	0.995
	ADC 3.0—18/18	4.9	2.137	0.963	1.115
	ADC 3.0—18/16	5.4	2.296	0.978	1.353
	ADC 3.0—16/16	5.8	2.961	1.427	1.474
ADC 4.5 	ADC 4.5—20/18	4.6	3.673	1.018	1.616
	ADC 4.5—18/18	5.4	5.120	1.605	1.833
	ADC 4.5—18/16	5.9	5.501	1.634	2.188
	ADC 4.5—16/16	6.8	7.026	2.344	2.411
ADC 6.0 	ADC 6.0—18/18	6.0	9.626	2.339	2.630
	ADC 6.0—18/16	6.4	10.345	2.387	3.085
	ADC 6.0—16/16	7.3	13.110	3.372	3.446
	ADC 6.0—16/14	8.0	14.133	3.441	3.894
ADC 7.5 	ADC 7.5—18/18	6.6	15.828	3.160	3.503
	ADC 7.5—18/16	6.9	17.008	3.231	4.056
	ADC 7.5—16/16	8.0	21.424	4.504	4.574
	ADC 7.5—16/14	9.2	23.076	4.606	5.120

TABLE OF PROPERTIES NOTES:

1. Section properties for all sections have been computed in accordance with the A.I.S.I. "Specification For The Design of Cold-Formed Steel Structural Members" (Latest Edition).

Note: All dimensions are nominal.

2. All values given in the table are for one foot widths of units.

3. To find the total allowable uniformly distributed load per square foot for any floor section, divide the coefficient of bending for the proper deck span condition by the square of the deck span length in feet.

4. To find the allowable load per square foot which would cause a deck deflection no greater than 1/180th of the span, divide the coefficient of deflection for the appropriate span condition by the cube of the deck span length in feet. (For L/240 or L/360 deflecton limitation, multiply the listed coefficient by 180/240 or 180/360.)

5. It is generally considered good practice to limit the span of non-composite floor units to 30 times their depth and composite floor units to 36 times their depth. For composite units the depth should be considered as the total depth of concrete and deck.

6. The coefficient of strength values shown above are based upon an allowable deck stress of 20,000 psi.

	Coefficient of Strength in Bending Simple Span	Coefficient of Strength in Bending 2 Spans	Coefficient of Strength in Bending 3 Spans	Coefficient of Deflection at 1/180 Simple Span	Coefficient of Deflection at 1/180 2 Spans	Coefficient of Deflection at 1/180 3 Spans
	3,390 5,630 5,730 8,450	5,830 6,480 7,960 8,630	5,290 8,100 8,960 10,780	30,160 43,620 47,020 61,360	72,640 105,070 113,280 147,810	56,910 82,310 88,740 115,790
	7,920 12,840 13,040 19,030	13,270 14,870 18,040 19,650	12,380 18,580 20,380 24,570	131,550 186,790 200,690 258,810	316,880 449,950 483,430 623,440	248,240 352,490 378,710 488,400
	13,570 21,400 21,790 31,250	21,550 24,440 29,170 32,150	21,210 30,550 34,040 40,180	321,050 447,520 480,830 614,120	773,360 1,078,030 1,158,250 1,479,340	605,840 844,510 907,360 1,158,900
	31,190 31,830 44,960 45,880	35,070 41,130 45,950 51,920	43,830 49,730 57,430 64,900	841,380 904,230 1,145,910 1,235,320	2,026,770 2,178,160 2,760,340 2,975,730	1,587,750 1,706,350 2,162,420 2,331,150
	42,130 43,080 60,050 61,410	46,710 54,080 60,990 68,270	58,380 67,310 76,230 85,330	1,383,480 1,486,620 1,872,610 2,017,000	3,332,620 3,581,070 4,510,870 4,858,700	2,610,730 2,805,370 3,533,760 3,806,250

7. Coefficients of Strength in Bending and Coefficients of Deflection were determined from the appropriate "Beam Diagrams and Formulas for Various Static Loading Conditions" as presented in the AISC "Manual of Steel Construction," Seventh Edition. In determining the above coefficients all spans are considered to be uniformly loaded and of equal length for multi-span conditions.

GENERAL NOTES:

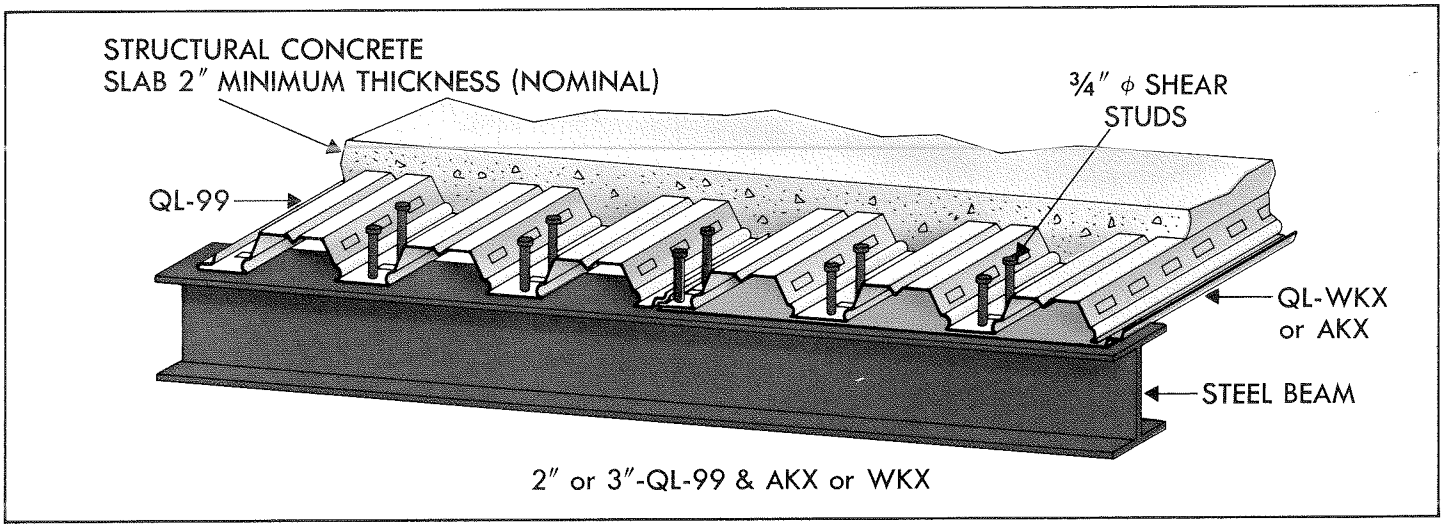
1. Other gauge combinations are available—but these are the most efficient in composite design.

2. Properties for non-composite sections are the same as the above composite sections.

3. For load-span tables using the above sections and various concrete slabs, see H. H. Robertson long-span floor/ceiling systems catalog Q-132 (latest edition).

*Self-aligning lips available only from Connersville, Indiana plant. Only hook-type lips are produced at Stockton, California plant.

Composite beam design



STUDS CAN ATTAIN THEIR FULL CAPACITY WITH EITHER FLOOR UNIT.

Composite beam design has long been recognized as a basic design method of maximizing the advantages of concrete and steel. For years, bridge design has utilized steel and concrete acting compositely to effect construction cost savings. More recently, the same design principles have been utilized in many types of structural designs for buildings.

Composite beam design is fast becoming a standard for design. As a result of this, guidelines for its use are found in Sec. 1.11 of the current AISC specification. The manual further notes the most common methods of developing composite action between the concrete slab and the steel beam. Of those mentioned, the most economical and most frequently used is the stud shear connector.

By welding stud shear connectors to the top flange of floor beams, a portion of the concrete slab can be made to act in conjunction with the beams in resisting vertical loads. The stud shear connectors transfer horizontal shear from the concrete slab to the steel beam. They also prevent a vertical separation of these two structural elements. In essence, they mechanically interlock concrete with steel to form a series of T-beam sections.

By reducing the size and weight of steel beams, as compared to a non-composite frame, a savings of from 15 to 30 percent can be realized in the structural frame installed cost. Smaller structural members also permit a reduction in ceiling to floor height.

Other advantages made possible by utilizing composite beam design include increased beam stiffness, reduced deflection, and less beam fireproofing.

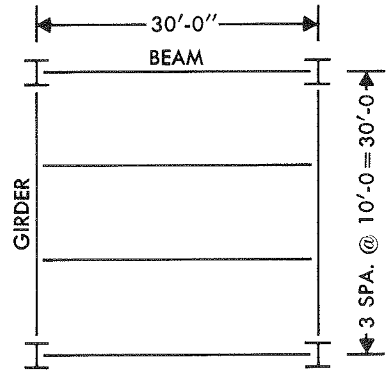
And composite beam design makes larger bay sizes, with their many advantages, economically practical.

A composite beam with stud shear connectors, coupled with a composite Q-Lock floor, is an even more desirable application of product function. It is important, however, to realize that minor design differences in product may substantially affect efficient utilization. Exhaustive research at Robertson's Building Products Technical Center has confirmed that the rib geometry of the steel floor has a profound effect upon the shear value of stud shear connectors. Both 3″ QL-99 and 2″ QL-99 profiles were designed specifically for use with composite beam construction.

To assist you in analysis of the benefits of composite beam construction, the following comparisons relate three solutions to a design hypothesis:

Design Comparison

GIVEN:
Bay Size: 30′-0 x 30′-0
Live Load = 100 psf
Req'd Fire Rating = 2 hrs.
Deck = 3″ QL-99-20
Concrete Slab = 6¼″ Total Depth
Concrete = 3,000 psi Lightweight (110 pcf)
Steel Beams = ASTM-A-36



SCHEME I:
Composite Slab, Non-composite Beam, Non-Composite Girder
Required Beam = W18 x 50
Required Girder = W27 x 94
Weight of Steel Floor Beams and Girders per sq. ft. = 8.14#

SCHEME II:
Composite Slab, Composite Beam, Non-Composite Girder
Required Beam = W18 x 35 with 16—¾″ ϕ Studs
Required Girder = W27 x 94
Weight of Steel Floor Beams and Girders per sq. ft. = 6.64#

SCHEME III:
Composite Slab, Composite Beam, Composite Girder
Required Beam = W18 x 35 with 16—¾″ ϕ Studs
Required Girder = W24 x 76 with 40—¾″ ϕ Studs
Weight of Steel Floor Beams and Girders per sq. ft. = 6.04#

Please refer to Robertson catalog Q-141 (latest edition) for design load/span tables for available Robertson composite beam/composite floor variations.

Structural diaphragm design

Introduction

The resultant wind force on a building is a function of the height and shape of the structure as well as area and wind velocity. The resultant seismic force on a building is a function of mass and intensity of shock. Wind forces are applied at the surface of the building; whereas seismic forces are applied at the center of mass under acceleration.

Massiveness in a building in the form of heavy walls, partitions, and floors may assist in the resistance of wind forces but in the case of an earthquake, the same elements which provide lateral resistance also generate inertia forces due to their weight which may more than offset their structural capacity.

In a multi-storied structure subjected to earthquake shock, heavy floors and partitions which have adequate strength for any one tier, may by reason of inherent mass contribute to high column and beam stresses in lower tiers.

Regardless of dead load consideration, adequate horizontal bracing must be provided at each floor level to properly distribute lateral forces to the columns, walls or vertical bracing systems. This horizontal bracing system may be in the form of horizontal trusswork, or may utilize the strength of the floor material, acting as a diaphragm for stress transferring purposes. Economy usually dictates the use of the latter method.

A floor diaphragm material possessing the characteristics of light weight and high strength is very desirable for use as a stress distributing medium. It reduces, or eliminates, the necessity for bracing, and at the same time contributes minimum mass to the generation of inertia forces.

Such a material is available in the form of Robertson Composite Beam/Composite Q-Floor Systems.

Design

A structural diaphragm, as considered by the architect or engineer, is an element which acts as a beam having its web placed in a horizontal position in order that it may efficiently resist lateral forces applied to the building. The web of the beam in this analogy is the composite slab. The flanges of the beam are the marginal supporting members on all four sides of the diaphragm. The web is considered to resist shearing forces only, whereas the flanges resist flexural forces only.

The proportion of marginal beam assumed to act as a flange is a matter of judgment. The deeper the beam, the smaller the proportion which may be considered to be effective for diaphragm flange purposes. A conservative approach suggests the use of the top flange only for this function. Data, as published in Robertson catalog Q-135, is based upon the test condition that the diaphragm always has flanges in some form.

These flanges may be:

a) Rolled structural beams, not part thereof.

b) A continuously welded bearing plate.

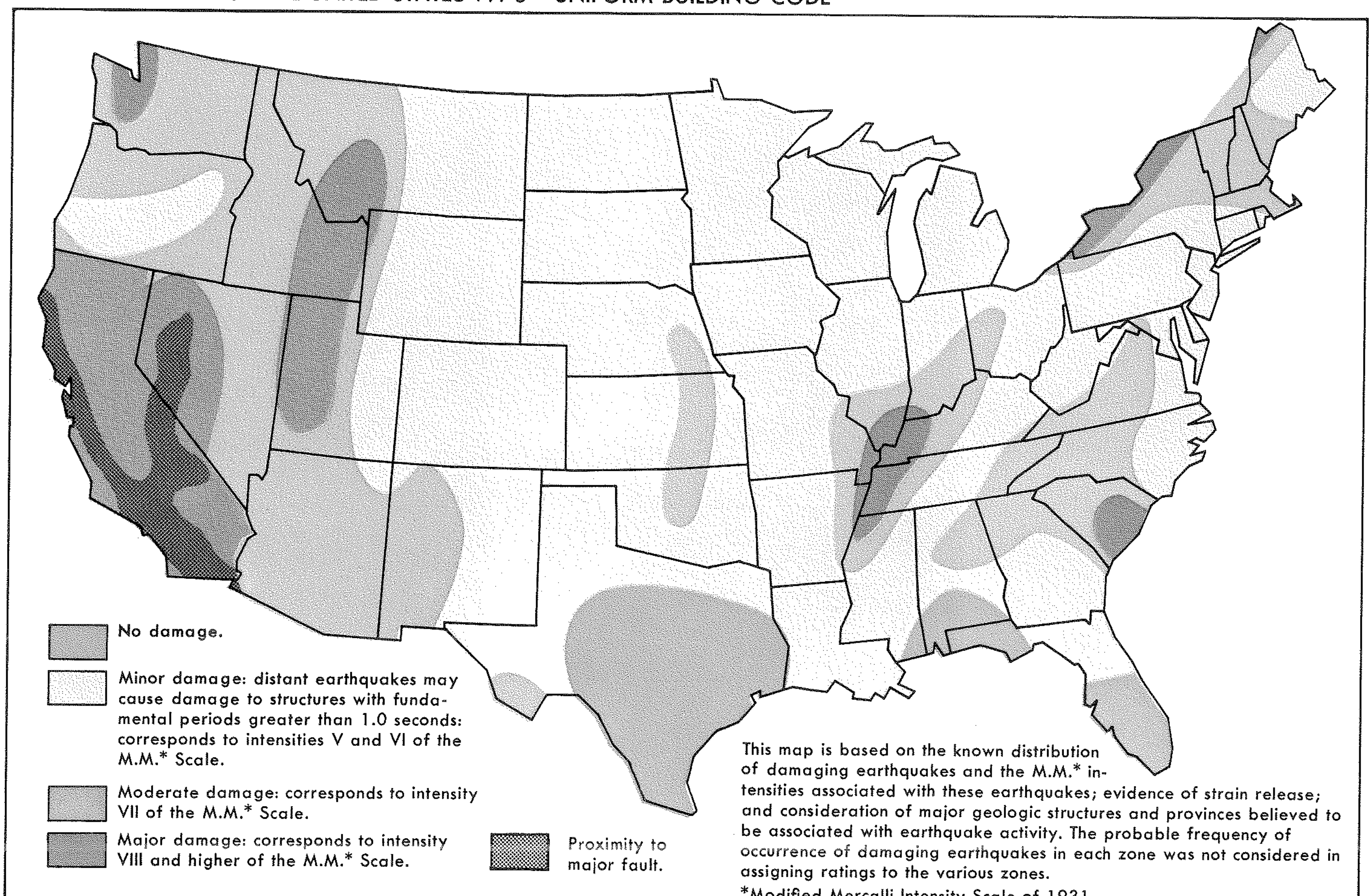
Such flanges must function on all four edges of the diaphragm.

Shear Distribution

Shear distribution is governed by the flexibility of diaphragm. In the extremes, a diaphragm may be described as being flexible or rigid. Most diaphragms, however, fall between these extremes.

The measure of flexibility is the flexibility factor 'F' measured in units of

SEISMIC ZONE MAP OF THE UNITED STATES 1976—UNIFORM BUILDING CODE



microinches per unit perimeter shear, where perimeter shear is expressed in pounds per foot. Diaphragm flexibility ranges from 'very flexible' (F 150) to 'rigid' (F 1). Between these two extremes, three other flexibility categories are defined, namely: 'flexible,' 'semi-flexible' and 'semi-rigid.'

In the case of rigid diaphragms, horizontal forces applied to the diaphragm are transferred to the supporting members in proportion to their relative stiffnesses (i.e.—the diaphragm is assumed to be inflexible relative to the supports).

A flexible diaphragm is just the opposite: The vertical supports are considered to be non-yielding because the stiffness of the vertical supporting members relative to the stiffness of the diaphragm is great. Thus the horizontal loading taken by the vertical supporting members is in proportion to the contributing areas without continuity effects.

The semi-rigid and semi-flexible diaphragms display characteristics of both the rigid and flexible diaphragms. The horizontal support reactions are influenced by both the stiffness of the diaphragm and the vertical members. The action is analogous to a continuous beam system of appreciable stiffness on yielding supports. Due to the difficulty of analyzing such a system, it is common to make certain reasonable simplifying assumptions which will yield a satisfactory solution.

Application

Steel floor units can play an important role in transferring the lateral forces acting on a steel frame structure. Properly welded to the beams and girders, these units will form a diaphragm with the framing members which transfers wind or seismic related horizontal forces to the columns. After the concrete has been placed over the floor units and allowed to cure the diaphragm's capacity for shear transfer is greatly increased.

Tests were conducted at Los Angeles and Stockton, California in 1949 and 1963 respectively, under the direction of S. B. Barnes & Associates, Consulting Engineers, for the purpose of evaluating Robertson Q-Floor and Q-Deck as a structural diaphragm. The tests were also aimed at the development of a system of data in which a structural design could take advantage of the potential diaphragm strength in the design of buildings. The data thus generated is in the form of tabulated shear values and flexibility factors.

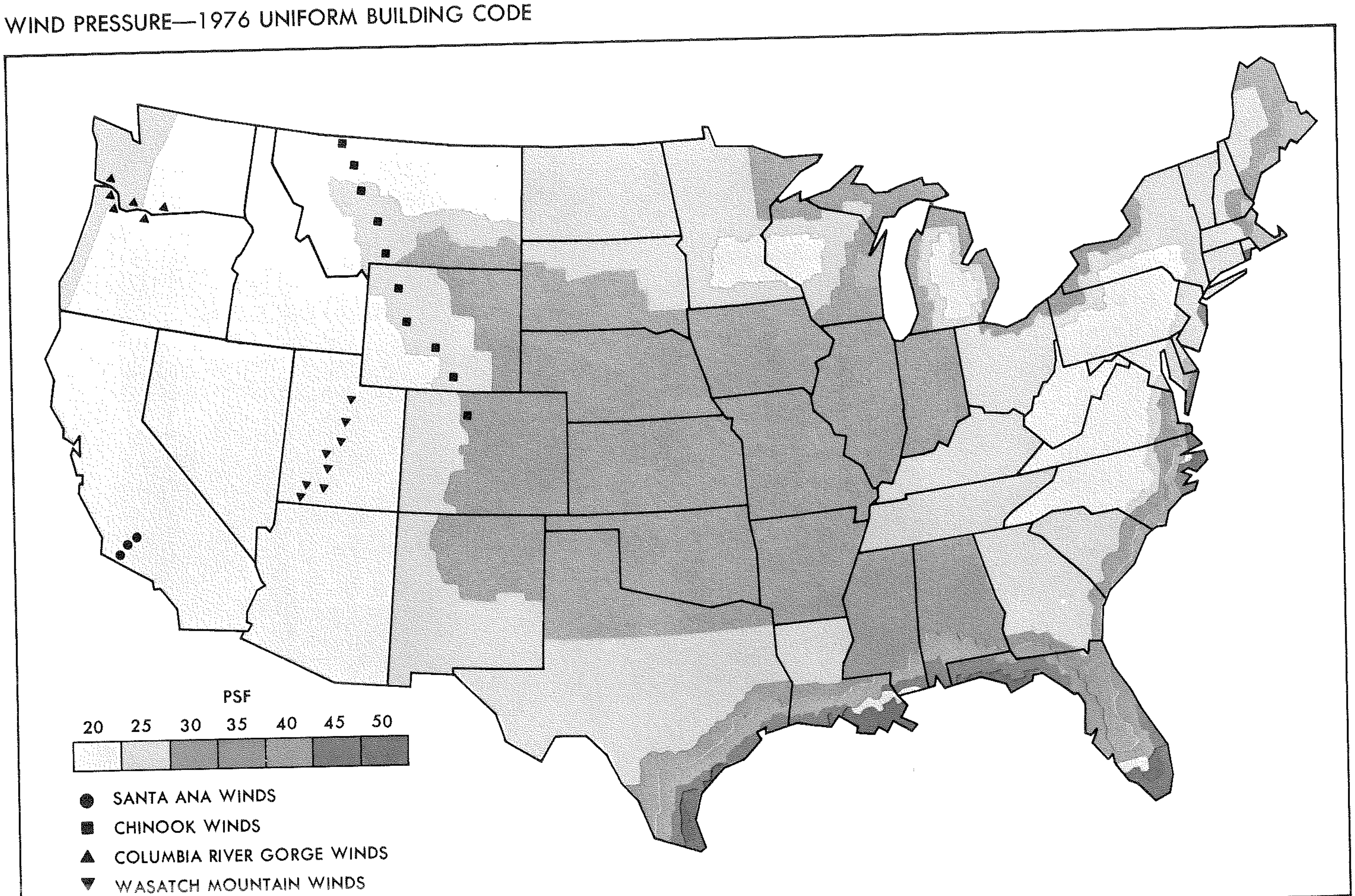
This data is accepted and approved by the International Congress of Building Officials (ICBO) and the City of Los Angeles.

References

For design information on many Robertson steel floor units, refer to Robertson catalog Q-135 entitled "Robertson Shear Values and Flexibility Factors."

The charts on pages 17 and 18 may assist you in determining probable geographic areas of concern regarding seismic shock and the wind effects on variables of a building structure. Reference source for the chart data is the Uniform Building Code 1976 Edition.

WIND PRESSURE—1976 UNIFORM BUILDING CODE



ALLOWABLE RESULTANT WIND PRESSURES—COMBINED INWARD AND OUTWARD PRESSURES ON EXTERIOR SURFACES OF ORDINARY SQUARE BUILDINGS AT 30 FEET ABOVE GROUND—UNIFORM BUILDING CODE, 1976 EDITION

TABLE NO. 23-F—WIND PRESSURES FOR VARIOUS HEIGHT ZONES ABOVE GROUND[1] (1976 U.B.C.)

HEIGHT ZONES (in feet)	WIND-PRESSURE-MAP AREAS (pounds per square foot)						
	20	25	30	35	40	45	50
Less than 30	15	20	25	25	30	35	40
30 to 49	20	25	30	35	40	45	50
50 to 99	25	30	40	45	50	55	60
100 to 499	30	40	45	55	60	70	75
500 to 1199	35	45	55	60	70	80	90
1200 and over	40	50	60	70	80	90	100

[1]See Map. Wind pressure column in the table should be selected which is headed by a value corresponding to the minimum permissible, resultant wind pressure indicated for the particular locality.

The figures given are recommended as minimum. These requirements do not provide for tornadoes.

TABLE NO. 23-G—MULTIPLYING FACTORS FOR WIND PRESSURES—CHIMNEYS, TANKS, AND SOLID TOWERS (1976 U.B.C.)

HORIZONTAL CROSS SECTION	FACTOR
Square or rectangular	1.00
Hexagonal or octagonal	0.80
Round or elliptical	0.60

TABLE NO. 23-H—SHAPE FACTORS FOR RADIO TOWERS AND TRUSSED TOWERS (1976 U.B.C.)

TYPE OF EXPOSURE	FACTOR
Wind normal to one face of tower	
Four-cornered, flat or angular sections, steel or wood	2.20
Three-cornered, flat or angular sections, steel or wood	2.00
Wind on corner, four-cornered tower, flat or angular sections	2.40
Wind parallel to one face of three-cornered tower, flat or angular sections	1.50
Factors for towers with cylindrical elements are approximately two-thirds of those for similar towers with flat or angular sections	
Wind on individual members	
Cylindrical members	
Two inches or less in diameter	1.00
Over two inches in diameter	0.80
Flat or angular sections	1.30

Fire resistance

Q-Lock composite floor assemblies have been tested and are listed in many designs in the latest Underwriters' Laboratories Fire Resistance Index. A partial list of Robertson's approved U.L. floor and ceiling designs appears in the Q-LOCK FLOORS TECHNICAL DATA BOOK, Q-115 (latest edition). Experience indicates that the most economical fire rated floor construction is achieved using one of these designs.

Concrete Volumes

Volume of concrete in cu. ft. per sq. ft. of area

Section	Thickness Over Top of Deck							
	2″	2½″	3″	3¼″	3½″	4″	4³⁄₁₆″	4½″
QL-3 QL-UKX	—	.255	.297	.318	.339	.380	.396	.422
2″ QL-99* QL-AKX	.250	.292	.333	.354	.375	.417	.432	.458
QL-21 QL-121 QL-NKX QL-TKX	—	.279	.320	.341	.362	.404	.419	.445
3″ QL-99* QL-WKX	.292	.333	.375	.396	.417	.458	.474	.500
FKX 12	—	.380	.422	.443	.464	.505	.521	.547

Section	Thickness Over Top of Deck						
	2½″	3″	3¼″	3½″	4″	4³⁄₁₆″	4½″
1½″ DC ADC	.240	.281	.302	.323	.365	.380	.406
3″ DC ADC 5	.271	.313	.333	.354	.396	.411	.438
4½″ DC ADC 5	.302	.344	.365	.385	.427	.443	.469
6″ DC ADC 5	.333	.375	.396	.417	.458	.474	.500
7½″ DC ADC 5	.365	.406	.427	.448	.490	.505	.531

NOTE: The concrete volumes listed above are based on the exact depths shown. No allowance has been made for frame or deck deflection.

*See pages 4 and 5 for further details.

Acoustical data

Sound Transmission

Robertson has been involved in a continuing testing program to determine the sound transmission qualities of our floor assemblies. An important consideration in many floor designs is their Sound Transmission Class (STC). Assemblies number 1 and 2 at the right show a blend of QL-3 and QL-UKX with 2½" of regular weight concrete topping and spray fiber fireproofing beneath the floor units. Assembly 2 utilized a ⅝" thick perforated mineral fiber suspended ceiling below the composite slab. A Sound Transmission Class (STC) of 50 was obtained for Assembly 1 with an Impact Noise Rating (INR) of −24. The suspended ceiling in Assembly 2 increased the STC value to 60 and improved the INR value to +5.

Since these are the shallowest composite deck sections made by Robertson, these STC and INR values represent a lower bound for expected results using other Q-Lock composite assemblies.

Noise Attenuation

Robertson Long Span Composite Deck is particularly suited to noise reduction in a structure. The composite DC/ADC blend shown in Assembly 3 achieved an STC of 54 and an Impact Insulation Classification (IIC) of 28 for a tile-covered assembly in a test performed at Riverbank Acoustical Laboratories. The carpeted assembly achieved an IIC value of 74. An STC of between 50 and 54 can be expected for the 4½" and 6" depths of deck.

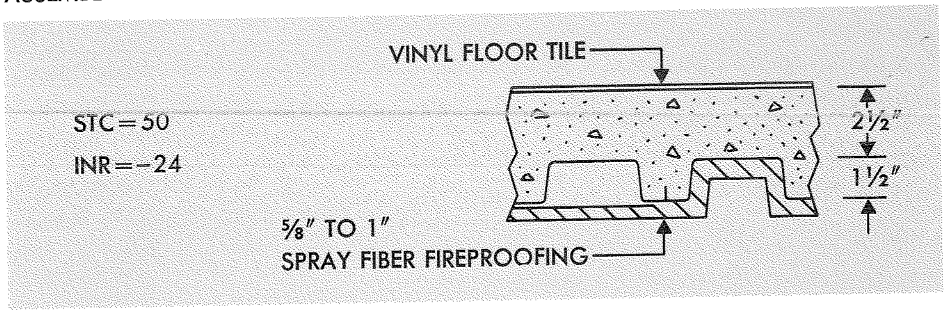
Higher values are possible if the concrete depth is increased or if regular weight concrete is used.

Robertson's Long Span Acoustical Deck (ADC) offers a Noise Reduction Coefficient (NRC) up to .95, with or without a concrete slab. This substantial reduction in reflected sound energy will greatly reduce the possibility of sound reverberation within a room.

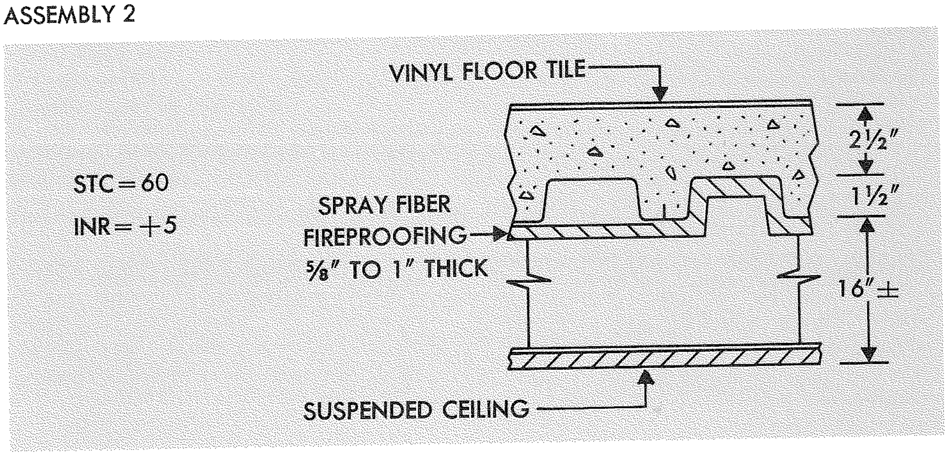
To reduce the transfer of sound energy through the ADC deck between adjoining rooms, a 3" wide, 2½# density batt is installed as shown by the deck erector. An average Sound Transmission Loss (STL) of 29 is obtained with this system.

In an assembly not shown, Robertson's 2" QL-99 was tested with 2" of regular weight concrete and a ⅝" thick ceiling tile attached to the bottom side of the deck. This assembly achieved an STC value of 52.

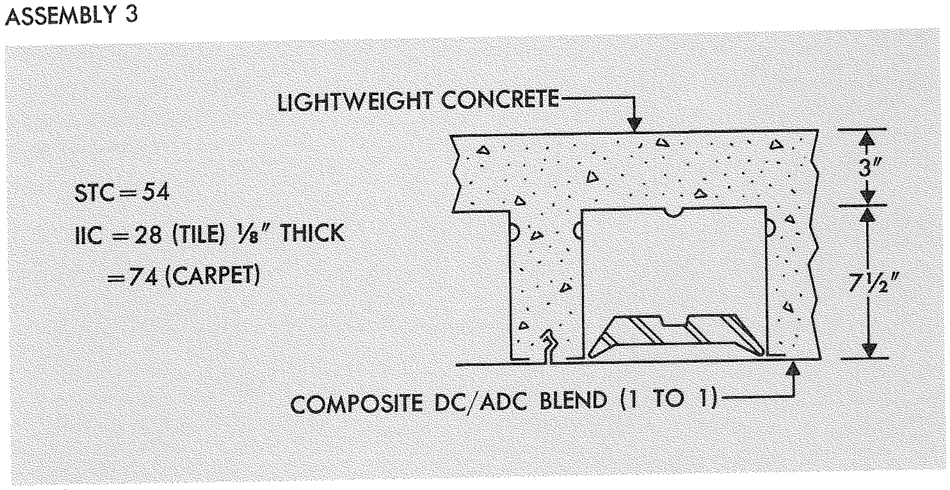
ASSEMBLY 1



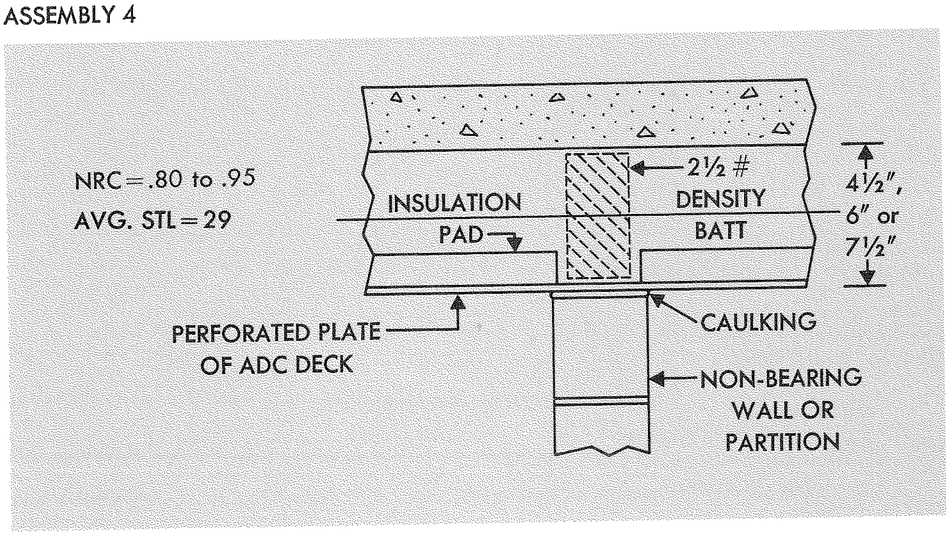
ASSEMBLY 2



ASSEMBLY 3



ASSEMBLY 4



Specifications

Non-Composite Floor

1. SCOPE

The work covered by this section shall include all labor, material, equipment and services necessary for the installation of Robertson Q-Floor, completed in accordance with this specification and the contract drawings. Cellular floor units may be used as electrical raceways. (See Note 4.)

2. WORK NOT INCLUDED (unless so specified in detail)

a. Concrete (minimum compressive strength 3000 psi)
b. Concrete reinforcing steel or shrinkage mesh
c. All openings or holes not shown and dimensioned on the structural drawings or unframed openings.
d. Structural steel supports or bracing of any kind
e. Fireproofing
f. Electrical fittings
g. Shear connectors
h. Unloading or hoisting
i. Shoring

3. MATERIALS

a. The steel floor units and all flashings shall be formed from steel sheets conforming to ASTM-A446. Before forming, the steel sheet shall be coated with a zinc coating conforming to ASTM-A525 and to Federal Specification QQ-S-775d, type 1, class e. Cellular floor units shall conform to the requirements of UL 209 for use as metal floor raceways. (See Note 1.)
b. Floor units shall be classified by Underwriters' Laboratories, Inc. Each unit or bundle shall be labeled and marked as required by UL, indicating manufacturer, testing and inspection.
c. The steel floor units shall have a depth not greater than__________inches (nominal) and shall be so formed as to provide flutes spaced not more than 12 inches on centers.

4. DESIGN

a. The steel floor units shall be designed in accordance with the AISI publication, "Specification for the Design of Cold-Formed Steel Structural Members" (latest edition). The minimum positive section modulus so obtained shall be used in calculations involving positive moments and the minimum negative section modulus shall be used with negative moments.
b. Moment and deflection formulas and coefficients for beams as shown in the AISC "Manual of Steel Construction" (latest edition) shall be used in determining the required gauges of steel floor unit.
c. The design strength of welds used to form a cellular unit from two or more sheets, shall be in accordance with AISI specifications.

5. DRAWINGS

Submit detailed layout drawings showing type and gauge of steel floor to be supplied. Drawings shall also show anchorage details, complete erection instructions and all accessories necessary to complete the erection of the steel floor.

6. FLASHING

The steel floor manufacturer shall furnish steel metal flashing to close openings between floor units and columns, and openings which occur where a change occurs in the direction of the floor span. These flashings shall be fastened in position by the steel floor erector.

7. ERECTION

a. The steel floor units shall be placed on the supporting steel framework, adjusted to final position, and permanently welded. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the floor units, the general contractor shall take the appropriate corrective action. The floor units shall not be placed until the necessary corrections are made. The floor units shall be placed in straight alignment for the entire length of run of flutes and with close registration of the flutes of one unit with those of abutting units. Sidelaps shall be properly fastened.
b. Steel floor units shall be fastened to the steel framework at ends of units and at all intermediate supports by ¾" diameter puddle welds spaced not more than 12 inches across the width of the floor unit (not more than 16 inches on center for SEC-21 and SEC-NKX). Where two units abut, each unit shall be so fastened to the steel framing.
c. The sidelaps of adjacent units shall be fastened as shown on the deck erection drawings.
d. Any fastener found to be defective or broken shall be replaced before concrete is placed.
e. Hoisting of the steel floor shall be performed at no cost to the floor manufacturer. Steel floor units shall be hoisted to each individual floor as required and designated by the floor erector.

8. HOLES

Floor units shall be cut by the floor erector to fit framed openings which are dimensioned on the structural drawings. All other holes shall be cut by the trade requiring the hole. (See Note 3.)

9. CONCRETE

Concrete with admixtures containing chloride salts or other deleterious materials is not to be used with Q-Floor.

NOTES FOR SPECIFICATION WRITER

1. Always choose a UL design which involves spray fireproofing protection for the bottom of the floor units if the floor is to be used as a raceway.
2. Steel floor used to support concrete buggy runways shall be adequately protected against wheel damage. The plywood runway should be blocked from the bottom flange of the deck and a wood curb should be installed along each edge of the runway. Shoring may be required.
3. Specifications for other sections which coordinate with steel floor such as heating, plumbing, plaster furring, electrical, etc. should contain the following paragraph: "Any cutting, reinforcing, drilling or patching of the steel floor units required for the performance of work under this section shall be performed at the expense of the trade requiring such work."
4. When the floor cells are to be used as raceways, the electrical contractor shall apply 2" wide tape to butt joints so as to prevent dirt or foreign matter from entering the cells. This work is to be done as soon as possible after the steel floor erector has secured the floor in place.

Composite Floor Deck

1. SCOPE

The work covered by this section shall include all labor, material, equipment and services necessary for the installation of Robertson Q-Lock Floor, completed in accordance with this specification and the contract drawings. Cellular floor units may be used as electrical raceways. (See Note 4.)

2. WORK NOT INCLUDED (unless so specified in detail)

a. Concrete (minimum compressive strength 3000 psi)
b. Concrete reinforcing steel or shrinkage mesh
c. All openings or holes not shown and dimensioned on the structural drawings or unframed openings.
d. Structural steel supports or bracing of any kind
e. Fireproofing
f. Electrical fittings
g. Shear connectors
h. Unloading or hoisting
i. Shoring

3. SUBSTITUTIONS

No substitution will be considered unless a written request for approval has been submitted and is received by the architect at least ten (10) days prior to the bid date.

4. MATERIALS

a. The steel floor units and all flashings shall be formed from steel sheets conforming to ASTM-A446. Before forming, the steel sheet shall be coated with a zinc coating conforming to ASTM-A525 and to Federal Specification QQ-S-775d, type 1, class e. Cellular floor units shall conform to the requirements of UL 209 for use as metal floor raceways. (See Note 1.)
b. Floor units shall be formed with integral locking lugs or embossments to provide a mechanical lock between the steel floor and the concrete slab. Minimum depth of embossments or locking lugs = .050"
c. Floor units shall be classified by Underwriters' Laboratories, Inc. Each unit or bundle shall be labeled and marked as required by UL, indicating manufacturer, testing and inspection.
d. The steel floor units shall have a depth not greater than__________inches (nominal) and shall be so formed as to provide cells spaced not more than 12 inches on centers.

5. DESIGN

a. The steel floor units shall be designed in accordance with the AISI publication, "Specification for the Design of Cold-Formed Steel Structural Members" (latest edition). The minimum positive section modulus so obtained shall be used in calculations involving positive moments and the minimum negative section modulus shall be used with negative moments.
b. Moment and deflection formulas and coefficients for beams as shown in the AISC "Manual of Steel Construction" (latest edition) shall be used in determining the required gauges of steel floor unit.
c. Composite floor slabs (combined steel and concrete sections) shall be capable of supporting a superimposed load of __________ pounds per square foot. (See Note 2.)
d. The design strength of welds used to form a cellular unit from two or more sheets, shall be in accordance with AISI specifications.

6. DRAWINGS

Submit detailed layout drawings showing type and gauge of steel floor to be supplied. Drawings shall also show anchorage details, complete erection instructions and all accessories necessary to complete the erection of the steel floor.

7. FLASHING

The steel floor manufacturer shall furnish sheet metal flashing to close openings between floor units and columns, and openings which occur where a change occurs in the direction of the floor span. These flashings shall be fastened in position by the steel floor erector.

8. ERECTION

a. The steel floor units shall be placed on the supporting steel framework, adjusted to final position, and permanently welded. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the floor units, the general contractor shall take the appropriate corrective action. The floor units shall not be placed until the necessary corrections are made. The floor units shall be placed in straight alignment for the entire length of run of flutes and with close registration of the flutes of one unit with those of abutting units. Sidelaps shall be properly fastened.
b. Steel floor units shall be fastened to the steel framework at ends of units and at all intermediate supports by ¾" diameter puddle welds spaced not more than 12 inches across the width of the floor unit (not more than 16 inches on center for QL-21 and QL-NKX). Where two units abut, each unit shall be so fastened to the steel framing.
c. The sidelaps of adjacent units shall be fastened as shown on the deck erection drawings.
d. Any fastener found to be defective or broken shall be replaced before concrete is placed.
e. Hoisting of the steel floor shall be performed at no cost to the floor manufacturer. Steel floor units shall be hoisted to each individual floor as required and designated by the floor erector.

9. HOLES

Floor units shall be cut by the floor erector to fit framed openings which are dimensioned on the structural drawings. All other holes shall be cut by the trade requiring the hole. (See Note 3.)

10. CONCRETE

Concrete with admixtures containing chloride salts or other deleterious materials is not to be used with Q-Lock Floor.

NOTES FOR SPECIFICATION WRITER

1. Always choose a UL design which involves spray fireproofing protection for the bottom of the floor units if the floor is to be used as a raceway.
2. Enter the live load listed in the tables for the proper concrete type, depth and gauge of floor.
3. Specifications for other sections which coordinate with steel floor such as heating, plumbing, plaster furring, electrical, etc. should contain the following paragraph: "Any cutting, reinforcing, drilling or patching of the steel floor units required for the performance of work under this section shall be performed at the expense of the trade requiring such work."
4. When the floor cells are to be used as raceways, the electrical contractor shall apply 2" wide tape to butt joints. This work is to be done as soon as possible after the steel floor erector has secured the floor in place.
5. Steel floor used to support concrete buggy runways shall be adequately protected against wheel damage. The plywood runway should be blocked from the bottom flange of the deck and a wood curb should be installed along each edge of the runway. Shoring may be required.

SECTION 13051—METAL FLOOR DECK WITH ELECTRICAL DISTRIBUTION SYSTEM

PART 1: General

1.01 DESCRIPTION OF WORK

The metal floor deck, electrical trench headers, and preset electrical outlet system plus all accessories and labor necessary for the complete installation of these items, are included.

1.02 RELATED ITEMS NOT INCLUDED IN THIS SECTION

Material and labor for all items not specifically mentioned or shown on the drawings including, but not limited to, the following:

a. Concrete
b. Concrete shrinkage mesh or reinforcing steel
c. Fireproofing
d. Shear connectors
e. Shoring (if required)
f. Miscellaneous structural supports
g. Holes or openings through the floor deck (unless detailed)
h. Preset outlet finish assemblies, partitions, receptacles, wiring, jacks; etc. except where specifically included.
i. Unloading or hoisting of materials

1.03 QUALITY ASSURANCE

a. Products produced by H. H. Robertson Company, Pittsburgh, Pennsylvania, or its licensees, establish the minimum quality of required function, dimension and appearance to be met by any proposed substitution.
b. The manufacturer and erector shall demonstrate a minimum of five (5) years of experience with this type of electrified floor system.
c. All welding shall be performed by welders experienced in light gauge steel welding.

1.04 SUBSTITUTIONS

a. No substitution will be considered unless a written request for approval has been submitted and received by the architect at least ten (10) days prior to the bid date.
b. Substitution requests shall designate the name of the item for which the substitution is proposed and shall include a complete description of the proposed substitute including drawings, performance and test data, samples and other items required for complete evaluation.
c. Approved substitutions will be set forth in an addendum prior to the bid date.

1.05 SUBMITTALS

Submit erection/shop drawings for each product specified showing all erection procedures and accessories required.

1.06 CODES AND STANDARDS

a. Comply with the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold-Formed Steel Structural Members" latest edition.
b. Comply with the American Welding Society's "Code for Welding in Building Construction."
c. Comply with the National Electric Code.
d. (Others)

1.07 UNDERWRITERS' LABEL

All steel floor units shall be listed in the Underwriters' Laboratories "Fire Resistance Index" for Designs ______.
All cellular units shall be listed in the UL "Electrical Construction Materials List." Each cellular unit shall bear the UL label for use as a wire raceway.

PART 2: Products

2.01 STEEL FLOOR UNITS

2.01a MATERIALS

1. Steel floor units and accessories shall be fabricated from steel sheet conforming to ASTM A446.
2. The protective coating for floor units shall conform to ASTM A525, with a minimum coating weight of .25 oz./sq. ft. total weight both sides. The coating shall also conform to Federal Specification QQ-S-775d, type 1, class e.
3. All cellular floor units and fluted deck units used under bottomless trench headers shall conform to UL 209.

2.01b DESIGN

1. Section properties of the steel floor units shall be calculated according to the AISI procedure. The section properties shall be reduced where electrical access holes are provided.
2. In cases where multi-span floor units are used, the non-composite and composite design will be based upon uniform load conditions in all spans.
3. The maximum allowable bending stress in the steel floor shall be .6 Fy for non-composite design in trench header spans and for shoring calculations.
4. The metal floor deflection shall not exceed 1/180th of the clear span or ¾" under the uniformly distributed concrete dead load.

2.01c FABRICATION

All steel floor units shall be roll-formed to assure dimensional uniformity and strength. Sufficient embossments shall be provided to transfer twice the horizontal and vertical shearing forces in the composite slab. The minimum depth of embossments or indents shall be .050."

2.02 HANGER SYSTEM

a. Provide pierced hanger slots at 2'-0 centers longitudinally and 1'-0 centers transversely in all 2" and 3" QL-99 floor units. These slots may be used for installing hanger wires from the top of the deck prior to concrete placement. The #8 wires, supplied and installed by others, should have a pigtail configuration at the top end which, when embedded in the cured concrete, will develop a substantial load capacity for the wire.
b. Provide fold-down hanger tabs along the sidejoints of both cellular and non-cellular floor units at 1'-0 centers. These tabs shall have a static load capacity of 100# and will accommodate a #12 or #10 maximum (.135") size wire. All wires, their installation and tab activation shall be by trades requiring the tabs. No plastered ceilings shall be hung from fold down tabs.

2.03 TAPWAY (TRENCH) HEADER)

a. Tapway: UL labeled, KE-Q/TD
b. Openings: 1. 3" Floor, two-1⅞" x 6" (obround) into webs of telephone and special services cells.
2. 2" Floor, two 1½" x 8" (obround) into webs of telephone and special services cells.
3. 3" and 2" Floor—2¼" (round) into top of power cells.

c. Removable Covers "¼" nominal roller leveled steel (after size shearing).
d. Factory Assembled Cover Assemblies, Screed Bar Strips and Sides: Adjustable from 2⅜" (min.) to 3⁵⁄₁₆" (max.) over top of cells for 2½" nominal concrete fill; from 3⅛" (min.) to 4¹⁄₁₆" (max.) over top of cells for 3¼" nominal concrete fill; from 1⅞" (min.) to 2¹³⁄₁₆" (max.) over top of cells for 2" nominal concrete fill.
e. Side and Cover Supports: 5 square inches per lineal inch of keying surface; nominal ⅛" thick metal; nominal ⅜" width flat metal surface at screed level for seating floor tile at tile stop. Anchoring clips or studs not acceptable. Alignment key extrusion providing a minimum 3 lineal inches of alignment surface.
f. Painting: Covers dip process air dried primer coat.
g. Longitudinal Cover Gaskets: Nominal ¼" width, integral with vinyl edging, securely anchored to Tapway side units.
h. Edging for Finished Floor Tile: Vinyl composition with integral cover gaskets, ⅛" width on top, neutral gray color.
Option: Edging to match floor tile color.
i. Minimum Width of Tapway: 1¾" less than cover width.
j. Closure Units: Minimum 22 gauge zinc-coated steel.
k. Power Compartments: Minimum 3½" wide with 3¼" diameter opening in base to engage grommeted power cell opening.
Adjustable dividers on each side with top bearing surface of ½."

2.04 TAPMATE II BOXES (OUTLETS)

a. Tapmate II Boxes: UL Labeled, KEB Series.
b. Openings in Web of Cells: 1½" x 3¾" (Min. 5.15 square inch area).
c. Boxes: Integral formed steel body (sides, ends and top), nominal 4" x 4" (16 sq. in. minimum) top entry into body unit Cap entry with suitable minimum .032" thick steel closure cap having surfaces treated with a concrete release agent.
d. Box Body: Minimum 14 gauge zinc-coated steel. Box Side Closure: Minimum 20 gauge zinc-coated steel.
e.

Floor Depth	Concrete Fill	Tapmate Volume
3"	2"	117.2 cu. in.
2"	2"	90.2 cu. in.
3"	2½"	136.1 cu. in.
2"	2½"	108.7 cu. in.
3"	3¼"	162.8 cu. in.
2"	3¼"	135.4 cu. in.

f. Box Unit: Provide for two removable mounting plates. Supply one mounting plate with provision for two duplex receptacles. For 2" floor with 2" fill provide one mounting plate with provision for one duplex or four (4) single Leviton #1371 receptacles as a component of the Tapmate activation assembly.
Box Unit: Capable of housing five (5) amphenol connectors and single duplex receptacle or 30 amp backwired receptacle w/single duplex at all locations. Mounting plates for special services connectors to be field cut.
g. Knockouts: Provide__________% of Tapmate units with knockouts in one end only per following schedule: 3¼" fill unit—One 1" and one ¾" knockout
3" fill unit—Two ¾" knockouts
2½" fill unit—Two ¾" knockouts
2" fill units—not available

2.05 TAPMATE ACTIVATION ASSEMBLIES

a. Tapmate Assemblies: Consisting of cell grommets, proper receptacle, partition, adjusting ring, adjustable leveling devices and self-bushing egress plates at locations directed by architect. Provide total of ________# (generally 30%) Tapmate Activation Assemblies.

PART 3: Execution

3.01 STEEL FLOOR UNITS

3.02 GENERAL

Install steel floor units and accessories in accordance with the manufacturer's recommendations, the final erection drawings, and as herein specified.

3.03 PLACING FLOOR UNITS

1. Place floor units on the supporting steel framework and adjust to final position with proper end bearing and accurate alignment at the butt joint before permanent fastening. Do not stretch or contract units in a transverse direction. Electrical module lines shall be laid out on the structural steel frame in each bay and the deck units shall be located in strict accordance with the deck erection drawings in order to maintain the electrical module spacing.
2. Do not use steel floor for storage or working platforms until it has been permanently fastened. Storage loads must be supported on wood blocking in the flutes of the deck.

3.04 FASTENING FLOOR UNITS

1. Permanently fasten floor units to the steel supports with ¾" diameter fusion welds at end and intermediate supports as shown on the deck erection drawings.

3.05 CUTTING AND FITTING

Floor deck shall be cut to fit around columns and bracing shown on the structural drawings. Provide neat, square and trim cuts.

3.06 CLOSURES

Supply and fasten in place all closures at perimeter ends of cells or where cells change direction as shown on the deck erection drawings.

3.07 OPENINGS THROUGH FLOOR SLAB

1. The floor deck supplier will supply those framed floor openings which are shown on the structural drawings. Smaller openings shall be field cut by the trade requiring the opening. Where possible, holes shall be blocked out to eliminate concrete. Cutting of the metal deck shall be done only after the concrete has cured. The structural engineer shall be consulted before any hole is cut.
2. Reinforcement, if required, at all openings shall be supplied by the general contractor.

3.08 TOUCH-UP OF WELDS

Field welds or abrasions on floor units or flashings shall be field painted only when the finished installation is permanently exposed to the weather.

3.09 TAPROUTE SYSTEM INSTALLATION REQUIREMENTS

GENERAL: Install Taproute system (bottomless trench header and preset electrical outlets) exactly in accordance with the electrical drawings and this specification.

a. Tapway:
   1. Bush all openings with grommets.
   2. Covers shall be retained in position by mechanical latching devices, without exposed surface fasteners, be readily replaceable in field, and shall engage only at side and not on partitions, or into side rail assemblies.

3. Two cover lifting devices, of proper type, shall be delivered to owner for maintenance purposes.
4. Sides and cover support screed bar units shall be rigidly supported and keyed into the concrete fill continuously along the entire length.
5. Tapway raceway interconnections between telephone and auxiliary services shall occur at 12" intervals without reducing effective cross section of compartments. All cable pulling surfaces shall be bushed and curved edged. Minimum area for inter-connection shall be 12 square inches.
6. Adjustable dividers shall be raised to correct level and fusion welded into position with ½" long welds 2'-0" on centers, staggered both sides. All welds shall be touched up with paint.
7. Cover span between dividers or sides must not exceed 15" and covers must support a concentrated wheel load of 500# with a Factor of Safety of 2.0 on a minimum area of 7 square inches.
8. Tapway Cover Assembly and cellular closure units shall be fusion welded to top of cells using 3 welds per side of a 6' length of Tapway section.
9. Leveling of cover assembly must be done prior to concrete fill being poured.
10. Top cover assembly shall have free access for laying in of cables.
11. "Electrical Tapway devices" shall be set at a screed height. Contractor placing the floor fill shall carefully hand finish a minimum of 24" adjacent to Tapway sides, so that top of fill and electrical Tapway and/or devices are *flush* after finish has set.
12. During installation, temporary exposed surface edging shall be flush with adjacent screed strip and cover, and be readily replaceable during construction and/or after finished installation of finished floor tile, edging shall be reversed and permanently and rigidly secured to cover support screed bar units, providing a straight line, square edge for butting floor tile edges.

b. Tapmate II Boxes:
1. Apply concrete release agent to inside and outside of entry cap, if not shop applied.
2. Shop cut openings into webs of cellular metal deck unit cells for access of pre-set outlet box.
3. Secure boxes by U.L. approved clip methods, or by 1" long fusion welds at each end.
4. Boxes must be free of fillers, debris and other materials foreign to the wiring system before and after concrete fill.
5. Shall be placed on a double staggered pattern.

c. Tapmate Activation Assemblies:
1. Installed under electrical section of these specifications.
2. Activation assemblies shall have an initial adjustment range of 1$\frac{5}{16}$" maximum above nominal concrete fill line, and a maximum of $\frac{5}{16}$" below.

d. Connections to Panels, Interconnecting Cabinets and the like:
1. Make all connections complete using components of the system as indicated on drawings.

NOTES TO SPECIFIER

1.02 Minimum concrete strength is 3,000 psi for structural and fire rating considerations. Concrete with admixtures containing calcium chloride shall not be used with the metal deck nor shall sea water be used in the concrete mix.

1.03a A certificate of compliance to the specifications for all materials in this section can be required by the specifier.

1.06d Enter here all other governing codes not mentioned.

1.07 Proper UL Floor and Ceiling Design should be listed. Require each bidder to supply proof of UL approval in the listed (or similar) design for each floor unit bid. Bidders should also supply exact required fireproofing under all floor units.

2.01a_1 Minimum yield (Fy) of steel may be specified as 33,000 psi.

2.01a_3 UL 209 is entitled "Standard for Cellular Metal Floor Raceways and Fittings."

2.01b 1. Certification of section properties for decks with access holes (or test reports) may be required.
2. The moment coefficients listed in the latest edition of the AISC "Manual of Steel Construction" shall be used for all calculations involved in composite design. Contact your Robertson representative for additional technical data.
3. The AISI publication "Specifications for the Design of Cold Formed Steel Structural Members" (latest edition), shall govern the design of the steel floor units. The minimum section modulus calculated with the top of the floor unit in tension, shall be used for calculations involving negative moments.

3.03 a. Steel floor used to support runways for concrete buggies shall be adequately planked and protected against wheel damage. Wood blocking should be placed in the bottom of each edge of the runway to prevent the buggy wheel from contact with the floor. Shoring may be required if the buggy loads approach the design strength of the deck.
b. Insert this note in other pertinent sections of the job specifications: "If the project requires a dead level floor slab the combined effect of girder, beam, and deck deflections must be anticipated. The concrete thickness at the center of the bay will be a maximum. This could affect the gauge of the steel floor units. The additional concrete at center bay will also require the removal of more concrete for activating the electrical floor outlets. Consult the floor manufacturer for solutions to this problem."

3.09a 1. Coordinate finished flooring adjacent to Tapway with Division 9- Finishes. Wherever possible, covers shall have full tile installed across the width.
2. As an option, the edging for the Tapway can match tile color if specified. Revise if required. Additional lead time and extra costs must be considered.
3. Tapmate activation assemblies are furnished under this Section 13051 and installed by electrical section of specification. Revise if other requirements are desired.
4. For carpet floor covering, architectural contract drawings should provide details of the carpet treatment, including method of anchoring carpet at Tapway sides and to covers.
5. Specifier may wish to add the following to the Electrical Sections of Specifications:
"Activation assemblies will be provided by the general contractor."
"Electrical contractor shall provide necessary wiring and proper duplex or single type receptacles to activate Tapmate preset boxes at locations directed by the architect."

Metric Conversion Table

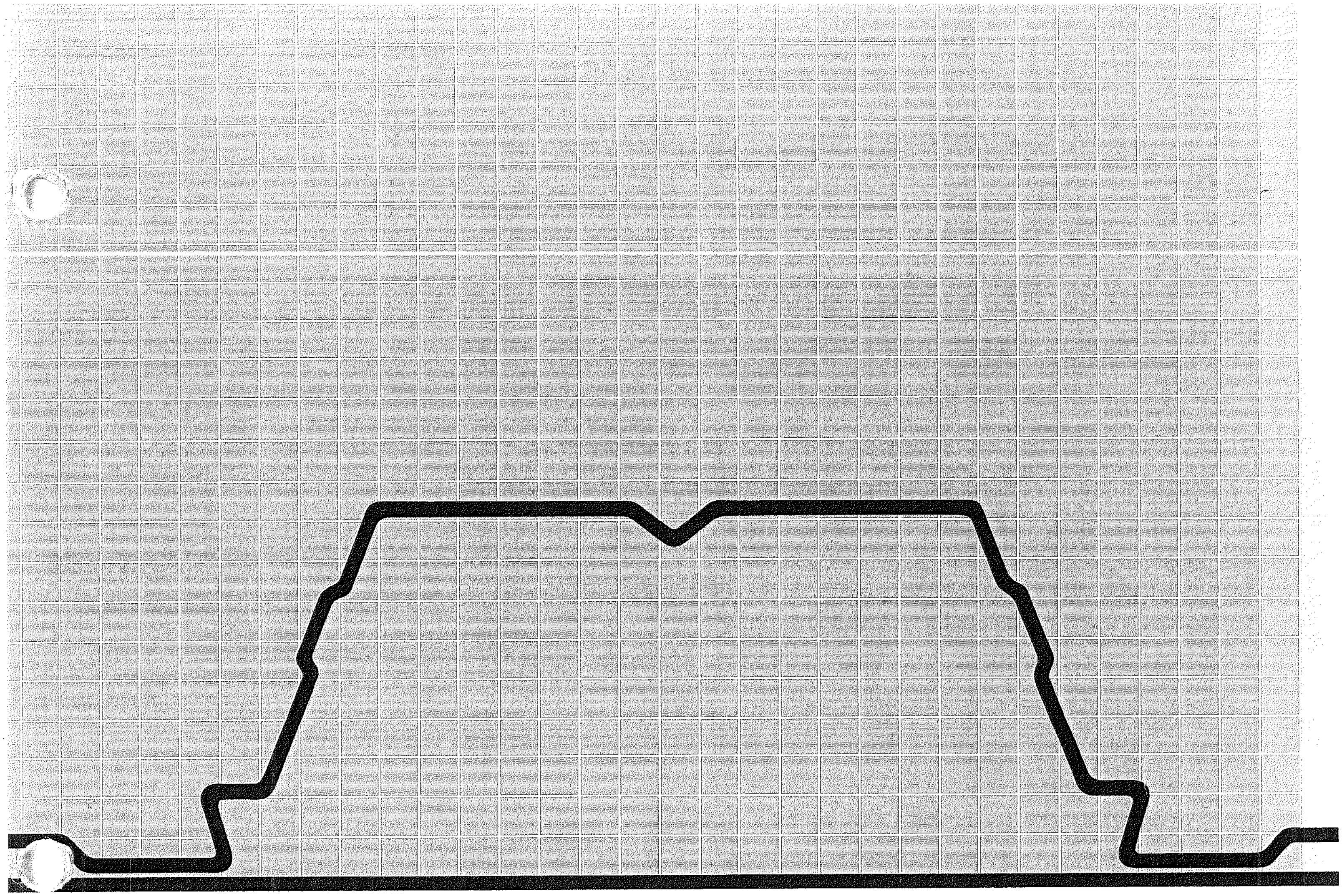
CONVERSION FACTORS ENGLISH UNITS TO METRIC					CONVERSION FACTORS METRIC UNITS TO ENGLISH				
in	X	25.4	=	mm	mm	÷	25.4	=	in
in	X	2.54	=	cm	cm	÷	2.54	=	in
in	X	0.0254	=	m	m	÷	0.0254	=	in
in^2	X	645.	=	mm^2	mm^2	÷	645.	=	in^2
in^2	X	6.45	=	cm^2	cm^2	÷	6.45	=	in^2
in^3	X	16390.	=	mm^3	mm^3	÷	16390.	=	in^3
in^3	X	16.39	=	cm^3	cm^3	÷	16.39	=	in^3
in^3	X	0.00001639	=	m^3	m^3	÷	0.00001639	=	in^3
ft	X	30.48	=	cm	cm	÷	30.48	=	ft
ft	X	0.3048	=	m	m	÷	0.3048	=	ft
ft^2	X	929	=	cm^2	cm^2	÷	929.	=	ft^2
ft^2	X	0.09290	=	m^2	m^2	÷	0.09290	=	ft^2
ft^3	X	28300	=	cm^3	cm^3	÷	28300.	=	ft^3
ft^3	X	0.0283	=	m^3	m^3	÷	0.0283	=	ft^3
lb	X	453.6	=	gram	gram	÷	453.6	=	lb
lb	X	0.4536	=	kg	kg	÷	0.4536	=	lb
lb/in	X	0.01786	=	kg/mm	kg/mm	÷	0.01786	=	lb/in
lb/in	X	0.1786	=	kg/cm	kg/cm	÷	0.1786	=	lb/in
lb/in^2	X	0.07030	=	kg/cm^2	kg/cm^2	÷	0.07030	=	lb/in^2
lb/in^2	X	703.	=	kg/m^2	kg/m^2	÷	703.	=	lb/in^2
lb/in^3	X	0.0277	=	kg/cm^3	kg/cm^3	÷	0.0277	=	lb/in^3
lb/in^3	X	27700.	=	kg/m^3	kg/m^3	÷	27700.	=	lb/in^3
lb/ft	X	0.01488	=	kg/cm	kg/cm	÷	0.01488	=	lb/ft
lb/ft^2	X	4.88	=	kg/m^2	kg/m^2	÷	4.88	=	lb/ft^2
lb/ft^3	X	16.018	=	kg/m^3	kg/m^3	÷	16.018	=	lb/ft^3

Robertson

H. H. Robertson Company
U. S. Building Products Division
400 Holiday Drive
Pittsburgh, Pa. 15220

Printed in U.S.A.
Issued August, 1977
Reprinted March, 1979

Q-147TD-79 (J)



Q-Lock® Floors

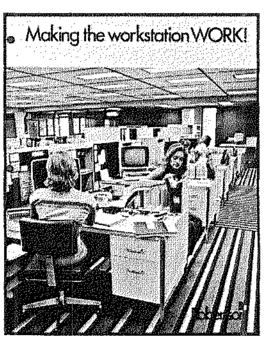
Technical Data Book

Load tables and design examples

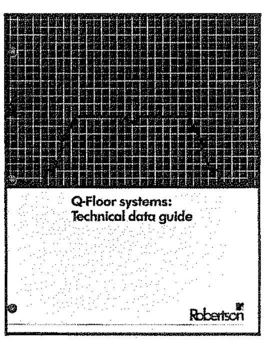
Robertson

Table of contents

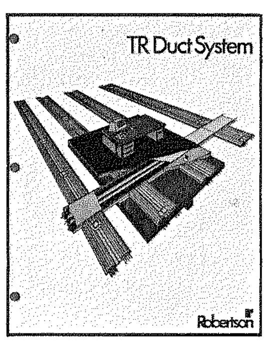
Other Robertson floor and electrical catalogs



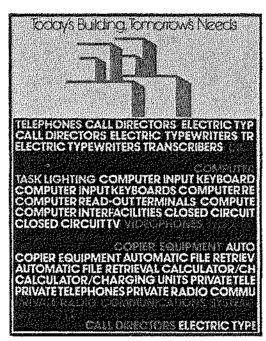
Q-172



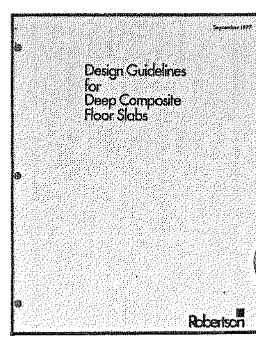
Q-147 TD



Q-174



Q-175



SEPT-'77

Introduction

Q-Lock Floor incorporates a concept of composite coaction of concrete and steel which is dependent upon unique deformations of the corrugated steel deck. The deformations include cusps on the webs of the QL-99 type sections along with embossments or V-groove stiffeners on the top and bottom flanges. The deformations are engineered to provide an optimum balance between wet concrete carrying capability and composite coaction with a hardened covering concrete slab. The remaining Q-Lock sections depend on indentations and embossments, which are provided on the flanges and the webs of the units, to develop the composite slab. Indentations are defined as areas of metal extending away from the concrete slab. Embossments are defined as areas of metal protruding into the concrete slab.

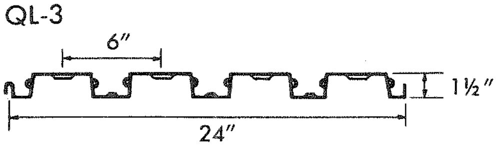
The type of deformation and the dimensions and locations of such deformations have been carefully selected and designed following extensive investigation.

The design features of Q-Lock Floor provide a useful blend of (1) maximum "wet strength" in the steel deck sections, and (2) adequate lug area to achieve horizontal shear transfer between the steel deck and the concrete slab. The "wet strength," required to carry the concrete and construction loads, is based on section properties computed for the Q-Lock section.

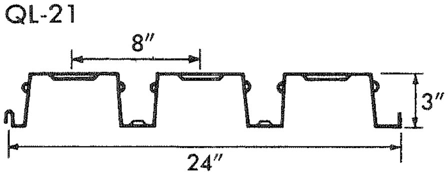
Tests for determining allowable loads and spans were conducted by quarter point loading, first to the design load, cycled, and then to failure load. All allowable load values given in the span tables were based on a safety factor of at least 2.0 on ultimate load. Fire tests have been conducted at Underwriters' Laboratories.

AVAILABLE TYPES

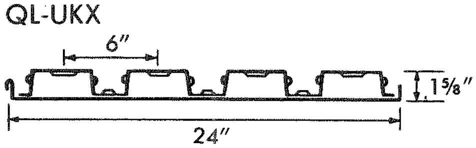
QL-3



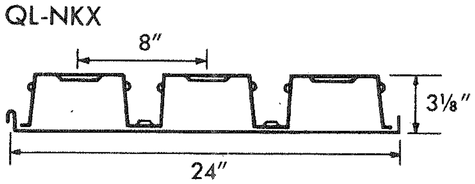
QL-21



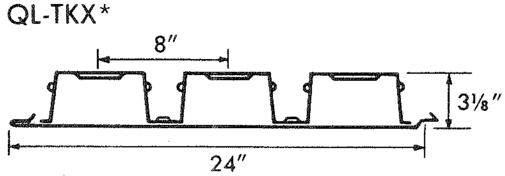
QL-UKX



QL-NKX

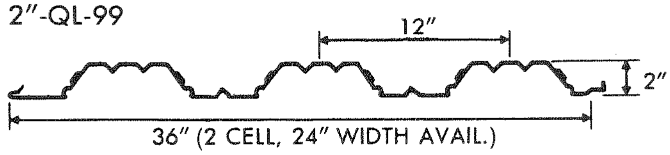


QL-TKX*

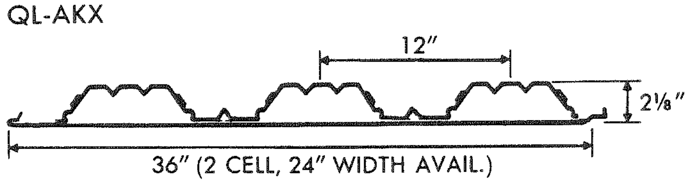


*NOTE: Section properties and load span tables for this section are the same as for QL-NKX.

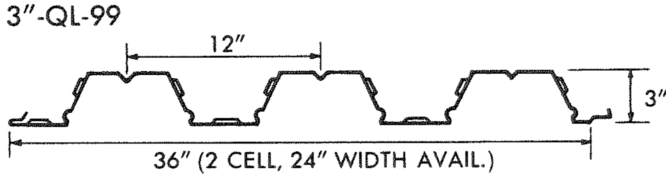
2″-QL-99



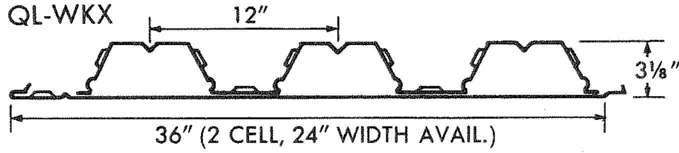
QL-AKX



3″-QL-99



QL-WKX



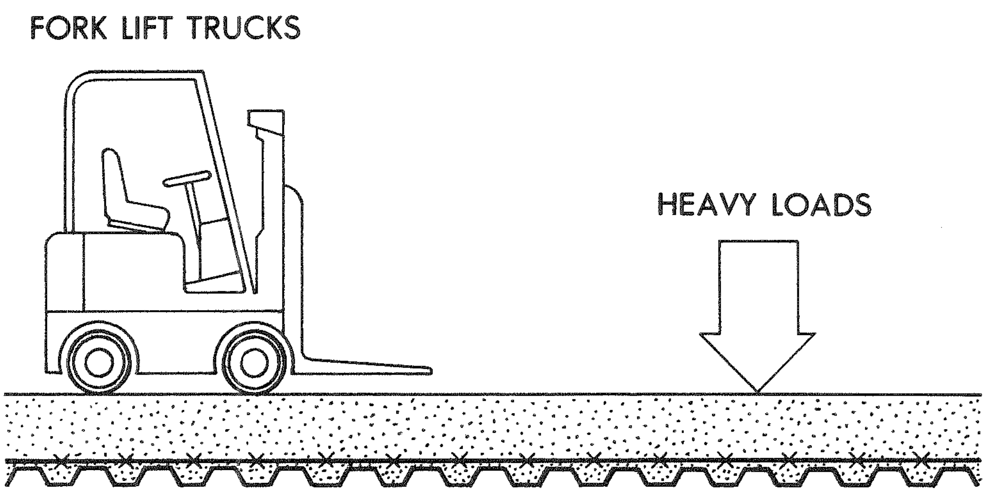
Volume of concrete cu.ft. per sq.ft. of area

Section	Thickness Over Top of Deck							
	2″	2½″	3″	3¼″	3½″	4″	4³⁄₁₆″	4½″
QL-3 QL-UKX	—	.255	.297	.318	.339	.380	.396	.422
2″ QL-99 QL-AKX	.250	.292	.333	.354	.375	.417	.432	.458
QL-21 QL-NKX QL-TKX	—	.279	.320	.341	.362	.404	.419	.445
3″ QL-99 QL-WKX	.292	.333	.375	.396	.417	.458	.474	.500

NOTE: The concrete volumes listed above are based on the exact depths shown. No allowance has been made for frame or deck deflection.

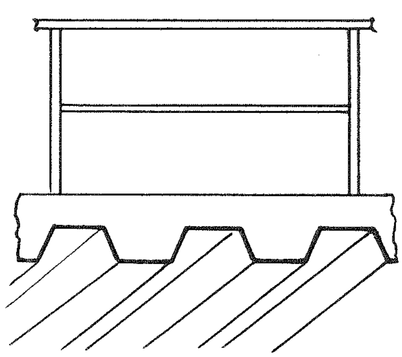
Composite slabs-Related topics

Industrial Slabs



Robertson can now offer composite slab design for Fork-Lift Truck and Heavy Load areas. A recent series of static and dynamic tests on full scale Q-Lock composite slabs verifies excellent composite slab performance for these applications. Composite slabs up to 24" in thickness and live loads in excess of 2000 PSF are now possible using Robertson deck.

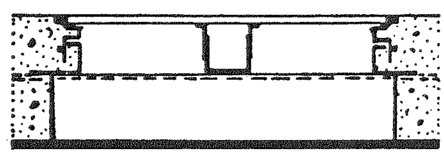
Ask your local Robertson representative for a copy of "Design Guidelines for Deep Composite Floor Slabs".



EXPOSED UNDERSIDE AREAS

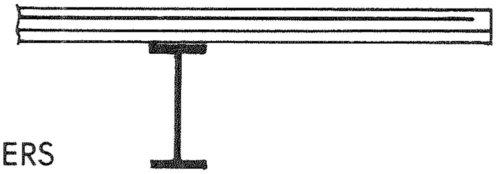
Where underside areas of floors or roofs will be left exposed, deck of 20 gauge or heavier should be considered. Construction traffic, where excessive, can cause unsightly conditions that result in customer dissatisfaction. As a further precaution, design drawings should advise the contractor of exposed underside areas so he can take suitable precautions.

TRENCH HEADER SPAN



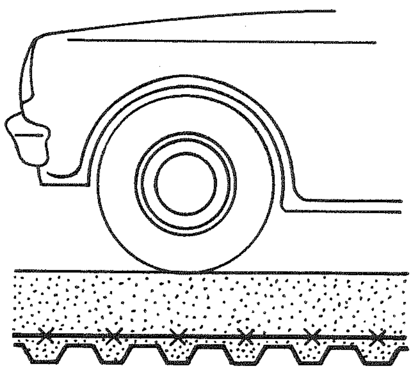
An electrical Trench Header placed in a composite, Q-Lock slab, displaces concrete required for composite action. Where this occurs, the steel floor units are generally designed to carry the full dead and live loads, non-compositely. A reduction in the steel floor span by adjusting the floor beam layout is the ideal solution. It eliminates the need for heavier gauge floor in the Trench Header span, thereby maintaining continuity in the steel floor layout.

There are several other methods of floor design for Trench Header spans. Some of these methods are: (a) Use of heavier gauge floor units designed non-compositely in the trench header span; (b) Use of reinforcing bars above the beams. (This method has no specific UL approval) (c) Partial composite design where permitted by certain UL designs.



FLOOR CANTILEVERS

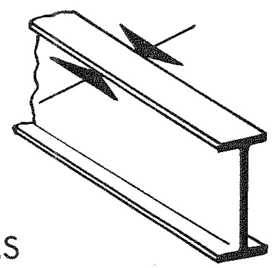
Where it is architecturally or structurally desirable to cantilever a floor slab at the perimeter of a building as shown, such cantilevers should be designed with reinforcing bars in the top portion of the slab designed to carry the full live load. Although in many cases, the steel floor alone would carry the full dead and live loads, a crack may open in the concrete slab above the exterior support. Engineering judgment must dictate the maximum length of unreinforced floor cantilevers.



PARKING GARAGE STRUCTURES

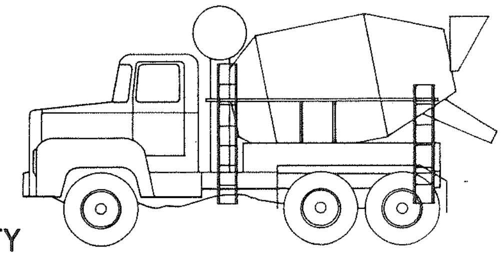
Robertson Q-Lock floor has been used successfully in parking garage structures in the southern portions of the United States. In the northern areas, or where calcium chloride or other salts are used for snow removal this type of construction is not recommended. Salt laden water could deteriorate the deck if hairline cracks formed in the concrete slab. Roof slabs of parking garages utilizing Q-Lock floor should have their top surfaces protected to prevent rain water entry and a reduced life for the deck as well as the structural beams.

Contact the Robertson salesman for complete guidelines for the design of parking garage floor slabs.



LATERAL BRACING FOR BEAMS

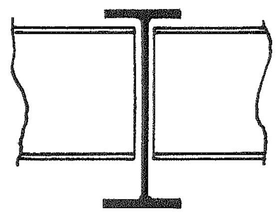
Properly welded Q-Floor or Q-Lock Floor can generally be considered as adequate bracing for the compression flanges of any rolled steel beam. Use of deck as lateral bracing for plate girders and deep trusses should be considered only if calculations or tests so verify its application.



CONCRETE PLACEMENT AND QUALITY

Placement and vibration of concrete for floor slabs should conform to the applicable sections of the ACI Standards. In particular, concrete should be deposited near its final location, and raked and shoveled to approximate screed elevation as placement proceeds. Vibration should be for consolidation only.

Quality concrete, properly placed and properly cured, is essential in the field production of Q-Lock composite slabs. Concrete of 3000 psi ultimate compressive strength has been used in determination of Q-Lock slab structural properties. Higher strength concrete may be used if desired. Improperly cured concrete can result in excessive concrete shrinkage, cracking, surface checking and/or excessive surface dusting with impaired functional performance for the life of the slab.

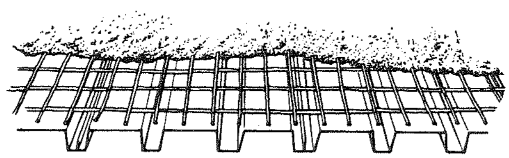


RAISED GIRDER DESIGN

A savings in steel fabricating costs can be achieved by eliminating the coping of all beams at the girder connection. This is done by raising the elevation of the girder just enough so that the steel beam clears the girder flange. Raising the girder more than this minimal amount might preclude the use of composite girder design.

A reduction in ceiling to floor height and overall building height can also be achieved by this raised girder detail.

The advisability of adopting a raised girder condition must be weighed against its effect on the economy of the composite girder. Other factors to consider are: mechanical space requirements between floor and ceiling, floor module or bay size, shear diaphragm design, deck layout over the girder, and girder flashing detail.



WIRE MESH

Welded wire fabric is recommended for all Q-Lock floor slabs and is required in all U.L. fire rated assemblies. The purpose of this mesh is to resist the top slab stresses caused by more rapid drying of the concrete in the upper portion of the slab. Therefore, it should be located as close as practical to the top surface of the slab. Experience has shown the best location to be about 1 inch from the top surface.

The position of the mesh should be fixed, particularly above deck supports, by the use of chairs or other devices. If composite beams are used, the top of the shear studs can be used for this purpose by tying or welding the mesh to the stud.

Another option would be to weld or tie a pencil rod to the shear studs and drape the mesh over the pencil rod.

Although this wire mesh is not designed to resist the negative moments at the deck supports, if properly located, it will generally minimize cracks or confine them to the hairline variety.

Fire ratings

All of Robertson's steel floor units have been tested by Underwriters' Laboratories, Inc., and are listed in a wide variety of Designs in the U.L. "Fire Resistance Directory." Cellular sections are approved as "cellular metal raceway," since they comply with all of the requirements of U.L. 209. The following is a partial list of Robertson's Floor and Ceiling approvals involving only the most economical and popular assemblies.

Unprotected floor assemblies should not be employed if the floor will be electrified. Instead, an appropriate spray fireproofed assembly should be used.

FIRE RESISTANCE—UNDERWRITERS' LABORATORIES LISTINGS— TABLE OF RESTRAINED RATINGS

	U.L. Design No.	Listed Q-Lock (QL-) Floor Units	Concrete Type & Thickness	Trench Header		Tapmate			Composite Beam	Fireproofing* For Slab
				Standard	Tapway	I	II	II F		
1-Hour	D914	21, NKX, TKX, WKX, 2" & 3"-99, AKX, 3, UKX	2½" L.W.	No	No	No	No	No	No	None
	D902	3,UKX, 21, 2" & 3"-99 NKX, TKX, WKX, AKX	3½" N.W.	No	No	No	No	No	Yes	None
	D858	TKX, 2" & 3"-99 AKX, WKX	2½" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type D— C/F Fiber
	D859	TKX, 2" & 3"-99 AKX, WKX	2" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type D— C/F Fiber
2-Hour	D712	UKX, 21, NKX, TKX 2" & 3"-99, AKX, WKX	2½" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	No	Type MK-5 Cementitious
	D722	2" & 3"-99, AKX, WKX NKX, 21	2½" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type MK-5 Cementitious
	D739	2" & 3"-99, AKX, WKX 3, NKX, UKX	2½" L.W.	No	Yes	No	Yes	Yes	Yes	Type MK-5 Cementitious
	D743	2" & 3"-99, WKX	2" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type MK-5 Cementitious
	D826	3, UKX, 21, NKX, TKX AKX, WKX, 2" & 3"-99	3¼" L.W.	Yes	No	Yes	No	No	Yes	Type C Fiber
	D840	3, UKX, 21, 2" & 3"-99 NKX, TKX, WKX, AKX	3¼" L.W.	No	No	No	No	No	Yes	None
	D858	TKX, 2" & 3"-99 AKX, WKX	2½" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type D— C/F Fiber
	D859	TKX, 2" & 3"-99 AKX, WKX	2" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type D— C/F Fiber
	D902	3, UKX, 21, 2" & 3"-99 NKX, TKX, WKX, AKX	4½" N.W.	No	No	No	No	No	Yes	None
3-Hour	D703	2" & 3"-99 AKX, WKX, TKX	2½" L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type MK-5 Cementitious
	D708	2" & 3"-99, AKX, UKX WKX, TKX, NKX, 21, 3	2½" N.W. L.W.	Yes	Yes	Yes	Yes	No	Yes	Type MK-5 Cementitious
	D858	TKX, 2" & 3"-99 AKX, WKX	2½" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type D— C/F Fiber
	D859	TKX, 2" & 3"-99 AKX, WKX	2" N.W. L.W.	Yes	Yes	Yes	Yes	Yes	Yes	Type D— C/F Fiber
	D902	3, UKX, 21, 2" & 3"-99 NKX, TKX, WKX, AKX	4³⁄₁₆" L.W.	No	No	No	No	No	Yes	None

*See U.L. Fire Resistance Index and/or Latest Individual Design Cards for Required Fireproofing Thickness and/or Other Requirements.

Q-Lock building code approvals (a partial list)

1. ICBO Report No. 1388
2. ICBO Report No. 2739
3. SBCC Report No. 72151
4. City of Los Angeles, Research Report No. 23597
5. City of New York, Approval Calendar No. 448-40-SM

Specifications

1. SCOPE

The work covered by this section shall include all labor, material, equipment and services necessary for the installation of Robertson Q-Lock Floor, completed in accordance with this specification and the contract drawings. Cellular floor units may be used as electrical raceways. (See Note 4.)

2. WORK NOT INCLUDED
(unless so specified in detail)

a. Concrete
b. Concrete reinforcing steel or shrinkage mesh
c. All openings or holes not shown and dimensioned on the structural drawings or unframed openings.
d. Structural steel supports or bracing of any kind
e. Fireproofing
f. Electrical fittings
g. Shear connectors
h. Unloading or hoisting
i. Shoring

3. SUBSTITUTIONS

No substitution will be considered unless a written request for approval has been submitted and is received by the architect at least ten (10) days prior to the bid date.

4. MATERIALS

a. The steel floor units and all flashings shall be formed from steel sheets conforming to ASTM-A446. Before forming, the steel sheet shall be coated with a zinc coating conforming to ASTM-A525 and to Federal Specification QQ-S-775e. Cellular floor units shall conform to the requirements of UL 209 for use as metal floor raceways. (See Note 1.)
b. Floor units shall be formed with integral locking lugs or embossments to provide a mechanical lock between the steel floor and the concrete slab. Minimum depth of embossments or locking lugs = .050″
c. Floor units shall be classified by Underwriters' Laboratories, Inc. Each unit or bundle shall be labeled and marked as required by UL, indicating manufacturer, testing and inspection.
d. The steel floor units shall have a depth not greater than ________ inches (nominal) and shall be so formed as to provide cells spaced not more than 12 inches on centers.

5. DESIGN

a. The steel floor units shall be designed in accordance with the AISI publication, "Specification for the Design of Cold-Formed Steel Structural Members" (latest edition). The minimum positive section modulus so obtained shall be used in calculations involving positive moments and the minimum negative section modulus shall be used with negative moments.
b. Moment and deflection formulas and coefficients for beams as shown in the AISC "Manual of Steel Construction" (latest edition) shall be used in determining the required gauges of steel floor unit.
c. Composite floor slabs (combined steel and concrete sections) shall be capable of supporting a superimposed load of ________ pounds per square foot. (See Note 2.)
d. The design strength of welds used to form a cellular unit from two or more sheets, shall be in accordance with AISI specifications.

6. DRAWINGS

Submit detailed layout drawings showing type and gauge of steel floor to be supplied. Drawings shall also show anchorage details, complete erection instructions and all accessories necessary to complete the erection of the steel floor.

7. FLASHING

The steel floor manufacturer shall furnish sheet metal flashing to close openings between floor units and columns, and openings which occur where a change occurs in the direction of the floor span. These flashings shall be fastened in position by the steel floor erector.

8. ERECTION

a. The steel floor units shall be placed on the supporting steel framework, adjusted to final position, and permanently welded. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the floor units, the general contractor shall take the appropriate corrective action. The floor units shall not be placed until the necessary corrections are made. The floor units shall be placed in straight alignment for the entire length of run of flutes and with close registration of the flutes of one unit with those of abutting units. Sidelaps shall be properly fastened.
b. Steel floor units shall be fastened to the steel framework at ends of units and at all intermediate supports by ¾″ diameter puddle welds spaced not more than 12 inches across the width of the floor unit (not more than 16 inches on center for QL-21 and QL-NKX). Where two units abut, each unit shall be so fastened to the steel framing.
c. The sidelaps of adjacent units shall be fastened as shown on the deck erection drawings.
d. Any fastener found to be defective or broken shall be replaced before concrete is placed.
e. Hoisting of the steel floor shall be performed at no cost to the floor manufacturer. Steel floor units shall be hoisted to each individual floor as required and designated by the floor erector.

9. HOLES

Floor units shall be cut by the floor erector to fit framed openings which are dimensioned on the structural drawings. All other holes shall be cut by the trade requiring the hole. (See Note 3.)

10. CONCRETE

Concrete with admixtures containing chloride salts or other deleterious materials is not to be used with Q-Lock Floor. Minimum concrete strength shall be 3000 psi.

NOTES FOR SPECIFICATION WRITER

1. Always choose a UL design which involves spray fireproofing protection for the bottom of the floor units if the floor is to be used as a raceway.
2. Enter the live load listed in the tables for the proper concrete type, depth and gauge of floor.
3. Specifications for other sections which coordinate with steel floor such as heating, plumbing, plaster furring, electrical, etc. should contain the following paragraph: "Any cutting, reinforcing, drilling or patching of the steel floor units required for the performance of work under this section shall be performed at the expense of the trade requiring such work."
4. When the floor cells are to be used as raceways, the electrical contractor shall apply 2″ wide tape to butt joints. This work is to be done as soon as possible after the steel floor erector has secured the floor in place.
5. Steel floor used to support concrete buggy runways shall be adequately protected against wheel damage. The plywood runway should be blocked from the bottom flange of the deck and a wood curb should be installed along each edge of the runway. Shoring may be required.

Design symbols

E = Modulus of elasticity of steel, psi

I_c = Moment of inertia of composite section (L/360 deflection), in^4

I_s = Moment of inertia of steel unit, in^4

M_{DL} = Moment for dead load (W_{DL}), in-lb.

M_{LL} = Simple span moment for live load (W_{LL}), in-lb.

N = Modulus of elasticity ratio—steel to concrete

$+S_b$ = Section modulus of steel section, bottom flange (Positive Bending), in^3

$+S_t$ = Section modulus of steel section, top flange (Positive Bending), in^3

$-S_b$ = Section modulus of steel section, bottom flange (Negative Bending), in^3

$-S_t$ = Section modulus of steel section, top flange (Negative Bending), in^3

S_{bc} = Section modulus of composite section, bottom of steel, in^3

S_{cc} = Section modulus of composite section, top of concrete, in^3

V_R = Resisting vertical shear capacity of slab, lbs.

Δ = Deflection of deck unit or composite slab, in

All section properties are expressed in units per foot of width.

Design notes

1. Composite slab design is based on a simple span analysis.
2. Asterisk(s) (*) indicate(s) shoring required at midspan; all other spans require no shoring.
3. Shoring requirements are determined as follows:
   a. Dead load of concrete and deck plus 20 psf construction load will not stress section greater than 20,000 psi. If the construction load exceeds 20 psf, the span and/or gauge must be changed at the discretion of the design engineer.
   b. Stress due to concrete load plus deck dead load plus 200# concentrated load for one foot width of construction shall not exceed 26,667 psi.
   c. Dead load of concrete and deck will not cause deflections greater than Span/180 or a maximum of ¾″.
4. All concrete to be (f'c) = 3000 psi. For concrete of greater strength, contact the local H. H. Robertson Company representative.
5. Loads shown in the tables for unshored conditions represent the most critical condition of:
   a. Deflection—superimposed load will not deflect composite slab more than L/360.
   b. Bending, controlled by:
   (1) $M_{DL}/S_b + M_{LL}/S_{bc} \leq 27{,}000$ psi
   (2) $M_{DL} + M_{LL})/S_{bc} \leq 20{,}000$ psi
   c. Compressive stress in the top fiber of the concrete slab cannot exceed 1350 psi.
   d. Horizontal shear load, based on a minimum safety factor of 2.0 on ultimate load.

The design criteria for shored spans is too complex for presentation in this brochure, but is available upon request from the H. H. Robertson Company.

6. Contact the local H. H. Robertson Company office for use of any of the following on Q-Lock slabs:
   a. Live loads in excess of 200 psf as shown in the tables above the heavy horizontal line. Such loads generally indicate "long term" conditions for which the effects of concrete creep must be considered.
   b. Heavy concentrated loads.
   c. Slabs subjected to vibration.
   d. Masonry walls or partitions.
   e. Spans containing electrical trench header.
7. A 6 × 6 welded wire fabric shrinkage mesh, located one inch from the top of the concrete slab, is recommended for all slab thicknesses. Listed below are the recommended wire sizes for respective slab thicknesses measured from top of deck to top of slab. These wire sizes apply to both stone and lightweight concrete. Wire mesh is required for U.L. fire rating.

Slab Thickness Inches	6 × 6 Welded Wire Mesh: Wire Size
3¼″ or less	W1.5 x W1.5
3½″	W2 x W2
4″	W2 x W2
4½″	W2.5 x W2.5
5″	W3 x W3
5½″	W3 x W3
6″	W3.5 x W3.5

8. For floor construction, the maximum Q-Lock span should not exceed 32 times the total composite assembly thickness.
9. Superimposed loads = All loads except weight of slab and deck.
10. Concrete slab thickness = Depth of concrete above top of deck, t.

Design example

Check the shoring requirements and the allowable superimposed load for 3″-QL-99-18 ga. given the following conditions:

Span = 12′-0″ c/c, 11′-6″ clear, 3-span condition
Concrete = 2½″ regular weight (145 pcf) above top of floor unit (f′c=3000 psi)
Dead Load = 51.7 psf (steel floor plus concrete)
Live Load = 152 psf (see tables)
I_s = 1.221 in⁴
Minimum (+) S = .769 in³
Minimum (−) S = .712 in³

Part I Check the steel floor as a form for concrete.

Design Limits:

a. Dead load deflection limited to L/180 or ¾″ whichever is smaller.
b. Steel floor stress limited to 26,667 psi for dead load plus 200# concentrated load at midspan.
c. Steel floor stress limited to 20,000 psi for dead load plus 20 psf construction load.

For Deflection as a Concrete Form:

$$\Delta = \frac{.0069\, W_{DL}\, L^4 \times 1728}{EI_s} = \frac{.0069 \times 51.7 \times 11.5^4 \times 1728}{29.5 \times 10^6 \times 1.221}$$

Δ = 0.298″

$$L/180 = \frac{11.5 \times 12}{180} = 0.766'' \text{ (¾'' governs)}$$

0.298″ < .75″
O.K. for Deflection

For Stress as a Concrete Form:

(a)

$$+F_b = \frac{(.96 \times W_{DL} \times L^2) + (485.2L)^{\dagger}}{(+)\,S\ \text{Minimum}} < 26{,}667 \text{ psi} \qquad (1)$$

$$+F_b = \frac{(.96 \times 51.7 \times 11.5^2) + (485.2 \times 11.5)}{.769} < 26{,}667 \text{ psi}$$

$+F_b$ = 15,800 psi < 26,667 psi O.K.

$$-F_b = \frac{(1.2\, W_{DL}\, L^2) + (246.33L)^{\dagger}}{(-)\,S\ \text{Minimum}} < 26{,}667 \text{ psi} \qquad (2)$$

$$-F_b = \frac{(1.2 \times 51.7 \times 11.5^2) + (246.33 \times 11.5)}{.712} < 26{,}667 \text{ psi}$$

$-F_b$ = 15,500 psi < 26,667 psi O.K.

(b)

$$(-)\,F_b = \frac{1.2\,(W_{DL} + 20)\, L^{2\dagger}}{(-)\,S\ \text{Minimum}} < 20{,}000 \text{ psi} \qquad (3)$$

$$(-)\,F_b = \frac{1.2 \times 71.7 \times 11.5^2}{.712} < 20{,}000 \text{ psi}$$

$-F_b$ = 16,000 psi < 20,000 psi O.K.

Part II Check the listed allowable load of 152 psf on the composite slab.

From the tables:

I_c = 8.534 V_R = 2117
S_{cc} = 4.908 N = 9
S_{bc} = 2.219

(a) Allowable load governed by Deflection = L/360

$$W_{LL} = \frac{.001485\,(29.5 \times 10^6)\, I_c^{\dagger}}{L^3} \qquad (4)$$

$$W_{LL} = \frac{.001485\,(29.5 \times 10^6)\, 8.534}{11.5^3}$$

W_{LL} = 246 psf

(b) Allowable load governed by 20,000 psi bottom fiber stress

$$W_{LL} = \frac{20{,}000\, S_{bc}}{1.5\, L^2} - W_{DL}$$

$$W_{LL} = \frac{20{,}000 \times 2.219}{1.5 \times 11.5^2} - 51.7 \text{ psf}$$

W_{LL} = 223.7 − 51.7 = 172 psf (Governs)††

(c) Allowable load governed by 27,000 psi bottom fiber stress

$$W_{LL} = \frac{18{,}000\, S_{bc}}{L^2} - \frac{.08\, W_{DL}\,(S_{bc})\, 12^{\dagger}}{1.5\, S_b} \qquad (5)$$

$$W_{LL} = \frac{18{,}000 \times 2.219}{11.5^2} - \frac{.08 \times 51.7 \times 2.219 \times 12}{1.5 \times .769}$$

W_{LL} = 302 − 95 = 207 psf

(d) Allowable load governed by concrete stress of .45 f′c

$$W_{LL} = \frac{.45\, f'c\, N\, S_{cc}^{\dagger}}{1.5\, L^2} = \frac{.45\,(3000)\, 9\,(4.908)}{1.5 \times 11.5^2} \qquad (6)$$

W_{LL} = 300 psf

(e) Allowable load governed by horizontal shear

$$W_{LL} = \frac{2V_R}{L} = \frac{2 \times 2117}{11.5} = 368 \text{ psf}$$

For checking a 2-span condition the numbered formulas in the above problem would be:

$$(1)\ +F_b = \frac{.84\, W_{DL}\, L^2 + 490L}{+\,S_{Minimum}}$$

$$(2)\ -F_b = \frac{1.5\, W_{DL}\, L^2 + 230.9\, L}{-\,S_{Minimum}}$$

$$(3)\ -F_b = \frac{1.5\,(W_{DL} + 20)\, L^2}{-\,S_{Minimum}}$$

(4) Same as for 3-span condition

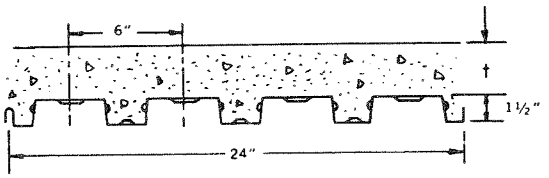
$$(5)\ W_{LL} = \frac{18{,}000\, S_{bc}}{L^2} - \frac{9\, W_{DL}\, S_{bc}\, 12}{128\,(1.5\, S_b)}$$

(6) Same as for 3-span condition

†Derivation available on request.

††Due to a difference in dead load stress in the steel floor unit, the allowable live load can vary for 1, 2 or 3-span conditions where steel stress governs. For simplicity, we list the least allowable live load for any of these span conditions. In the load-span tables on page 23, the listed live load of 152 psf applies to a 1-span condition. For a 3-span condition, the allowable load could be increased to 172 psf as shown above.

QL-3-22



SECTION PROPERTIES
Steel Unit Only

I_s = .18
(+) S_t = .203
(+) S_b = .24
(–) S_t = .247
(–) S_b = .209

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	38.9	44.9	51	57	63.1
V_R Lbs.	1049	1204	1363	1525	1688
I_c	2.487	3.425	4.536	5.821	7.285
S_{cc}	2.413	3.034	3.715	4.451	5.239
S_{bc}	1.075	1.302	1.536	1.774	2.015

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
6.	* 324	* 372	* 420	* 470	** 521
6.25	* 310	* 355	* 402	** 450	** 498
6.5	* 297	* 341	** 385	*** 431	*** 477
6.75	* 275	** 327	*** 370	*** 414	*** 458
7.	** 253	*** 314	*** 355	*** 398	*** 440
7.25	*** 242	*** 296	*** 342	*** 383	*** 424
7.5	*** 223	*** 274	*** 325	*** 369	*** 408
7.75	*** 206	*** 253	*** 300	*** 347	*** 393
8.	*** 191	*** 234	*** 277	*** 320	*** 363
8.25	*** 177	*** 217	*** 257	*** 296	*** 335
8.5	*** 164	*** 201	*** 238	*** 274	*** 309
8.75	*** 152	*** 186	*** 220	*** 253	*** 285
9.	*** 141	*** 173	*** 204	*** 234	*** 264
9.25	*** 131	*** 160	*** 189	*** 217	*** 243
9.5	*** 122	*** 149	*** 175	*** 201	*** 224
9.75	*** 113	*** 138	*** 162	*** 185	*** 207
10.	*** 105	*** 128	*** 150	*** 171	*** 190
10.25	*** 98	*** 119	*** 139	*** 158	*** 175
10.5	*** 91	*** 110	*** 128	*** 146	*** 161
10.75		*** 102	*** 119	*** 134	*** 147
11.		*** 94	*** 109	*** 123	*** 135
11.25		*** 87	*** 101	*** 113	*** 123
11.5		*** 80	*** 92	*** 103	*** 111
11.75		*** 74	*** 85	*** 94	
12.		*** 68	*** 77	*** 85	

N=14

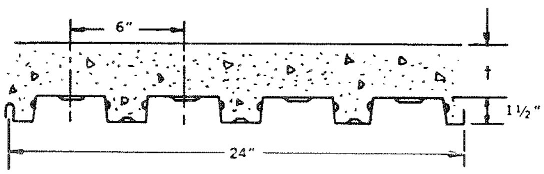
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	29.9	34.5	36.8	39.1	45.4
V_R Lbs.	1031	1181	1258	1336	1553
I_c	2.167	3.003	3.480	3.999	5.637
S_{cc}	1.790	2.256	2.506	2.768	3.544
S_{bc}	1.015	1.236	1.350	1.465	1.786

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
6.	343	* 371	* 395	* 419	* 487
6.25	* 310	* 355	* 378	* 401	* 467
6.5	* 290	* 340	* 363	* 385	* 448
6.75	* 267	* 327	* 348	* 370	** 430
7.	* 246	* 301	* 330	** 358	*** 413
7.25	* 227	** 279	** 305	*** 342	*** 398
7.5	** 210	*** 268	*** 294	*** 320	*** 384
7.75	*** 201	*** 248	*** 272	*** 297	*** 364
8.	*** 185	*** 231	*** 253	*** 276	*** 338
8.25	*** 169	*** 215	*** 235	*** 256	*** 314
8.5	*** 154	*** 200	*** 219	*** 239	*** 292
8.75	*** 141	*** 186	*** 204	*** 222	*** 272
9.	*** 130	*** 173	*** 190	*** 207	*** 254
9.25	*** 119	*** 162	*** 178	*** 193	*** 236
9.5	*** 110	*** 151	*** 166	*** 181	*** 220
9.75	*** 102	*** 141	*** 155	*** 169	*** 205
10.	*** 94	*** 131	*** 145	*** 158	*** 192
10.25	*** 88	*** 122	*** 135	*** 147	*** 179
10.5	*** 82	*** 113	*** 127	*** 138	*** 167
10.75		*** 105	*** 118	*** 128	*** 155
11.		*** 98	*** 111	*** 120	*** 145
11.25		*** 92	*** 103	*** 112	*** 135
11.5		*** 86	*** 96	*** 104	*** 125
11.75		*** 81	*** 90	*** 97	*** 116
12.		*** 76	*** 84	*** 91	*** 108

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
_____ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .23
(+) S_t = .265
(+) S_b = .291
(–) S_t = .298
(–) S_b = .261

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	39.4	45.5	51.5	57.5	63.6
V_R Lbs.	1047	1200	1356	1516	1678
I_c	2.850	3.929	5.209	6.695	8.388
S_{cc}	2.581	3.244	3.971	4.760	5.605
S_{bc}	1.269	1.539	1.816	2.100	2.388

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
6.	349	400	452	505	559
6.25	335	384	434	* 447	* 495
6.5	322	369	* 383	* 428	** 474
6.75	310	* 325	* 368	** 411	** 455
7.	* 273	* 313	** 353	** 395	** 437
7.25	* 263	* 301	** 340	** 380	*** 421
7.5	* 253	** 290	** 327	*** 366	*** 405
7.75	** 242	** 279	** 316	*** 353	*** 391
8.	** 224	** 270	*** 305	*** 341	*** 377
8.25	** 209	*** 261	*** 295	*** 329	*** 364
8.5	** 194	*** 246	*** 285	*** 318	*** 352
8.75	*** 186	*** 229	*** 273	*** 308	*** 341
9	*** 171	*** 214	*** 254	*** 294	*** 330
9.25	*** 157	*** 199	*** 236	*** 273	*** 309
9.5	*** 145	*** 186	*** 220	*** 254	*** 287
9.75	*** 134	*** 173	*** 205	*** 237	*** 267
10.	*** 124	*** 162	*** 192	*** 220	*** 248
10.25	*** 115	*** 151	*** 179	*** 205	*** 230
10.5	*** 107	*** 141	*** 166	*** 191	*** 214
10.75	*** 100	*** 132	*** 155	*** 178	*** 198
11.		*** 123	*** 144	*** 165	*** 184
11.25		*** 114	*** 134	*** 153	*** 170
11.5		*** 107	*** 125	*** 142	*** 157
11.75		*** 99	*** 116	*** 132	*** 145
12.		*** 92	*** 108	*** 122	*** 134

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

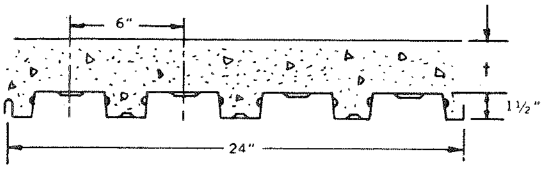
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	30.4	35	37.3	39.6	45.9
V_R Lbs.	1030	1177	1252	1329	1544
I_c	2.460	3.411	3.956	4.548	6.424
S_{cc}	1.907	2.400	2.666	2.945	3.772
S_{bc}	1.195	1.456	1.590	1.726	2.108

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
6.	343	392	417	443	514
6.25	329	376	400	425	494
6.5	317	362	385	409	475
6.75	305	348	371	393	* 427
7.	294	336	357	* 353	* 410
7.25	272	* 301	* 321	* 340	* 395
7.5	252	* 291	* 309	* 328	** 381
7.75	* 231	* 281	* 298	** 317	** 368
8.	* 210	** 268	** 288	** 306	** 355
8.25	* 191	** 250	** 274	** 296	*** 343
8.5	** 175	** 233	** 256	** 278	*** 332
8.75	** 160	** 218	*** 247	*** 270	*** 322
9.	** 147	*** 204	*** 231	*** 252	*** 310
9.25	** 136	*** 188	*** 217	*** 236	*** 290
9.5	*** 125	*** 174	*** 202	*** 221	*** 272
9.75	*** 116	*** 161	*** 186	*** 207	*** 255
10.	*** 107	*** 149	*** 173	*** 195	*** 239
10.25	*** 100	*** 138	*** 160	*** 183	*** 224
10.5	*** 93	*** 129	*** 149	*** 171	*** 210
10.75	*** 86	*** 120	*** 139	*** 160	*** 197
11.		*** 112	*** 130	*** 149	*** 185
11.25		*** 104	*** 121	*** 139	*** 173
11.5		*** 98	*** 113	*** 131	*** 162
11.75		*** 92	*** 106	*** 122	*** 152
12.		*** 86	*** 100	*** 115	*** 142

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-3-18



SECTION PROPERTIES
Steel Unit Only

I_s = .337
(+) S_t = .41
(+) S_b = .398
(−) S_t = .398
(−) S_b = .363

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	40.3	46.3	52.4	58.4	64.4
V_R Lbs.	1045	1193	1346	1502	1661
I_c	3.493	4.820	6.403	8.246	10.355
S_{cc}	2.854	3.583	4.386	5.258	6.197
S_{bc}	1.635	1.984	2.346	2.716	3.092

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
6.	348	397	448	500	553
6.25	334	381	430	480	531
6.5	321	367	414	462	511
6.75	309	353	398	445	492
7.	298	340	384	429	474
7.25	288	329	371	414	458
7.5	278	318	359	400	443
7.75	269	307	347	387	** 386
8.	261	298	336	** 337	** 372
8.25	253	289	311	** 325	** 360
8.5	241	263	** 282	** 315	*** 348
8.75	218	** 242	** 273	** 305	*** 337
9.	197	** 235	** 264	*** 295	*** 326
9.25	** 193	** 227	*** 256	*** 286	*** 316
9.5	** 178	** 221	*** 249	*** 277	*** 307
9.75	** 165	*** 214	*** 241	*** 269	*** 298
10.	** 153	*** 208	*** 234	*** 262	*** 289
10.25	*** 142	*** 196	*** 228	*** 254	*** 281
10.5	*** 132	*** 182	*** 222	*** 247	*** 273
10.75	***·123	*** 169	*** 216	*** 241	*** 266
11.		*** 158	*** 209	*** 234	*** 259
11.25		*** 148	***196	*** 227	*** 252
11.5		*** 138	*** 184	*** 213	*** 241
11.75		*** 130	*** 172	*** 200	*** 226
12.		*** 122	*** 162	*** 188	*** 212

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

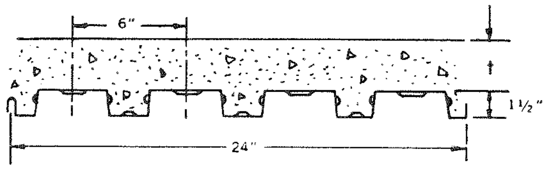
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	31.3	35.9	38.2	40.5	46.8
V_R Lbs.	1030	1171	1244	1319	1528
I_c	2.969	4.119	4.781	5.502	7.796
S_{cc}	2.095	2.631	2.922	3.227	4.134
S_{bc}	1.528	1.865	2.038	2.215	2.712

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
6.	343	390	414	439	509
6.25	329	375	398	422	489
6.5	317	360	383	405	470
6.75	305	347	368	390	452
7.	294	334	355	376	436
7.25	284	323	343	363	421
7.5	274	312	331	351	407
7.75	266	302	321	340	394
8.	254	292	311	329	382
8.25	231	284	301	319	370
8.5	211	275	292	310	356
8.75	194	267	283	295	** 318
9.	178	246	257	** 266	** 308
9.25	164	224	** 244	** 258	** 299
9.5	151	** 210	** 237	** 251	** 290
9.75	140	** 194	** 225	** 244	*** 282
10.	** 130	** 180	** 209	*** 237	*** 274
10.25	** 120	** 167	*** 194	*** 223	*** 267
10.5	** 112	*** 155	*** 180	*** 208	*** 260
10.75	** 104	*** 145	*** 168	*** 194	*** 253
11.		*** 135	*** 157	*** 181	*** 247
11.25		*** 126	*** 147	*** 169	*** 239
11.5		*** 118	*** 137	*** 158	*** 224
11.75		*** 111	*** 129	*** 148	*** 210
12.		*** 104	*** 121	*** 139	*** 197

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .442
(+) S_t = .572
(+) S_b = .506
(–) S_t = .495
(–) S_b = .459

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	41	47.1	53.1	59.2	65.2
V_R Lbs.	1042	1186	1335	1489	1646
I_c	4.065	5.619	7.479	9.652	12.146
S_{cc}	3.075	3.856	4.721	5.664	6.879
S_{bc}	1.985	2.414	2.859	3.316	3.782

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
6.	347	395	445	496	548
6.25	333	379	427	476	526
6.5	320	364	411	458	506
6.75	308	351	395	441	487
7.	297	338	381	425	470
7.25	287	327	368	410	454
7.5	277	316	356	397	438
7.75	268	306	344	384	424
8.	260	296	333	372	411
8.25	252	287	323	361	399
8.5	245	279	314	350	** 344
8.75	238	271	305	* 301	** 333
9.	231	263	* 262	** 292	** 322
9.25	225	256	** 254	** 283	** 312
9.5	207	* 219	** 246	** 274	*** 303
9.75	192	** 212	** 239	** 266	*** 294
10.	* 178	** 206	** 232	*** 258	*** 286
10.25	** 165	** 201	*** 225	*** 251	*** 278
10.5	** 153	** 195	*** 219	*** 244	*** 270
10.75	** 143	*** 190	*** 213	*** 238	*** 263
11.		*** 184	*** 208	*** 231	*** 256
11.25		*** 172	*** 202	***225	*** 249
11.5		*** 161	*** 197	*** 220	*** 243
11.75		*** 151	*** 192	*** 214	*** 237
12.		*** 142	*** 187	*** 209	*** 231

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	32	36.6	38.9	41.2	47.5
V_R Lbs.	1030	1166	1237	1309	1514
I_c	3.412	4.738	5.504	6.340	9.009
S_{cc}	2.246	2.815	3.125	3.451	4.423
S_{bc}	1.844	2.254	2.467	2.684	3.296

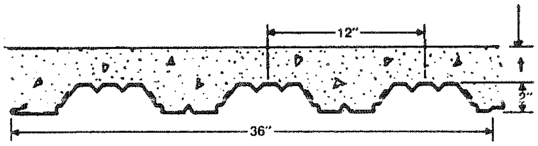
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
6.	343	385	412	436	504
6.25	329	373	395	419	484
6.5	317	358	380	402	465
6.75	305	345	366	388	448
7.	294	333	353	374	432
7.25	284	321	341	361	417
7.5	274	311	329	349	403
7.75	265	301	319	337	390
8.	257	291	309	327	378
8.25	249	282	299	317	367
8.5	242	274	291	308	356
8.75	223	266	282	299	346
9.	205	259	274	291	336
9.25	188	252	267	283	327
9.5	174	242	260	275	* 287
9.75	161	223	253	268	** 279
10.	149	207	* 222	** 235	** 271
10.25	138	* 192	** 216	** 228	** 264
10.5	129	** 179	** 208	** 222	** 257
10.75	* 120	** 167	** 194	** 217	*** 250
11.		** 155	** 181	** 208	*** 244
11.25		** 145	** 169	*** 195	*** 238
11.5		** 136	*** 158	*** 182	*** 232
11.75		*** 127	*** 148	*** 171	*** 226
12.		*** 120	*** 139	*** 160	*** 221

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

2"-QL-99-20



SECTION PROPERTIES
Steel Unit Only

I_s = .419
(+) S_t = .397
(+) S_b = .427
(–) S_t = .386
(–) S_b = .363

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	38.4	44.5	50.5	56.5	68.6
V_R Lbs.	1139	1285	1439	1599	1929
I_c	3.177	4.331	5.705	7.304	11.189
S_{cc}	2.537	3.146	3.821	4.557	6.195
S_{bc}	1.141	1.371	1.610	1.857	2.366

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
6.5	321	388	442	492	* 593
6.75	295	356	420	473	* 554
7.	272	328	387	* 436	* 489
7.25	251	303	357	* 390	* 430
7.5	232	280	* 324	* 348	* 377
7.75	* 214	* 259	* 292	* 310	** 452
8.	* 199	* 241	* 262	* 276	** 422
8.25	* 185	* 219	* 235	** 307	** 382
8.5	* 172	* 198	* 210	** 286	*** 384
8.75	* 160	* 179	** 229	** 266	*** 358
9.	* 149	** 181	** 214	*** 260	*** 333
9.25	* 139	** 169	** 200	*** 242	*** 311
9.5	** 130	** 158	*** 194	*** 226	*** 290
9.75	** 121	*** 153	*** 182	*** 212	*** 271
10.	** 113	*** 143	*** 170	*** 198	*** 253
10.25	*** 109	*** 134	*** 159	*** 185	*** 237
10.5	*** 102	*** 125	*** 149	*** 173	*** 221
10.75	*** 95	*** 117	*** 139	*** 162	*** 206
11.		*** 109	*** 130	*** 152	*** 193
11.25		*** 102	*** 122	*** 142	*** 180
11.5		*** 96	*** 114	*** 133	*** 168
11.75		*** 90	*** 107	*** 124	*** 156
12.		*** 84	*** 100	*** 116	*** 146
12.25			*** 93	*** 108	*** 135
12.5			*** 87	*** 101	*** 126

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

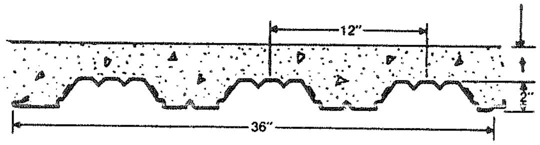
	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	29.6	34.2	38.8	41.1	49.7
V_R Lbs.	1132	1270	1418	1495	1792
I_c	2.784	3.805	5.032	5.723	8.791
S_{cc}	1.898	2.351	2.856	3.127	4.244
S_{bc}	1.083	1.304	1.537	1.656	2.117

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
6.5	312	377	436	460	551
6.75	287	347	410	442	531
7.	265	320	379	409	512
7.25	245	296	351	378	478
7.5	227	274	325	351	* 431
7.75	* 210	* 255	* 302	* 326	* 388
8.	* 196	* 237	* 281	* 303	* 349
8.25	* 182	* 221	* 262	* 278	* 313
8.5	* 170	* 206	* 243	* 253	* 281
8.75	* 159	* 192	* 221	* 229	** 318
9.	* 148	* 180	* 201	* 208	** 298
9.25	* 139	* 169	183	** 216	** 280
9.5	* 130	* 155	** 188	** 203	*** 273
9.75	* 122	** 148	** 176	** 191	*** 257
10.	* 114	** 139	** 166	*** 186	*** 241
10.25	** 107	*** 131	*** 161	*** 175	*** 227
10.5	** 101	*** 123	*** 151	*** 164	*** 213
10.75	** 95	*** 119	*** 143	*** 154	*** 200
11.		*** 112	*** 134	*** 145	*** 189
11.25		*** 105	*** 126	*** 137	*** 178
11.5		*** 99	*** 119	*** 129	*** 167
11.75		*** 93	*** 112	*** 122	*** 157
12.		*** 88	*** 106	*** 115	*** 148
12.25			*** 100	*** 108	*** 139
12.5			*** 94	*** 102	*** 131

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .558
(+) S_t = .525
(+) S_b = .567
(−) S_t = .519
(−) S_b = .531

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	39.2	45.2	51.3	57.3	69.4
V_R Lbs.	1136	1277	1427	1584	1909
I_c	3.921	5.353	7.066	9.066	13.950
S_{cc}	2.814	3.487	4.235	5.053	6.881
S_{bc}	1.477	1.777	2.091	2.415	3.086

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.	324	364	407	452	545
7.25	313	352	393	437	526
7.5	302	340	380	422	509
7.75	288	329	368	408	492
8.	268	319	356	396	477
8.25	250	302	346	384	438
8.5	233	282	331	357	391
8.75	218	264	302	323	347
9.	203	247	275	292	** 378
9.25	190	231	250	263	** 367
9.5	179	212	227	** 296	** 356
9.75	167	194	206	** 281	** 342
10.	157	178	** 227	** 264	*** 336
10.25	148	162	** 214	** 249	*** 326
10.5	139	** 169	** 201	** 234	*** 314
10.75	127	** 159	** 189	*** 229	*** 296
11.		** 150	** 179	*** 216	*** 278
11.25		** 142	*** 174	*** 203	*** 262
11.5		** 133	*** 164	*** 192	*** 247
11.75		*** 129	*** 155	*** 181	*** 232
12.		*** 122	*** 146	*** 170	*** 219
12.25			*** 138	*** 161	*** 206
12.5			*** 130	*** 151	*** 194
12.75			*** 122	*** 143	*** 183
13.			*** 115	*** 135	*** 172

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	30.4	35	39.5	41.8	50.4
V_R Lbs.	1133	1264	1407	1481	1772
I_c	3.386	4.633	6.137	6.987	10.781
S_{cc}	2.094	2.588	3.142	3.440	4.673
S_{bc}	1.393	1.680	1.983	2.139	2.744

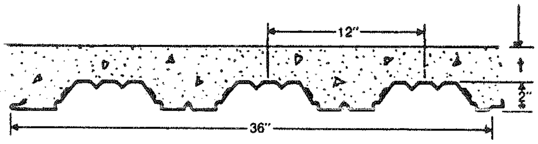
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.	323	361	402	423	506
7.25	312	348	388	408	488
7.5	299	337	375	395	472
7.75	278	326	363	382	457
8.	259	315	351	370	443
8.25	242	294	341	359	429
8.5	226	275	326	348	417
8.75	212	257	305	330	401
9.	198	241	286	310	365
9.25	186	226	269	291	333
9.5	173	213	253	268	303
9.75	160	200	237	247	275
10.	148	189	218	227	** 315
10.25	137	178	201	208	** 297
10.5	128	168	185	191	** 281
10.75	119	157	* 189	** 204	** 266
11.		146	** 179	** 193	** 251
11.25		** 141	** 169	** 183	*** 247
11.5		** 133	** 160	** 173	*** 233
11.75		** 125	** 152	** 164	*** 221
12.		** 117	** 144	*** 160	*** 209
12.25			*** 140	*** 152	*** 198
12.5			*** 132	*** 144	*** 188
12.75			*** 125	*** 136	*** 178
13.			*** 119	*** 129	*** 169

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

2"-QL-99-16



SECTION PROPERTIES
Steel Unit Only

I_s = .698
(+) S_t = .651
(+) S_b = .706
(−) S_t = .647
(−) S_b = .683

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	40	46	52	58.1	70.2
V_R Lbs.	1135	1272	1419	1572	1892
I_c	4.605	6.292	8.317	10.690	16.504
S_{cc}	3.049	3.772	4.581	5.467	7.452
S_{bc}	1.806	2.176	2.564	2.966	3.798

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.	324	363	405	449	540
7.25	313	350	391	433	522
7.5	302	339	378	419	504
7.75	292	328	366	405	488
8.	283	318	354	393	473
8.25	275	308	344	381	458
8.5	267	299	333	370	445
8.75	259	290	324	359	432
9.	252	282	315	349	420
9.25	241	275	306	340	409
9.5	226	267	298	331	379
9.75	213	289	291	317	* 342
10.	200	244	272	289	** 332
10.25	187	230	250	* 269	** 323
10.5	174	213	229	* 261	** 314
10.75	162	197	* 230	** 254	** 306
11.		* 193	** 224	** 248	*** 298
11.25		* 183	** 218	** 241	*** 290
11.5		** 173	** 206	** 235	*** 283
11.75		** 163	** 195	** 228	*** 276
12.		** 154	** 185	*** 223	*** 269
12.25			*** 180	*** 211	*** 262
12.5			*** 171	*** 200	*** 256
12.75			*** 162	*** 190	*** 246
13.			*** 154	*** 180	*** 233

N=14

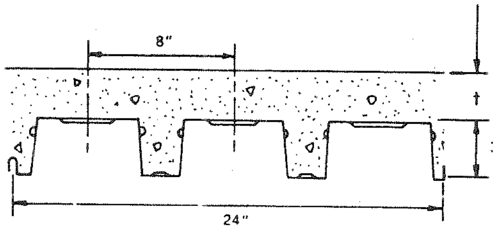
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	31.1	35.7	40.3	42.6	51.2
V_R Lbs.	1136	1261	1400	1472	1756
I_c	3.931	5.378	7.131	8.126	12.579
S_{cc}	2.259	2.785	3.378	3.698	5.026
S_{bc}	1.695	2.046	2.418	2.611	3.359

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.	324	360	400	420	501
7.25	313	348	386	406	484
7.5	303	336	373	392	468
7.75	293	325	361	380	453
8.	284	315	350	368	439
8.25	275	305	339	356	425
8.5	267	296	329	346	413
8.75	257	288	320	336	401
9.	236	280	311	327	390
9.25	217	272	302	318	379
9.5	200	265	294	310	369
9.75	185	251	287	302	360
10.	172	235	280	294	351
10.25	159	218	266	287	331
10.5	148	203	252	268	304
10.75	138	189	238	249	* 293
11.		177	221	230	* 286
11.25		165	205	213	** 279
11.5		154	* 203	* 220	** 272
11.75		145	* 192	** 209	** 265
12.		* 136	** 180	** 199	** 259
12.25			** 169	** 189	** 247
12.5			** 159	** 180	*** 242
12.75			** 150	** 171	*** 230
13.			** 142	** 162	*** 219

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .675
(+) S_t = .386
(+) S_b = .453
(−) S_t = .468
(−) S_b = .424

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	42.8	48.8	54.8	60.9	66.9
V_R Lbs.	975	1079	1188	1300	1415
I_c	4.432	5.738	7.251	8.973	10.908
S_{cc}	3.620	4.332	5.110	5.947	6.841
S_{bc}	1.317	1.559	1.812	2.074	2.343

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
8.	231	269	290	* 285	* 310
8.25	215	244	* 252	* 275	** 299
8.5	200	* 222	* 244	** 266	** 289
8.75	185	* 215	** 236	** 257	** 279
9.	* 173	* 207	** 228	** 249	** 270
9.25	* 162	** 194	** 221	** 241	*** 262
9.5	** 151	** 181	** 212	*** 234	*** 254
9.75	** 141	** 169	*** 205	*** 227	*** 246
10.	** 132	** 159	*** 192	*** 220	*** 239
10.25	** 124	*** 152	*** 179	*** 207	*** 232
10.5	** 116	*** 142	*** 168	*** 194	*** 220
10.75	*** 110	*** 133	*** 157	*** 181	*** 205
11.	*** 103	*** 125	*** 147	*** 169	*** 192
11.25	*** 96	*** 117	*** 138	*** 159	*** 179
11.5	*** 90	*** 109	*** 129	*** 148	*** 168
11.75	*** 84	*** 102	*** 120	*** 139	*** 157
12.	*** 78	*** 96	*** 113	*** 129	*** 146
12.25	*** 73	*** 89	*** 105	*** 121	*** 136
12.5	*** 68	*** 83	*** 98	*** 113	*** 127
12.75	*** 63	*** 78	*** 92	*** 105	*** 118
13.	*** 59	*** 72	*** 85	*** 98	*** 109
13.25	*** 55	*** 67	*** 79	*** 91	*** 101
13.5	*** 51	*** 63	*** 74	*** 84	*** 94
13.75	*** 47	*** 58	*** 68	*** 78	*** 87
14.	*** 44	*** 54	*** 63	*** 72	*** 80

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

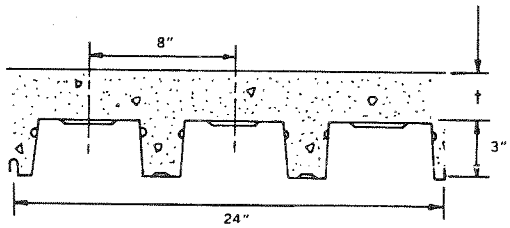
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	33	37.6	39.9	42.1	48.4
V_R Lbs.	968	1067	1118	1171	1321
I_c	3.897	5.057	5.709	6.410	8.591
S_{cc}	2.712	3.243	3.528	3.825	4.703
S_{bc}	1.236	1.468	1.589	1.712	2.063

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
8.	224	266	279	292	330
8.25	209	249	271	283	320
8.5	195	233	253	267	* 279
8.75	182	218	233	243	* 270
9.	170	204	213	* 233	* 262
9.25	159	* 191	* 207	* 224	** 254
9.5	149	* 179	* 194	* 210	** 246
9.75	* 140	* 168	** 182	** 198	** 239
10.	* 131	** 158	** 171	** 186	** 226
10.25	* 123	** 148	** 161	** 175	*** 219
10.5	** 116	** 139	** 152	** 164	*** 206
10.75	** 109	** 131	** 143	*** 158	*** 194
11.	** 103	** 124	*** 137	*** 149	*** 182
11.25	** 96	*** 118	*** 129	*** 140	*** 172
11.5	** 91	*** 111	*** 121	*** 132	*** 162
11.75	*** 85	*** 104	*** 114	*** 124	*** 152
12.	*** 80	*** 98	*** 108	*** 117	*** 143
12.25	*** 75	*** 92	*** 101	*** 110	*** 135
12.5	*** 71	*** 87	*** 95	*** 104	*** 127
12.75	*** 66	*** 82	*** 90	*** 98	*** 120
13.	*** 62	*** 77	*** 84	*** 92	*** 113
13.25	*** 59	*** 72	*** 79	*** 87	*** 106
13.5	*** 55	*** 68	*** 75	*** 81	*** 99
13.75	*** 52	*** 64	*** 70	*** 76	*** 93
14.	*** 48	*** 60	*** 66	*** 72	*** 88

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-21-20



SECTION PROPERTIES
Steel Unit Only

I_s = .855
(+) S_t = .5
(+) S_b = .555
(−) S_t = .564
(−) S_b = .521

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	43.3	49.3	55.4	61.4	67.4
V_R Lbs.	981	1082	1188	1299	1412
I_c	5.124	6.626	8.370	10.359	12.597
S_{cc}	3.904	4.663	5.492	6.387	7.343
S_{bc}	1.561	1.846	2.146	2.456	2.775

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.	213	240	262	274	** 269
9.25	199	224	237	** 241	** 261
9.5	187	204	* 214	** 233	** 253
9.75	173	185	** 208	** 226	** 245
10.	159	* 185	** 202	** 220	*** 238
10.25	145	** 179	** 196	** 213	*** 231
10.5	** 145	** 173	** 190	*** 207	*** 225
10.75	** 136	** 163	*** 185	*** 201	*** 218
11.	** 128	** 154	*** 180	*** 196	*** 212
11.25	** 121	*** 147	*** 174	*** 191	*** 207
11.5	** 114	*** 139	*** 164	*** 186	*** 201
11.75	*** 107	*** 130	*** 154	*** 178	*** 196
12.	*** 101	*** 123	*** 145	*** 167	*** 190
12.25	*** 95	*** 115	*** 136	*** 157	*** 179
12.5	*** 89	*** 108	*** 128	*** 148	*** 168
12.75	*** 84	*** 102	*** 120	*** 139	*** 158
13.	*** 78	*** 96	*** 113	*** 131	*** 148
13.25	*** 74	*** 90	*** 106	*** 123	*** 139
13.5	*** 69	*** 84	*** 100	*** 115	*** 130
13.75	*** 65	*** 79	*** 94	*** 108	*** 122
14.	*** 60	*** 74	*** 88	*** 101	*** 114
14.25	*** 56	*** 69	*** 82	*** 94	*** 106
14.5	*** 53	*** 65	*** 77	*** 88	*** 99
14.75	*** 49	*** 61	*** 72	*** 82	*** 92
15.		*** 56	*** 67	*** 77	*** 86

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

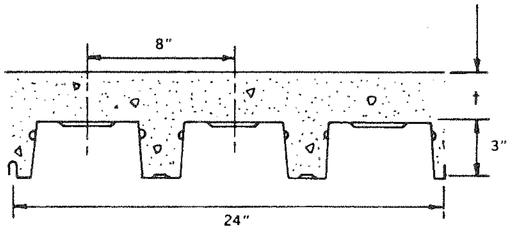
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	33.5	38.1	40.4	42.7	49
V_R Lbs.	977	1071	1121	1173	1319
I_c	4.470	5.792	6.535	7.336	9.831
S_{cc}	2.918	3.478	3.780	4.095	5.028
S_{bc}	1.460	1.732	1.874	2.019	2.433

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.	206	238	249	260	293
9.25	194	231	242	253	285
9.5	182	217	236	246	270
9.75	171	204	218	226	245
10.	161	192	200	208	* 232
10.25	151	177	184	190	** 225
10.5	143	163	169	* 196	** 219
10.75	134	* 161	** 175	** 190	** 213
11.	127	** 152	** 166	** 179	** 208
11.25	* 119	** 144	** 157	** 170	*** 202
11.5	** 113	** 136	** 148	** 160	*** 197
11.75	** 106	** 129	** 140	** 152	*** 189
12.	** 100	** 122	*** 134	*** 146	*** 179
12.25	** 95	*** 116	*** 127	*** 138	*** 169
12.5	** 89	*** 109	*** 120	*** 130	*** 160
12.75	*** 84	*** 103	*** 113	*** 123	*** 151
13.	*** 80	*** 98	*** 107	*** 117	*** 143
13.25	*** 75	*** 92	*** 101	*** 110	*** 136
13.5	*** 71	*** 87	*** 96	*** 104	*** 128
13.75	*** 67	*** 82	*** 90	*** 99	*** 121
14.	*** 63	*** 78	*** 85	*** 93	*** 115
14.25	*** 60	*** 73	*** 81	*** 88	*** 108
14.5	*** 56	*** 69	*** 76	*** 83	*** 102
14.75	*** 53	*** 65	*** 72	*** 79	*** 97
15.		*** 62	*** 68	*** 74	*** 91

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = 1.258
(+) S_t = .755
(+) S_b = .765
(−) S_t = .753
(−) S_b = .714

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	44.2	50.3	56.3	62.3	68.4
V_R Lbs.	994	1089	1190	1297	1406
I_c	6.385	8.236	10.394	12.864	15.652
S_{cc}	4.387	5.215	6.125	7.112	8.170
S_{bc}	2.027	2.394	2.781	3.184	3.599

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.	221	242	264	288	312
9.25	215	235	257	280	304
9.5	209	229	250	273	296
9.75	204	223	244	266	288
10.	198	217	238	259	281
10.25	194	212	232	253	274
10.5	189	207	226	247	265
10.75	185	202	221	236	** 217
11.	179	198	209	214	** 211
11.25	169	183	190	** 190	** 205
11.5	158	168	** 171	** 185	** 200
11.75	147	154	** 166	** 180	*** 195
12.	136	** 150	** 162	** 176	*** 190
12.25	126	** 146	** 158	*** 171	*** 185
12.5	116	** 142	*** 154	*** 167	*** 180
12.75	** 121	** 139	*** 151	*** 163	*** 176
13.	** 115	** 136	*** 147	*** 159	*** 172
13.25	** 109	*** 132	*** 143	*** 155	*** 168
13.5	** 103	*** 125	*** 140	*** 152	*** 164
13.75	*** 97	*** 118	*** 137	*** 148	*** 160
14.	*** 92	*** 112	*** 133	*** 145	*** 156
14.25	*** 87	*** 106	*** 126	*** 141	*** 153
14.5	*** 82	*** 100	*** 119	*** 138	*** 149
14.75	*** 78	*** 95	*** 113	*** 131	*** 146
15.		*** 89	*** 107	*** 124	*** 140
15.25		*** 84	*** 101	*** 117	*** 133
15.5		*** 80	*** 95	*** 111	*** 125
15.75		*** 75	*** 90	*** 104	*** 118
16.		*** 71	*** 85	*** 98	*** 111

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	34.4	39	41.3	43.6	49.9
V_R Lbs.	996	1083	1129	1178	1318
I_c	5.505	7.105	8.009	8.984	12.035
S_{cc}	3.270	3.873	4.199	4.542	5.559
S_{bc}	1.885	2.231	2.412	2.599	3.134

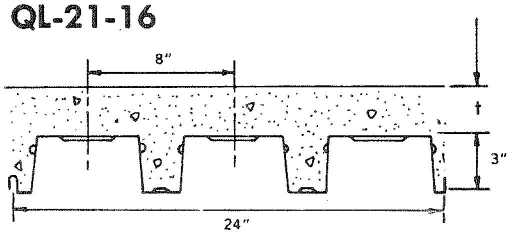
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.	221	240	251	261	292
9.25	215	234	244	254	284
9.5	209	228	237	248	277
9.75	204	222	231	241	270
10.	199	216	225	235	263
10.25	194	211	220	229	257
10.5	189	206	215	224	251
10.75	183	201	210	219	245
11.	173	196	205	214	239
11.25	164	192	200	209	234
11.5	155	185	196	204	222
11.75	147	176	184	190	204
12.	139	165	171	176	187
12.25	131	153	159	163	** 183
12.5	123	143	147	151	** 179
12.75	116	133	136	** 157	** 174
13.	109	123	** 148	** 154	** 170
13.25	103	** 130	** 141	** 150	*** 167
13.5	98	** 123	** 135	** 146	*** 163
13.75	** 92	** 117	** 128	*** 140	*** 159
14.	** 87	** 111	*** 122	*** 133	*** 156
14.25	** 83	*** 106	*** 116	*** 127	*** 153
14.5	** 79	*** 101	*** 110	*** 120	*** 149
14.75	** 75	*** 96	*** 105	*** 114	*** 142
15.		*** 91	*** 100	*** 109	*** 135
15.25		*** 86	*** 95	*** 104	*** 128
15.5		*** 82	*** 90	*** 99	*** 122
15.75		*** 78	*** 86	*** 94	*** 116
16.		*** 74	*** 81	*** 89	*** 111

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

_____ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-21-16



SECTION PROPERTIES
Steel Unit Only

I_s = 1.703
(+) S_t = 1.075
(+) S_b = .982
(−) S_t = .94
(−) S_b = .898

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	45.2	51.2	57.2	63.3	69.3
V_R Lbs.	1007	1095	1192	1294	1401
I_c	7.545	9.711	12.245	15.156	18.450
S_{cc}	4.799	5.679	6.653	7.713	8.853
S_{bc}	2.480	2.925	3.398	3.891	4.403

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.	223	243	265	287	311
9.25	217	236	257	279	302
9.5	212	230	251	272	295
9.75	206	224	244	265	287
10.	201	219	238	258	280
10.25	196	213	232	252	273
10.5	191	208	227	246	266
10.75	187	203	221	240	260
11.	183	199	216	235	254
11.25	179	194	212	230	249
11.5	175	190	207	225	243
11.75	171	186	202	220	238
12.	167	182	198	215	233
12.25	164	178	194	211	** 184
12.5	161	175	190	197	** 179
12.75	157	171	178	** 162	** 175
13.	149	159	163	** 158	*** 170
13.25	140	147	** 144	** 155	*** 166
13.5	130	** 130	** 140	*** 151	*** 163
13.75	121	** 128	** 137	*** 148	*** 159
14.	** 117	** 125	*** 134	*** 144	*** 155
14.25	** 114	** 122	*** 131	*** 141	*** 152
14.5	** 108	*** 119	*** 128	*** 138	*** 148
14.75	** 102	*** 117	*** 125	*** 135	*** 145
15.		*** 114	*** 123	*** 132	*** 142
15.25		*** 112	*** 120	*** 129	*** 139
15.5		*** 109	*** 118	*** 126	*** 136
15.75		*** 104	*** 115	*** 124	*** 133
16.		*** 99	*** 113	*** 121	*** 130

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

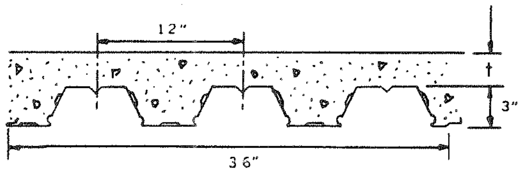
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	35.4	39.9	42.2	44.5	50.8
V_R Lbs.	1016	1095	1138	1184	1317
I_c	6.449	8.292	9.336	10.465	14.011
S_{cc}	3.574	4.206	4.551	4.914	5.997
S_{bc}	2.295	2.711	2.931	3.157	3.809

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.	225	243	253	263	292
9.25	219	236	246	256	284
9.5	214	230	239	249	277
9.75	208	224	233	242	270
10.	203	219	227	236	263
10.25	198	213	222	231	257
10.5	193	208	216	225	250
10.75	189	203	211	220	245
11.	184	199	207	215	239
11.25	180	194	202	210	234
11.5	176	190	198	205	229
11.75	173	186	193	201	224
12.	163	182	189	197	219
12.25	153	178	185	193	215
12.5	144	175	182	189	210
12.75	136	171	178	185	206
13.	128	165	175	182	202
13.25	121	156	171	178	193
13.5	114	147	163	168	** 163
13.75	108	139	153	157	** 159
14.	102	132	143	** 142	** 156
14.25	97	125	** 134	** 139	** 153
14.5	92	** 119	** 131	** 136	** 149
14.75	** 88	** 113	** 127	** 133	*** 146
15.		** 107	** 121	** 130	*** 143
15.25		** 102	** 115	*** 128	*** 140
15.5		** 97	** 109	*** 123	*** 138
15.75		** 92	*** 104	*** 117	*** 135
16.		*** 88	*** 99	*** 111	*** 132

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .731
(+) S_t = .439
(+) S_b = .465
(−) S_t = .49
(−) S_b = .383

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	44.4	50.5	56.5	62.6	74.6
V_R Lbs.	1944	2123	2316	2518	2942
I_c	4.646	5.943	7.446	9.158	13.221
S_{cc}	3.471	4.102	4.795	5.546	7.203
S_{bc}	1.247	1.443	1.650	1.863	2.307

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
8.5	* 185	* 202	* 210	** 281	*** 367
8.75	* 172	* 182	** 230	** 261	*** 341
9.	* 160	* 163	** 215	*** 255	*** 318
9.25	* 149	** 174	*** 209	*** 237	*** 296
9.5	** 139	** 162	*** 195	*** 221	*** 276
9.75	** 130	*** 158	*** 182	*** 207	*** 257
10.	*** 126	*** 148	*** 170	*** 193	*** 240
10.25	*** 118	*** 138	*** 159	*** 180	*** 224
10.5	*** 110	*** 129	*** 148	*** 168	*** 208
10.75	*** 103	*** 120	*** 139	*** 157	*** 194
11.	*** 96	*** 112	*** 129	*** 147	*** 181
11.25	*** 89	*** 105	*** 121	*** 137	*** 168
11.5	*** 83	*** 98	*** 113	*** 127	*** 157
11.75	*** 78	*** 91	*** 105	*** 119	*** 146
12.	*** 73	*** 85	*** 98	*** 111	*** 135
12.25	*** 68	*** 79	*** 91	*** 103	*** 125
12.5	*** 63	*** 74	*** 85	*** 96	*** 116
12.75	*** 58	*** 69	*** 79	*** 89	*** 107
13.	*** 54	*** 64	*** 73	*** 82	*** 99
13.25	*** 50	*** 59	*** 68	*** 76	*** 91
13.5	*** 47	*** 55	*** 63	*** 70	*** 83
13.75		*** 50	*** 58	*** 64	*** 76
14.		*** 46	*** 53	*** 59	*** 69
14.25		*** 43	*** 49	*** 54	*** 63
14.5		*** 39	*** 45	*** 49	*** 56

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

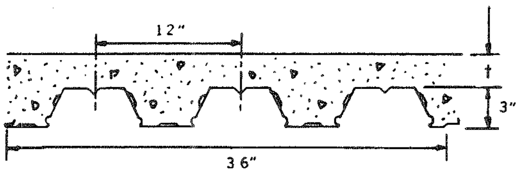
	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	34.1	38.7	43.3	45.6	54.2
V_R Lbs.	1947	2113	2296	2392	2770
I_c	4.161	5.325	6.682	7.434	10.700
S_{cc}	2.635	3.106	3.626	3.904	5.040
S_{bc}	1.193	1.383	1.582	1.685	2.086

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
8.5	* 186	* 216	* 246	* 254	* 276
8.75	* 173	* 202	* 224	* 230	* 247
9.	* 162	* 188	* 204	* 209	** 289
9.25	* 151	* 175	* 185	* 189	** 270
9.5	* 142	* 160	* 168	** 203	** 264
9.75	* 133	* 146	** 178	** 190	*** 248
10.	* 124	** 145	** 167	*** 186	*** 232
10.25	* 117	** 136	*** 163	*** 174	*** 218
10.5	** 110	*** 133	*** 153	*** 164	*** 205
10.75	** 103	*** 125	*** 144	*** 154	*** 193
11.	*** 100	*** 117	*** 135	*** 145	*** 181
11.25	*** 94	*** 110	*** 127	*** 136	*** 170
11.5	*** 88	*** 104	*** 120	*** 128	*** 160
11.75	*** 83	*** 97	*** 113	*** 120	*** 150
12.	*** 78	*** 91	*** 106	*** 113	*** 141
12.25	*** 73	*** 86	*** 100	*** 106	*** 133
12.5	*** 69	*** 81	*** 94	*** 100	*** 125
12.75	*** 65	*** 76	*** 88	*** 94	*** 117
13.	*** 61	*** 71	*** 83	*** 88	*** 110
13.25	*** 57	*** 67	*** 78	*** 83	*** 103
13.5	*** 53	*** 63	*** 73	*** 78	*** 96
13.75		*** 59	*** 68	*** 73	*** 90
14.		*** 55	*** 64	*** 68	*** 84
14.25		*** 52	*** 60	*** 64	*** 79
14.5		*** 48	*** 56	*** 60	*** 73

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

3"-QL-99-20



SECTION PROPERTIES
Steel Unit Only

I_s = .913
(+) S_t = .561
(+) S_b = .566
(−) S_t = .594
(−) S_b = .486

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	44.9	50.9	57	63	75.1
V_R Lbs.	1946	2120	2309	2508	2927
I_c	5.359	6.855	8.594	10.578	15.296
S_{cc}	3.729	4.402	5.144	5.948	7.727
S_{bc}	1.474	1.708	1.952	2.207	2.735

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.	197	225	* 237	* 244	** 375
9.25	* 184	* 205	* 214	* 218	*** 366
9.5	* 172	* 187	* 192	** 263	*** 343
9.75	* 161	* 169	* 173	** 246	*** 321
10.	* 151	* 153	** 203	*** 241	*** 301
10.25	* 142	* 139	** 190	*** 226	*** 282
10.5	* 133	** 155	*** 186	*** 212	*** 264
10.75	** 125	*** 151	*** 175	*** 199	*** 248
11.	** 117	*** 142	*** 164	*** 187	*** 232
11.25	*** 114	*** 133	*** 154	*** 175	*** 218
11.5	*** 107	*** 125	*** 145	*** 164	*** 204
11.75	*** 100	*** 117	*** 136	*** 154	*** 191
12.	*** 94	*** 110	*** 127	*** 145	*** 179
12.25	*** 88	*** 103	*** 120	*** 136	*** 168
12.5	*** 82	*** 97	*** 112	*** 127	*** 157
12.75	*** 77	*** 91	*** 105	*** 119	*** 147
13.	*** 72	*** 85	*** 99	*** 112	*** 137
13.25	*** 68	*** 80	*** 92	*** 105	*** 128
13.5	*** 63	*** 75	*** 86	*** 98	*** 119
13.75		*** 70	*** 81	*** 91	*** 111
14.		*** 65	*** 75	*** 85	*** 103
14.25		*** 61	*** 70	*** 79	*** 96
14.5		*** 57	*** 66	*** 74	*** 89
14.75		*** 53	*** 61	*** 68	*** 82
15.			*** 57	*** 63	*** 75

N=14

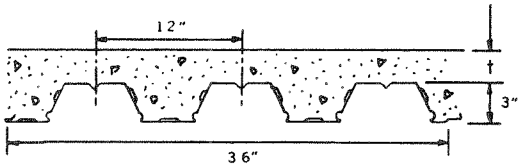
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	34.6	39.1	43.7	46	54.6
V_R Lbs.	1953	2113	2290	2384	2756
I_c	4.763	6.093	7.648	8.512	12.270
S_{cc}	2.824	3.322	3.875	4.171	5.384
S_{bc}	1.407	1.630	1.866	1.988	2.464

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.	197	229	263	280	* 309
9.25	* 184	* 214	* 247	* 256	* 280
9.5	* 173	* 201	* 228	* 234	* 253
9.75	* 162	* 189	* 209	* 214	* 228
10.	* 153	* 178	* 191	* 196	* 205
10.25	* 143	* 166	* 175	* 179	** 258
10.5	* 135	* 153	* 160	* 163	*** 252
10.75	* 127	* 141	* 146	** 183	*** 238
11.	* 120	* 129	** 161	** 173	*** 225
11.25	* 113	* 119	** 152	*** 169	*** 212
11.5	* 107	** 125	*** 149	*** 160	*** 200
11.75	** 101	*** 121	*** 141	*** 151	*** 189
12.	** 95	*** 115	*** 133	*** 142	*** 178
12.25	*** 92	*** 108	*** 125	*** 134	*** 168
12.5	*** 87	*** 102	*** 119	*** 127	*** 159
12.75	*** 82	*** 96	*** 112	*** 120	*** 150
13.	*** 77	*** 91	*** 106	*** 113	*** 142
13.25	*** 73	*** 86	*** 100	*** 107	*** 134
13.5	*** 69	*** 81	*** 94	*** 101	*** 126
13.75		*** 77	*** 89	*** 95	*** 119
14.		*** 72	*** 84	*** 90	*** 113
14.25		*** 68	*** 79	*** 85	*** 106
14.5		*** 64	*** 75	*** 80	*** 100
14.75		*** 61	*** 71	*** 76	*** 94
15.			*** 66	*** 71	*** 88

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = 1.221
(+) S_t = .816
(+) S_b = .769
(–) S_t = .803
(–) S_b = .712

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	45.6	51.7	57.7	63.8	75.9
V_R Lbs.	1951	2117	2299	2493	2903
I_c	6.672	8.534	10.704	13.190	19.125
S_{cc}	4.167	4.908	5.729	6.622	8.605
S_{bc}	1.916	2.219	2.539	2.872	3.567

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.	269	313	360	399	440
9.25	252	294	337	365	398
9.5	237	276	315	334	359
9.75	223	259	290	305	323
10.	209	244	266	278	289
10.25	197	229	244	253	259
10.5	186	213	224	230	** 355
10.75	175	196	204	209	** 330
11.	165	180	187	188	** 305
11.25	156	166	170	** 238	*** 311
11.5	147	152	** 198	** 225	*** 294
11.75	136	140	** 187	** 213	*** 277
12.	125	** 153	** 177	*** 209	*** 262
12.25	116	** 145	** 167	*** 198	*** 248
12.5	107	** 137	*** 164	*** 187	*** 234
12.75	** 113	** 130	*** 155	*** 177	*** 221
13.	** 107	*** 126	*** 147	*** 167	*** 209
13.25	** 101	*** 119	*** 139	*** 158	*** 198
13.5	*** 96	*** 113	*** 131	*** 150	*** 187
13.75		*** 107	*** 124	*** 141	*** 176
14.		*** 101	*** 117	*** 134	*** 167
14.25		*** 95	*** 111	*** 126	*** 157
14.5		*** 90	*** 105	*** 119	*** 148
14.75		*** 85	*** 99	*** 113	*** 140
15.			*** 93	*** 106	*** 131
15.25			*** 88	*** 100	*** 124
15.5			*** 83	*** 94	*** 116
15.75			*** 78	*** 89	*** 109
16.			*** 73	*** 83	*** 102

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	35.3	39.9	44.5	46.8	55.4
V_R Lbs.	1967	2116	2285	2375	2734
I_c	5.858	7.485	9.397	10.461	15.113
S_{cc}	3.143	3.685	4.290	4.615	5.952
S_{bc}	1.819	2.107	2.413	2.572	3.194

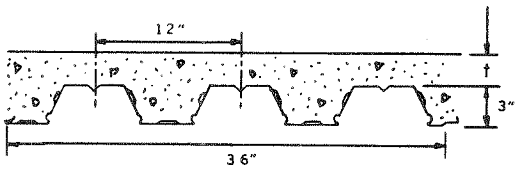
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.	264	306	352	376	470
9.25	248	288	331	353	441
9.5	233	271	311	333	406
9.75	219	255	293	313	374
10.	207	241	277	296	344
10.25	195	227	261	279	317
10.5	184	214	247	263	391
10.75	174	203	233	244	267
11.	165	192	219	226	245
11.25	156	182	203	209	224
11.5	148	172	188	193	204
11.75	140	163	174	178	** 253
12.	133	154	161	164	** 240
12.25	126	143	149	151	** 228
12.5	119	133	138	** 172	** 217
12.75	113	123	** 153	** 164	*** 213
13.	108	115	** 145	** 156	*** 202
13.25	102	** 120	** 138	** 148	*** 192
13.5	96	** 114	** 132	*** 145	*** 183
13.75		** 108	*** 128	*** 138	*** 174
14.		** 103	*** 122	*** 131	*** 165
14.25		*** 99	*** 116	*** 124	*** 157
14.5		*** 94	*** 110	*** 118	*** 149
14.75		*** 90	*** 105	*** 112	*** 142
15.			*** 99	*** 107	*** 135
15.25			*** 94	*** 102	*** 128
15.5			*** 90	*** 96	*** 122
15.75			*** 85	*** 92	*** 116
16.			*** 81	*** 87	*** 110

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

3"-QL-99-16



SECTION PROPERTIES
Steel Unit Only

I_s = 1.531
(+) S_t = 1.018
(+) S_b = .964
(−) S_t = 1.018
(−) S_b = .964

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	46.5	52.6	58.6	64.6	76.7
V_R Lbs.	1960	2118	2294	2483	2885
I_c	7.892	10.088	12.656	15.605	22.671
S_{cc}	4.542	5.338	6.223	7.189	9.340
S_{bc}	2.35	2.722	3.116	3.527	4.386

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.	340	395	454	515	625
9.25	319	371	426	485	573
9.5	300	349	401	456	525
9.75	283	329	378	430	481
10.	266	310	356	398	440
10.25	251	292	336	367	402
10.5	237	276	318	339	367
10.75	224	261	295	313	334
11.	212	247	274	288	303
11.25	201	234	253	265	274
11.5	190	221	234	243	247
11.75	180	206	216	223	** 346
12.	171	191	200	204	** 324
12.25	162	177	184	186	** 302
12.5	154	165	169	** 236	** 281
12.75	146	152	* 196	** 224	** 262
13.	136	141	** 187	** 213	*** 277
13.25	127	* 154	** 178	** 203	*** 264
13.5	* 126	** 146	** 169	** 193	*** 250
13.75		** 139	** 161	** 184	*** 238
14.		** 132	** 153	*** 180	*** 226
14.25		** 126	** 146	*** 171	*** 215
14.5		** 120	*** 142	*** 162	*** 204
14.75		** 114	*** 135	*** 154	*** 194
15.			*** 128	*** 147	*** 184
15.25			*** 122	*** 139	*** 175
15.5			*** 115	*** 132	*** 166
15.75			*** 110	*** 126	*** 157
16.			*** 104	*** 119	*** 149

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	36.2	40.8	45.3	47.6	56.2
V_R Lbs.	1986	2124	2285	2371	2720
I_c	6.862	8.755	10.986	12.232	17.693
S_{cc}	3.418	3.993	4.639	4.987	6.424
S_{bc}	2.222	2.573	2.947	3.142	3.907

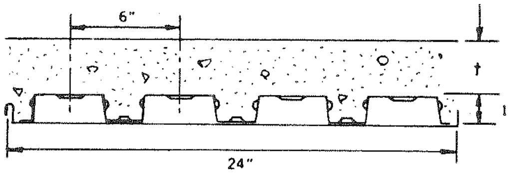
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.	329	382	439	469	586
9.25	310	360	413	442	552
9.5	292	339	390	416	521
9.75	275	320	368	393	491
10.	260	302	347	371	464
10.25	245	285	328	351	439
10.5	232	270	311	332	410
10.75	220	256	294	314	380
11.	208	242	279	298	353
11.25	197	230	265	283	327
11.5	187	218	251	269	303
11.75	178	207	239	254	281
12.	169	197	227	237	260
12.25	161	187	215	221	240
12.5	153	178	201	206	222
12.75	145	170	187	192	204
13.	136	162	175	179	** 252
13.25	129	154	163	166	** 240
13.5	122	145	152	* 182	** 229
13.75		136	* 162	* 173	** 219
14.		* 134	* 155	** 166	** 209
14.25		* 128	** 148	** 158	** 200
14.5		* 122	** 141	** 151	** 188
14.75		** 116	** 135	** 144	*** 187
15.			** 129	** 138	*** 179
15.25			** 123	** 132	*** 171
15.5			** 118	*** 128	*** 163
15.75			*** 114	*** 122	*** 156
16.			*** 109	*** 117	*** 149

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-UKX-20/20



SECTION PROPERTIES
Steel Unit Only

I_s = .381
(+) S_t = .31
(+) S_b = .785
(−) S_t = .344
(−) S_b = .568

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	41.1	47.1	53.2	59.2	65.2
V_R Lbs.	1415	1603	1795	1991	2190
I_c	5.055	6.814	8.883	11.269	13.977
S_{cc}	3.574	4.416	5.336	6.329	7.392
S_{bc}	2.572	3.027	3.491	3.962	4.439

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
7.	404	458	513	* 529	* 582
7.25	390	442	* 460	* 510	* 561
7.5	377	* 396	* 443	* 491	** 540
7.75	* 338	* 382	* 428	** 474	** 522
8.	* 327	* 369	** 413	** 458	** 504
8.25	* 316	* 357	** 400	** 443	*** 487
8.5	* 306	** 346	** 387	** 429	*** 472
8.75	** 296	** 335	** 375	*** 416	*** 457
9.	** 287	** 325	*** 363	*** 403	*** 443
9.25	** 279	*** 315	*** 353	*** 391	*** 430
9.5	** 258	*** 306	*** 342	*** 380	*** 417
9.75	*** 238	*** 298	*** 333	*** 369	*** 406
10.	*** 221	*** 289	*** 324	*** 359	*** 394
10.25	*** 205	*** 277	*** 315	*** 349	*** 384
10.5	*** 191	*** 257	*** 306	*** 340	*** 373
10.75	*** 178	*** 240	*** 299	*** 331	*** 364
11.		*** 224	*** 290	*** 322	*** 354
11.25		*** 209	*** 273	*** 314	*** 346
11.5		*** 196	*** 255	*** 307	*** 337
11.75		*** 184	*** 239	*** 297	*** 329
12.		*** 172	*** 225	*** 282	*** 321
12.25			*** 211	*** 267	*** 314
12.5			*** 199	*** 252	*** 301
12.75			*** 187	*** 238	*** 286
13.			*** 177	*** 224	*** 272

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	32.1	36.7	38.9	41.2	47.5
V_R Lbs.	1391	1570	1662	1756	2018
I_c	4.251	5.763	6.624	7.556	10.494
S_{cc}	2.605	3.223	3.555	3.902	4.930
S_{bc}	2.432	2.872	3.097	3.324	3.958

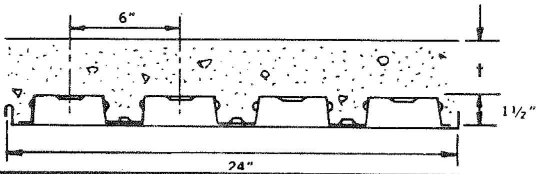
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
7.	397	448	475	501	576
7.25	383	433	458	484	556
7.5	371	418	443	468	* 506
7.75	359	405	429	* 426	* 489
8.	347	* 368	* 390	* 412	* 473
8.25	331	* 357	* 377	* 398	** 457
8.5	* 303	* 345	* 365	* 386	** 443
8.75	* 277	* 335	* 354	** 374	** 429
9.	* 255	** 325	** 344	** 363	** 417
9.25	* 235	** 315	** 334	** 352	*** 404
9.5	** 217	** 294	** 324	** 342	*** 393
9.75	** 200	** 272	*** 313	*** 333	*** 382
10.	** 186	*** 252	*** 290	*** 324	*** 372
10.25	** 172	*** 234	*** 269	*** 307	*** 362
10.5	*** 160	*** 218	*** 250	*** 285	*** 353
10.75	*** 149	*** 203	*** 233	*** 266	*** 344
11.		*** 189	*** 218	*** 248	*** 335
11.25		*** 177	*** 203	*** 232	*** 322
11.5		*** 165	*** 190	*** 217	*** 302
11.75		*** 155	*** 178	*** 204	*** 283
12.		*** 146	*** 167	*** 191	*** 266
12.25			*** 157	*** 180	*** 250
12.5			*** 148	*** 169	*** 235
12.75			*** 140	*** 159	*** 221
13.				*** 150	*** 209

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-UKX-20/18



SECTION PROPERTIES
Steel Unit Only

I_s = .411
(+) S_t = .317
(+) S_b = .938
(−) S_t = .358
(−) S_b = .764

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	41.7	47.8	53.8	59.9	65.9
V_R Lbs.	1426	1613	1805	2000	2197
I_c	5.725	7.701	10.024	12.702	15.741
S_{cc}	3.818	4.709	5.683	6.734	7.859
S_{bc}	3.029	3.550	4.082	4.622	5.167

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
7.	407	460	515	* 531	* 584
7.25	393	445	* 462	* 512	* 562
7.5	380	* 398	* 445	* 493	** 542
7.75	368	* 385	* 430	** 476	** 523
8.	* 329	* 372	* 415	** 460	** 505
8.25	* 318	* 359	** 402	** 445	** 489
8.5	* 308	** 348	** 389	** 430	*** 473
8.75	* 299	** 337	** 377	*** 417	*** 458
9.	** 289	** 327	*** 365	*** 404	*** 444
9.25	** 281	** 317	*** 354	*** 392	*** 431
9.5	** 273	*** 308	*** 344	*** 381	*** 418
9.75	*** 265	*** 299	*** 334	*** 370	*** 407
10.	*** 250	*** 291	*** 325	*** 360	*** 395
10.25	*** 232	*** 283	*** 316	*** 350	*** 385
10.5	*** 216	*** 275	*** 308	*** 341	*** 374
10.75	*** 201	*** 268	*** 300	*** 332	*** 365
11.		*** 253	*** 292	*** 323	*** 355
11.25		*** 236	*** 285	*** 315	*** 346
11.5		*** 221	*** 278	*** 308	*** 338
11.75		*** 207	*** 266	*** 300	*** 330
12.		*** 195	*** 252	*** 293	*** 322
12.25			*** 238	*** 286	*** 315
12.5			*** 224	*** 274	*** 307
12.75			*** 211	*** 260	*** 300
13.			*** 199	*** 247	*** 294

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

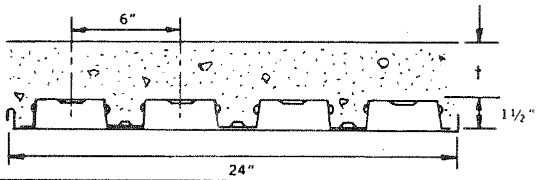
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	32.7	37.3	39.6	41.9	48.2
V_R Lbs.	1401	1579	1671	1764	2024
I_c	4.772	6.457	7.416	8.454	11.727
S_{cc}	2.770	3.421	3.771	4.137	5.219
S_{bc}	2.863	3.368	3.625	3.885	4.611

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
7.	400	451	477	504	578
7.25	386	435	461	486	558
7.5	373	421	445	470	* 508
7.75	361	407	431	455	* 490
8.	350	394	* 392	* 413	* 474
8.25	339	* 358	* 379	* 400	* 458
8.5	* 308	* 347	* 367	* 387	** 444
8.75	* 299	* 336	* 356	* 375	** 430
9.	* 286	* 326	** 345	** 364	** 418
9.25	* 264	** 317	** 335	** 354	** 405
9.5	* 243	** 308	** 326	** 343	*** 394
9.75	** 225	** 299	** 317	*** 334	*** 383
10.	** 209	** 282	*** 308	*** 325	*** 373
10.25	** 194	*** 262	*** 300	*** 316	*** 363
10.5	*** 180	*** 244	*** 280	*** 308	*** 353
10.75	*** 168	*** 227	*** 261	*** 298	*** 344
11.		*** 212	*** 244	*** 278	*** 336
11.25		*** 198	*** 228	*** 260	*** 328
11.5		*** 185	*** 213	*** 243	*** 320
11.75		*** 174	*** 200	*** 228	*** 312
12.		*** 163	*** 188	*** 214	*** 297
12.25			*** 176	*** 201	*** 279
12.5			*** 166	*** 189	*** 263
12.75			*** 156	*** 178	*** 247
13.				*** 168	*** 233

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .52
(+) S_t = .462
(+) S_b = .894
(−) S_t = .446
(−) S_b = .638

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	41.8	47.9	53.9	60	66
V_R Lbs.	1402	1583	1771	1963	2159
I_c	5.494	7.431	9.720	12.372	15.393
S_{cc}	3.708	4.583	5.544	6.585	7.702
S_{bc}	2.880	3.404	3.941	4.490	5.045

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
7.	400	452	506	561	616
7.25	386	436	488	541	595
7.5	373	422	472	523	575
7.75	361	408	457	506	557
8.	350	395	442	490	539
8.25	339	383	429	476	523
8.5	329	372	416	462	** 464
8.75	320	361	404	448	** 449
9.	311	351	393	** 396	** 436
9.25	303	342	** 347	** 385	** 423
9.5	280	333	** 337	** 373	*** 410
9.75	259	** 293	** 328	*** 363	*** 399
10.	** 240	** 285	** 318	*** 353	*** 388
10.25	** 223	** 277	*** 310	*** 343	*** 377
10.5	** 207	*** 270	*** 302	*** 334	*** 367
10.75	** 193	*** 261	*** 294	*** 325	*** 357
11.		*** 244	*** 286	*** 317	*** 348
11.25		*** 228	*** 279	*** 309	*** 340
11.5		*** 214	*** 272	*** 301	*** 331
11.75		*** 200	*** 257	*** 294	*** 323
12.		*** 188	*** 244	*** 287	*** 316
12.25			*** 231	*** 280	*** 308
12.5			*** 218	*** 266	*** 301
12.75			*** 205	*** 253	*** 294
13.			*** 193	*** 240	*** 286

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

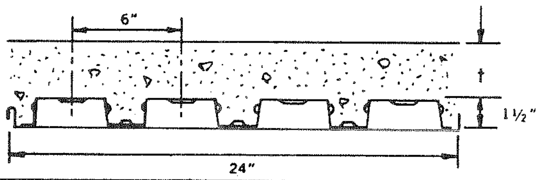
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	32.8	37.4	39.7	42	48.3
V_R Lbs.	1383	1555	1644	1734	1990
I_c	4.578	6.222	7.162	8.183	11.415
S_{cc}	2.696	3.332	3.676	4.036	5.106
S_{bc}	2.707	3.212	3.471	3.733	4.468

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
7.	395	444	469	495	568
7.25	381	428	453	478	549
7.5	368	414	438	462	530
7.75	356	401	424	447	513
8.	345	388	411	433	497
8.25	335	376	398	420	482
8.5	325	365	386	408	468
8.75	299	355	375	396	454
9.	275	345	365	385	442
9.25	253	336	355	375	430
9.5	233	317	346	365	** 387
9.75	216	294	337	355	** 376
10.	200	272	313	** 319	** 366
10.25	186	253	** 291	** 311	** 356
10.5	173	** 235	** 271	** 303	*** 347
10.75	161	** 219	** 252	** 288	*** 338
11.		** 204	** 235	*** 269	*** 330
11.25		** 191	*** 220	*** 251	*** 322
11.5		*** 179	*** 206	*** 235	*** 314
11.75		*** 168	*** 193	*** 220	*** 307
12.		*** 157	*** 181	*** 207	*** 289
12.25			*** 170	*** 195	*** 272
12.5			*** 160	*** 183	*** 256
12.75			*** 151	*** 172	*** 241
13.				*** 163	*** 227

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-UKX-18/18



SECTION PROPERTIES
Steel Unit Only

I_s = .566
(+) S_t = .472
(+) S_b = 1.063
(−) S_t = .463
(−) S_b = .825

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	42.5	48.5	54.6	60.6	66.7
V_R Lbs.	1403	1584	1771	1961	2156
I_c	6.256	8.459	11.066	14.086	17.530
S_{cc}	3.959	4.891	5.914	7.023	8.214
S_{bc}	3.439	4.058	4.692	5.338	5.993

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
7.	401	452	506	560	616
7.25	387	437	488	541	594
7.5	374	422	472	523	574
7.75	362	408	457	506	556
8.	350	396	442	490	539
8.25	340	384	429	475	522
8.5	330	372	416	461	507
8.75	320	362	404	448	** 448
9.	311	352	393	** 396	** 434
9.25	303	342	** 347	** 384	** 421
9.5	295	333	** 337	** 373	*** 409
9.75	287	** 293	** 327	** 362	*** 398
10.	274	** 285	** 318	*** 352	*** 387
10.25	** 246	** 277	*** 309	*** 342	*** 376
10.5	** 236	** 270	*** 301	*** 333	*** 366
10.75	** 220	*** 263	*** 293	*** 325	*** 356
11.		*** 256	*** 286	*** 316	*** 347
11.25		*** 250	*** 279	*** 308	*** 339
11.5		*** 238	*** 272	*** 301	*** 330
11.75		*** 226	*** 265	*** 293	*** 322
12.		*** 214	*** 259	*** 287	*** 315
12.25		*** 201	*** 250	*** 280	*** 307
12.5			*** 238	*** 273	*** 300
12.75			*** 226	*** 267	*** 293
13.			*** 215	*** 260	*** 287

N=14

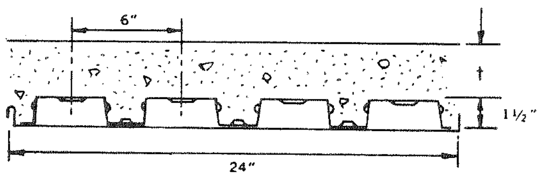
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	33.5	38	40.3	42.6	48.9
V_R Lbs.	1384	1555	1643	1733	1986
I_c	5.154	7.004	8.062	9.212	12.855
S_{cc}	2.862	3.535	3.899	4.281	5.414
S_{bc}	3.225	3.821	4.126	4.435	5.300

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
7.	395	444	469	495	567
7.25	381	429	453	478	548
7.5	369	414	438	462	529
7.75	357	401	424	447	512
8.	346	388	410	433	496
8.25	335	377	398	420	481
8.5	325	365	386	407	467
8.75	316	355	375	396	454
9.	307	345	365	385	441
9.25	285	336	355	374	429
9.5	263	327	346	364	418
9.75	243	319	337	355	** 375
10.	225	306	328	346	** 365
10.25	209	284	** 294	** 310	** 355
10.5	195	** 265	** 287	** 302	** 346
10.75	181	** 246	** 279	** 294	*** 337
11.		** 230	** 265	** 287	*** 329
11.25		** 215	** 248	*** 280	*** 321
11.5		** 201	*** 232	*** 265	*** 313
11.75		*** 189	*** 217	*** 248	*** 306
12.		*** 177	*** 204	*** 233	*** 299
12.25		*** 166	*** 192	*** 219	*** 292
12.5			*** 180	*** 206	*** 285
12.75			*** 170	*** 194	*** 271
13.				*** 183	*** 256

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only
I_s = .763
(+) S_t = .654
(+) S_b = 1.363
(−) S_t = .584
(−) S_b = 1.104

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	43.8	49.8	55.9	61.9	68
V_R Lbs.	1405	1580	1761	1948	2138
I_c	7.217	9.761	12.781	16.294	20.311
S_{cc}	4.256	5.247	6.340	7.528	8.806
S_{bc}	4.188	4.944	5.723	6.518	7.326

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
7.	401	451	503	556	611
7.25	387	435	486	537	590
7.5	374	421	469	519	570
7.75	362	407	454	502	551
8.	351	395	440	487	534
8.25	340	383	427	472	518
8.5	330	371	414	458	503
8.75	321	361	402	445	488
9.	312	351	391	433	475
9.25	303	341	380	421	462
9.5	295	332	370	410	450
9.75	288	324	361	399	438
10.	281	316	352	389	** 382
10.25	274	308	343	380	** 372
10.5	267	301	335	** 330	** 362
10.75	254	294	** 291	** 321	*** 353
11.		287	** 284	*** 313	*** 343
11.25		** 249	** 276	*** 305	*** 335
11.5		** 242	*** 270	*** 298	*** 327
11.75		** 237	*** 263	*** 291	*** 319
12.		*** 231	*** 257	*** 284	*** 311
12.25		*** 220	*** 251	*** 277	*** 304
12.5			*** 245	*** 271	*** 297
12.75			*** 240	*** 265	*** 290
13.			*** 233	*** 259	*** 284

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

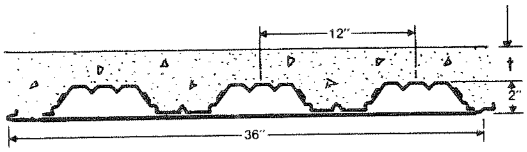
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	34.7	39.3	41.6	43.9	50.2
V_R Lbs.	1392	1555	1640	1727	1973
I_c	5.872	7.972	9.177	10.489	14.663
S_{cc}	3.063	3.772	4.156	4.560	5.763
S_{bc}	3.908	4.632	5.004	5.382	6.444

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
7.	397	444	468	493	563
7.25	384	429	452	476	544
7.5	371	414	437	460	526
7.75	359	401	423	445	509
8.	348	388	410	431	493
8.25	337	377	397	418	478
8.5	327	366	386	406	464
8.75	318	355	375	394	451
9.	309	345	364	383	438
9.25	301	336	354	373	426
9.5	293	327	345	363	415
9.75	277	319	336	354	404
10.	257	311	328	345	394
10.25	238	303	320	337	385
10.5	222	296	312	329	375
10.75	207	281	305	321	367
11.		262	298	314	** 326
11.25		245	282	307	** 318
11.5		229	264	** 272	** 310
11.75		215	** 247	** 266	** 303
12.		** 202	** 232	** 259	*** 296
12.25		** 189	** 218	** 249	*** 289
12.5			** 205	*** 235	*** 283
12.75			*** 193	*** 221	*** 276
13.				*** 209	*** 271

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-AKX-20/20



SECTION PROPERTIES
Steel Unit Only

I_s = .654
(+) S_t = .448
(+) S_b = 1.067
(−) S_t = .423
(−) S_b = .613

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	40.0	46.1	52.1	58.2	70.2
V_R Lbs.	1231	1377	1531	1689	2015
I_c	5.841	7.789	10.084	12.731	19.109
S_{cc}	3.575	4.368	5.239	6.184	8.274
S_{bc}	2.395	2.793	3.204	3.624	4.483

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.5	328	367	408	450	537
7.75	317	355	395	435	520
8.	307	344	382	422	503
8.25	298	334	371	409	** 442
8.5	289	324	360	397	** 427
8.75	281	314	349	** 348	** 414
9.	273	306	340	** 337	*** 401
9.25	266	297	** 297	** 327	*** 389
9.5	259	290	** 288	*** 317	*** 378
9.75	252	** 253	** 280	*** 308	*** 367
10.	** 221	** 246	*** 272	*** 299	*** 356
10.25	** 215	** 239	*** 265	*** 291	*** 346
10.5	** 209	*** 232	*** 257	*** 283	*** 337
10.75	** 200	*** 226	*** 251	*** 276	*** 328
11.		*** 220	*** 244	*** 269	*** 320
11.25		*** 215	*** 238	*** 262	*** 312
11.5		*** 209	*** 232	*** 255	*** 304
11.75		*** 198	*** 226	*** 249	*** 296
12.		*** 188	*** 221	*** 243	*** 289
12.25			*** 216	*** 237	*** 282
12.5			*** 206	*** 232	*** 276
12.75			*** 195	*** 226	*** 269
13.			*** 185	*** 221	*** 263
13.25			*** 176	*** 212	*** 257
13.5			*** 167	*** 202	*** 252
13.75				*** 192	*** 246
14.				*** 182	*** 241
14.25				*** 173	*** 233
14.5				*** 165	*** 222

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

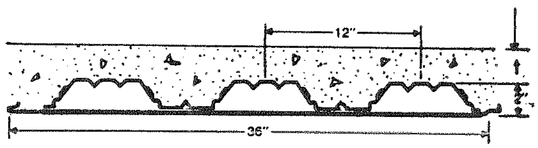
	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	31.2	35.8	40.3	42.6	51.2
V_R Lbs.	1221	1359	1505	1581	1873
I_c	4.984	6.667	8.665	9.785	14.720
S_{cc}	2.638	3.218	3.861	4.205	5.614
S_{bc}	2.284	2.667	3.064	3.268	4.047

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.5	325	362	401	421	499
7.75	315	350	388	408	483
8.	305	339	376	395	468
8.25	296	329	364	383	454
8.5	287	319	354	372	440
8.75	279	310	344	361	428
9.	271	302	334	351	416
9.25	264	293	325	341	** 371
9.5	254	286	316	332	** 360
9.75	235	278	308	324	** 350
10.	218	271	** 275	** 288	*** 341
10.25	202	265	** 267	** 281	*** 331
10.5	188	** 236	** 260	** 273	*** 323
10.75	175	** 230	** 254	*** 266	*** 314
11.		** 219	*** 247	*** 259	*** 307
11.25		*** 205	*** 241	*** 253	*** 299
11.5		*** 192	*** 236	*** 247	*** 292
11.75		*** 180	*** 230	*** 241	*** 285
12.		*** 169	*** 219	*** 236	*** 278
12.25			*** 206	*** 230	*** 272
12.5			*** 194	*** 219	*** 266
12.75			*** 183	*** 206	*** 260
13.			*** 172	*** 195	*** 254
13.25			*** 163	*** 184	*** 249
13.5			*** 154	*** 174	*** 243
13.75				*** 164	*** 238
14.				*** 156	*** 234
14.25					*** 222
14.5					*** 211

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-AKX-20/18



SECTION PROPERTIES
Steel Unit Only

I_s = .698
(+) S_t = .455
(+) S_b = 1.266
(−) S_t = .438
(−) S_b = .801

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	40.6	46.6	52.7	58.7	70.8
V_R Lbs.	1240	1386	1540	1698	2023
I_c	6.591	8.773	11.339	14.297	21.420
S_{cc}	3.812	4.651	5.572	6.570	8.777
S_{bc}	2.799	3.252	3.719	4.196	5.170

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.5	330	369	410	452	539
7.75	320	357	397	438	522
8.	310	346	385	424	505
8.25	300	336	373	411	** 443
8.5	291	326	362	399	** 429
8.75	283	317	352	388	** 415
9.	275	308	342	** 338	*** 402
9.25	268	299	** 298	** 328	*** 390
9.5	261	291	** 290	** 319	*** 379
9.75	254	** 254	** 281	*** 309	*** 368
10.	248	** 247	** 273	*** 301	*** 357
10.25	** 216	** 240	*** 266	*** 292	*** 348
10.5	** 210	*** 234	*** 259	*** 285	*** 338
10.75	** 205	*** 228	*** 252	*** 277	*** 329
11.		*** 222	*** 245	*** 270	*** 321
11.25		*** 216	*** 239	*** 263	*** 312
11.5		*** 211	*** 233	*** 256	*** 305
11.75		*** 206	*** 227	*** 250	*** 297
12.		*** 201	*** 222	*** 244	*** 290
12.25			*** 217	*** 238	*** 283
12.5			*** 212	*** 233	*** 276
12.75			*** 207	*** 227	*** 270
13.			*** 201	*** 222	*** 264
13.25			*** 191	*** 217	*** 258
13.5			*** 181	*** 213	*** 253
13.75				*** 208	*** 247
14.				*** 198	*** 242
14.25				*** 188	*** 237
14.5				*** 179	*** 232

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	31.7	36.3	40.9	43.2	51.8
V_R Lbs.	1229	1367	1513	1588	1880
I_c	5.58	7.452	9.671	10.914	16.390
S_{cc}	2.8	3.413	4.090	4.452	5.934
S_{bc}	2.669	3.105	3.557	3.787	4.670

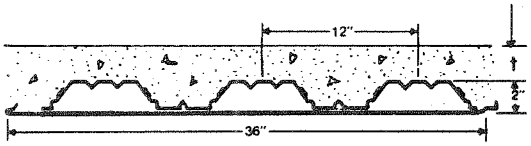
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.5	327	364	403	423	501
7.75	317	352	390	410	485
8.	307	341	378	397	470
8.25	298	331	366	385	455
8.5	289	321	356	373	442
8.75	281	312	345	363	429
9.	273	303	336	353	417
9.25	265	295	327	343	** 372
9.5	258	287	318	334	** 361
9.75	252	280	310	325	** 351
10.	244	273	** 276	** 289	** 342
10.25	226	266	** 269	** 282	*** 332
10.5	211	** 237	** 262	** 274	*** 324
10.75	196	** 231	** 255	*** 267	*** 315
11.		** 225	*** 249	*** 261	*** 307
11.25		** 220	*** 242	*** 254	*** 300
11.5		*** 214	*** 237	*** 248	*** 292
11.75		*** 201	*** 231	*** 242	*** 286
12.		*** 188	*** 226	*** 236	*** 279
12.25			*** 220	*** 231	*** 272
12.5			*** 215	*** 226	*** 266
12.75			*** 204	*** 221	*** 260
13.			*** 192	*** 216	*** 255
13.25			*** 182	*** 205	*** 249
13.5			*** 172	*** 194	*** 244
13.75				*** 183	*** 239
14.				*** 174	*** 234
14.25					*** 229
14.5					*** 225

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-AKX-18/20



SECTION PROPERTIES
Steel Unit Only

I_s = .821
(+) S_t = .585
(+) S_b = 1.203
(−) S_t = .553
(−) S_b = .744

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	40.8	46.8	52.9	58.9	71
V_R Lbs.	1217	1358	1507	1662	1982
I_c	6.393	8.558	11.122	14.094	21.299
S_{cc}	3.719	4.546	5.459	6.453	8.664
S_{bc}	2.703	3.168	3.651	4.148	5.163

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.5	324	362	401	443	528
7.75	314	350	388	428	511
8.	304	339	376	415	495
8.25	295	329	365	402	480
8.5	287	319	354	391	466
8.75	278	310	344	379	453
9.	270	301	334	369	440
9.25	263	293	325	359	428
9.5	256	285	317	349	** 370
9.75	249	278	309	340	** 359
10.	243	271	301	** 294	** 349
10.25	237	265	294	** 285	*** 340
10.5	231	258	** 253	** 278	*** 330
10.75	226	252	** 246	** 270	*** 322
11.		** 217	** 240	*** 263	*** 313
11.25		** 211	*** 233	*** 257	*** 305
11.5		** 206	*** 228	*** 250	*** 298
11.75		*** 201	*** 222	*** 244	*** 290
12.		*** 196	*** 217	*** 238	*** 283
12.25			*** 212	*** 233	*** 276
12.5			*** 207	*** 227	*** 270
12.75			*** 202	*** 222	*** 264
13.			*** 195	*** 217	*** 258
13.25			*** 185	*** 212	*** 252
13.5			*** 176	*** 207	*** 246
13.75				*** 202	*** 241
14.				*** 193	*** 236
14.25				*** 183	*** 231
14.5				*** 174	*** 226

N=14

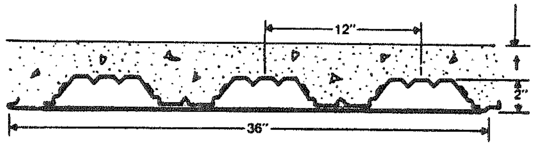
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	31.9	36.5	41.1	43.4	52
V_R Lbs.	1213	1343	1484	1557	1842
I_c	5.405	7.250	9.455	10.696	16.195
S_{cc}	2.738	3.337	4.005	4.364	5.840
S_{bc}	2.562	3.007	3.472	3.711	4.629

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.5	323	358	395	415	491
7.75	313	346	383	401	475
8.	303	335	371	389	460
8.25	294	325	359	377	446
8.5	285	316	349	366	433
8.75	277	307	339	356	421
9.	269	298	329	346	409
9.25	262	290	320	336	398
9.5	255	282	312	327	387
9.75	248	275	304	319	378
10.	236	268	296	311	368
10.25	219	262	289	303	359
10.5	204	255	282	296	** 317
10.75	190	250	276	289	** 308
11.		238	269	283	** 301
11.25		223	263	** 249	** 293
11.5		208	** 232	** 243	*** 286
11.75		** 195	** 226	** 237	*** 279
12.		** 183	** 221	** 231	*** 273
12.25			** 216	*** 226	*** 266
12.5			*** 211	*** 221	*** 260
12.75			*** 199	*** 216	*** 255
13.			*** 188	*** 211	*** 249
13.25			*** 178	*** 201	*** 244
13.5			*** 168	*** 190	*** 239
13.75				*** 180	*** 234
14.				*** 170	*** 229
14.25					*** 224
14.5					*** 220

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = .876
(+) S_t = .596
(+) S_b = 1.403
(−) S_t = .57
(−) S_b = .917

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	41.3	47.3	53.4	59.4	71.5
V_R Lbs.	1227	1368	1517	1672	1991
I_c	7.101	9.483	12.301	15.565	23.469
S_{cc}	3.937	4.804	5.761	6.802	9.116
S_{bc}	3.098	3.617	4.155	4.706	5.836

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.5	327	365	404	445	531
7.75	316	353	391	431	513
8.	306	342	379	418	497
8.25	297	331	367	405	482
8.5	288	322	357	393	468
8.75	280	312	346	382	455
9.	272	304	337	371	442
9.25	265	295	328	361	430
9.5	258	288	319	352	** 372
9.75	251	280	311	343	** 361
10.	245	273	303	334	** 351
10.25	239	267	296	** 287	*** 341
10.5	233	260	** 254	** 279	*** 332
10.75	228	254	** 248	** 272	*** 323
11.		** 218	** 241	*** 265	*** 315
11.25		** 213	** 235	*** 258	*** 306
11.5		** 208	*** 229	*** 252	*** 299
11.75		** 203	*** 223	*** 245	*** 291
12.		*** 198	*** 218	*** 240	*** 284
12.25		*** 193	*** 213	*** 234	*** 278
12.5			*** 208	*** 228	*** 271
12.75			*** 203	*** 223	*** 265
13.			*** 199	*** 218	*** 259
13.25			*** 194	*** 213	*** 253
13.5			*** 189	*** 209	*** 247
13.75				*** 204	*** 242
14.				*** 200	*** 237
14.25				*** 196	*** 232
14.5				*** 187	*** 227

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	32.4	37	41.6	43.8	52.4
V_R Lbs.	1223	1353	1494	1567	1851
I_c	5.963	7.982	10.391	11.745	17.744
S_{cc}	2.887	3.514	4.212	4.586	6.127
S_{bc}	2.937	3.434	3.952	4.218	5.239

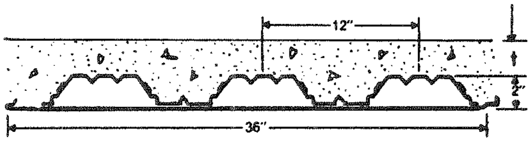
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.5	326	361	398	417	493
7.75	315	349	385	404	477
8.	305	338	373	391	462
8.25	296	328	362	379	448
8.5	287	318	351	368	435
8.75	279	309	341	358	423
9.	271	300	332	348	411
9.25	264	292	323	338	400
9.5	257	285	314	329	389
9.75	250	277	306	321	379
10.	244	270	298	313	370
10.25	238	264	291	305	361
10.5	225	257	284	298	** 318
10.75	210	251	278	291	** 310
11.		246	271	284	** 302
11.25		240	265	** 250	** 294
11.5		229	** 233	** 244	*** 287
11.75		215	** 228	** 238	*** 280
12.		** 202	** 222	** 233	*** 274
12.25		** 190	** 217	*** 227	*** 268
12.5			*** 212	*** 222	*** 262
12.75			*** 208	*** 217	*** 256
13.			*** 203	*** 213	*** 250
13.25			*** 195	*** 208	*** 245
13.5			*** 185	*** 204	*** 240
13.75				*** 197	*** 235
14.				*** 187	*** 230
14.25				*** 177	*** 225
14.5					*** 221

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-AKX-18/16



SECTION PROPERTIES
Steel Unit Only

I_s = .924
(+) S_t = .604
(+) S_b = 1.597
(−) S_t = .588
(−) S_b = 1.173

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	41.9	47.9	53.9	60	72.1
V_R Lbs.	1234	1376	1525	1679	1997
I_c	7.774	10.365	13.427	16.971	25.551
S_{cc}	4.131	5.036	6.034	7.118	9.526
S_{bc}	3.492	4.066	4.658	5.265	6.509

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.5	329	367	406	447	532
7.75	318	355	393	433	515
8.	308	344	381	419	499
8.25	299	333	369	407	484
8.5	290	323	358	395	470
8.75	282	314	348	383	456
9.	274	305	338	373	443
9.25	267	297	329	363	431
9.5	259	289	321	353	** 373
9.75	253	282	312	344	** 362
10.	246	275	305	335	** 352
10.25	240	268	297	** 288	** 342
10.5	235	262	** 255	** 280	*** 333
10.75	229	256	** 249	** 273	*** 324
11.		** 219	** 242	** 266	*** 315
11.25		** 214	** 236	*** 259	*** 307
11.5		** 209	** 230	*** 252	*** 299
11.75		** 203	*** 224	*** 246	*** 292
12.		** 199	*** 219	*** 240	*** 285
12.25		*** 194	*** 214	*** 235	*** 278
12.5			*** 209	*** 229	*** 272
12.75			*** 204	*** 224	*** 265
13.			*** 199	*** 219	*** 259
13.25			*** 195	*** 214	*** 254
13.5			*** 191	*** 209	*** 248
13.75				*** 205	*** 243
14.				*** 200	*** 237
14.25				*** 196	*** 232
14.5				*** 192	*** 228

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

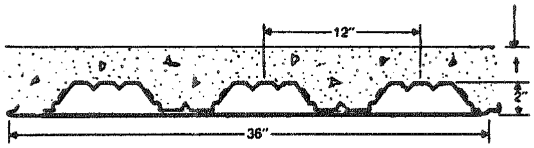
	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	32.9	37.5	42.1	44.4	53
V_R Lbs.	1230	1360	1500	1573	1856
I_c	6.483	8.671	11.273	12.736	19.213
S_{cc}	3.018	3.672	4.397	4.786	6.385
S_{bc}	3.309	3.860	4.431	4.723	5.846

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.5	328	362	400	419	495
7.75	317	351	387	406	479
8.	307	340	375	393	464
8.25	298	329	363	381	450
8.5	289	320	353	370	436
8.75	281	311	343	359	424
9.	273	302	333	349	412
9.25	266	294	324	340	401
9.5	259	286	315	331	390
9.75	252	279	307	322	380
10.	246	272	300	314	371
10.25	240	265	292	307	362
10.5	234	259	285	299	353
10.75	228	253	279	292	** 310
11.		247	272	286	** 303
11.25		241	266	** 251	** 295
11.5		236	** 234	** 245	** 288
11.75		231	** 228	** 239	*** 281
12.		** 203	** 223	** 234	*** 274
12.25		** 199	** 218	** 228	*** 268
12.5			** 213	*** 223	*** 262
12.75			*** 208	*** 218	*** 256
13.			*** 204	*** 213	*** 251
13.25			*** 200	*** 209	*** 245
13.5			*** 195	*** 204	*** 240
13.75				*** 200	*** 235
14.				*** 196	*** 230
14.25				*** 192	*** 226
14.5					*** 221

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

_______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = 1.104
(+) S_t = .745
(+) S_b = 1.733
(−) S_t = .723
(−) S_b = 1.292

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	42.6	48.7	54.7	60.7	72.8
V_R Lbs.	1227	1363	1508	1659	1973
I_c	8.23	10.997	14.281	18.099	27.384
S_{cc}	4.238	5.164	6.190	7.308	9.802
S_{bc}	3.779	4.416	5.078	5.759	7.158

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
7.5	327	363	402	442	526
7.75	316	351	389	428	509
8.	306	340	377	414	493
8.25	297	330	365	402	478
8.5	288	320	355	390	464
8.75	280	311	344	379	451
9.	272	303	335	368	438
9.25	265	294	326	358	426
9.5	258	287	317	349	415
9.75	251	279	309	340	404
10.	245	272	301	331	394
10.25	239	266	294	323	385
10.5	233	259	287	316	** 328
10.75	228	253	280	308	** 319
11.		247	274	301	** 311
11.25		242	268	** 255	** 303
11.5		237	262	** 249	*** 295
11.75		232	** 221	** 243	*** 288
12.		227	** 216	** 237	*** 281
12.25		** 192	** 211	*** 231	*** 274
12.5			** 206	*** 226	*** 267
12.75			*** 201	*** 221	*** 261
13.			*** 197	*** 216	*** 255
13.25			*** 192	*** 211	*** 250
13.5			*** 188	*** 206	*** 244
13.75				*** 202	*** 239
14.				*** 197	*** 234
14.25				*** 193	*** 229
14.5				*** 189	*** 224

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	33.7	38.3	42.9	45.2	53.8
V_R Lbs.	1229	1352	1488	1558	1835
I_c	6.818	9.135	11.898	13.457	20.389
S_{cc}	3.092	3.758	4.499	4.896	6.540
S_{bc}	3.561	4.173	4.808	5.134	6.392

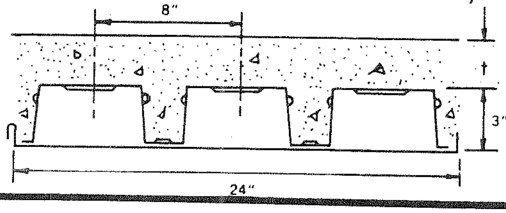
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
7.5	327	360	396	415	489
7.75	317	349	384	402	473
8.	307	338	372	389	458
8.25	298	327	360	377	445
8.5	289	318	350	366	431
8.75	281	309	340	356	419
9.	273	300	330	346	407
9.25	265	292	321	337	396
9.5	258	284	313	328	386
9.75	252	277	305	319	376
10.	245	270	297	311	367
10.25	239	263	290	304	358
10.5	234	257	283	296	349
10.75	228	251	276	290	341
11.		245	270	283	333
11.25		240	264	277	326
11.5		235	258	271	319
11.75		230	253	265	** 277
12.		225	248	259	** 271
12.25		217	242	254	** 264
12.5			238	** 220	** 258
12.75			** 206	** 216	** 253
13.			** 202	** 211	*** 247
13.25			** 197	** 206	*** 242
13.5			** 193	** 202	*** 237
13.75				*** 198	*** 232
14.				*** 194	*** 227
14.25				*** 190	*** 222
14.5					*** 218

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

_____ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-NKX-20/20 or QL-TKX-20/20



SECTION PROPERTIES
Steel Unit Only

I_s = 1,431
(+) S_t = .6
(+) S_b = 1.511
(−) S_t = .654
(−) S_b = .987

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	44.9	50.9	57	63	69.1
V_R Lbs.	1114	1216	1322	1431	1543
I_c	9.654	12.122	14.939	18.112	21.647
S_{cc}	5.711	6.685	7.737	8.865	10.063
S_{bc}	3.290	3.757	4.239	4.734	5.237

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.5	234	256	278	301	* 279
9.75	228	249	271	293	* 271
10.	222	243	264	* 245	** 263
10.25	217	237	* 221	** 238	** 256
10.5	212	231	* 215	** 231	** 248
10.75	207	* 193	** 209	** 225	** 242
11.	202	* 188	** 203	** 219	** 235
11.25	* 170	** 183	** 198	** 213	*** 229
11.5	* 165	** 179	** 193	*** 208	*** 223
11.75	** 161	** 174	** 188	*** 202	*** 217
12.	** 157	** 170	*** 183	*** 197	*** 212
12.25	** 154	** 166	*** 179	*** 192	*** 206
12.5	** 150	*** 162	*** 174	*** 188	*** 201
12.75	** 146	*** 158	*** 170	*** 183	*** 197
13.	*** 143	*** 154	*** 166	*** 179	*** 192
13.25	*** 140	*** 151	*** 162	*** 175	*** 187
13.5	*** 137	*** 147	*** 159	*** 171	*** 183
13.75	*** 134	*** 144	*** 155	*** 167	*** 179
14.	*** 131	*** 141	*** 152	*** 163	*** 175
14.25	*** 128	*** 138	*** 148	*** 160	*** 171
14.5	*** 125	*** 135	*** 145	*** 156	*** 167
14.75	*** 123	*** 132	*** 142	*** 153	*** 164
15.		*** 129	*** 139	*** 150	*** 160
15.25		*** 127	*** 136	*** 146	*** 157
15.5		*** 124	*** 133	*** 143	*** 154
16.75		*** 122	*** 131	*** 140	*** 150
16.		*** 119	*** 128	*** 138	*** 147
16.25			*** 126	*** 135	*** 144
16.5			*** 123	*** 132	*** 141

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

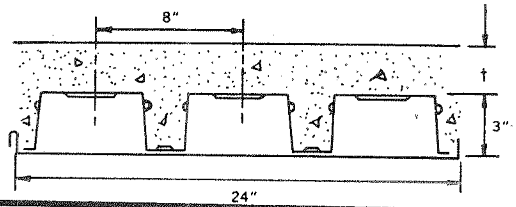
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	35.1	39.7	42	44.3	50.6
V_R Lbs.	1108	1203	1252	1303	1447
I_c	8.274	10.409	11.595	12.862	16.769
S_{cc}	4.227	4.940	5.320	5.715	6.878
S_{bc}	3.102	3.550	3.780	4.014	4.675

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.5	233	253	263	274	304
9.75	227	246	256	267	296
10.	221	240	250	260	289
10.25	216	234	244	254	282
10.5	211	229	238	248	275
10.75	206	223	233	242	* 236
11.	201	218	227	236	* 230
11.25	197	213	222	* 203	** 224
11.5	192	209	* 191	* 198	** 219
11.75	188	* 180	* 186	** 193	** 213
12.	184	* 175	** 182	** 189	** 208
12.25	* 159	** 171	** 178	** 184	** 203
12.5	* 156	** 167	** 174	** 180	*** 199
12.75	** 152	** 164	** 170	** 176	*** 194
13.	** 149	** 160	** 166	** 172	*** 190
13.25	** 146	** 157	** 162	*** 168	*** 185
13.5	** 143	** 153	*** 159	*** 165	*** 181
13.75	** 139	*** 150	*** 155	*** 161	*** 178
14.	** 132	*** 147	*** 152	*** 158	*** 174
14.25	*** 125	*** 144	*** 149	*** 154	*** 170
14.5	*** 118	*** 141	*** 146	*** 151	*** 167
14.75	*** 112	*** 138	*** 143	*** 148	*** 163
15.		*** 135	*** 140	*** 145	*** 160
15.25		*** 128	*** 137	*** 142	*** 157
15.5		*** 122	*** 135	*** 140	*** 154
15.75		*** 116	*** 130	*** 137	*** 151
16.		*** 111	*** 124	*** 134	*** 148
16.25			*** 118	*** 131	*** 145
16.5			*** 113	*** 125	*** 142

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



QL-NKX-20/18 or QL-TKX-20/18

SECTION PROPERTIES

Steel Unit Only

I_s = 1.542
(+) S_t = .613
(+) S_b = 1.835
(−) S_t = .685
(−) S_b = 1.319

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	45.4	51.5	57.5	63.6	69.6
V_R Lbs.	1132	1234	1340	1449	1561
I_c	11.122	13.916	17.100	20.679	24.660
S_{cc}	6.178	7.216	8.335	9.533	10.804
S_{bc}	3.924	4.459	5.010	5.573	6.147

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.5	238	259	282	305	328
9.75	232	253	274	297	* 274
10.	226	246	268	* 248	* 266
10.25	220	240	261	* 241	** 259
10.5	215	235	* 218	** 234	** 252
10.75	210	* 196	* 212	** 228	** 245
11.	205	* 191	** 206	** 222	** 238
11.25	* 173	* 186	** 201	** 216	** 232
11.5	* 168	** 181	** 196	** 210	*** 226
11.75	* 164	** 177	** 191	*** 205	*** 220
12.	** 160	** 172	** 186	*** 200	*** 214
12.25	** 156	** 168	*** 181	*** 195	*** 209
12.5	** 152	** 164	*** 177	*** 190	*** 204
12.75	** 149	*** 160	*** 173	*** 186	*** 199
13.	** 145	*** 157	*** 169	*** 181	*** 194
13.25	*** 142	*** 153	*** 165	*** 177	*** 190
13.5	*** 139	*** 150	*** 161	*** 173	*** 185
13.75	*** 136	*** 146	*** 157	*** 169	*** 181
14.	*** 133	*** 143	*** 154	*** 165	*** 177
14.25	*** 130	*** 140	*** 151	*** 162	*** 173
14.5	*** 127	*** 137	*** 147	*** 158	*** 169
14.75	*** 125	*** 134	*** 144	*** 155	*** 166
15.		*** 131	*** 141	*** 152	*** 162
15.25		*** 129	*** 138	*** 148	*** 159
15.5		*** 126	*** 135	*** 145	*** 156
15.75		*** 124	*** 133	*** 142	*** 152
16.		*** 121	*** 130	*** 139	*** 149
16.25			*** 127	*** 137	*** 146
16.5			*** 125	*** 134	*** 143

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	35.6	40.2	42.5	44.8	51.1
V_R Lbs.	1124	1219	1269	1320	1464
I_c	9.462	11.865	13.197	14.620	18.998
S_{cc}	4.553	5.310	5.714	6.133	7.364
S_{bc}	3.701	4.214	4.478	4.745	5.498

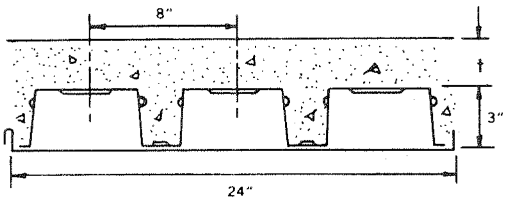
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.5	236	256	267	277	308
9.75	230	250	260	270	300
10.	224	243	253	264	292
10.25	219	238	247	257	285
10.5	214	232	241	251	279
10.75	209	226	236	245	* 239
11.	204	221	230	240	* 233
11.25	199	216	225	* 206	* 227
11.5	195	212	* 194	* 201	** 221
11.75	191	* 182	* 189	* 196	** 216
12.	187	* 178	* 185	** 191	** 211
12.25	* 162	* 174	** 180	** 187	** 206
12.5	* 158	** 170	** 176	** 182	** 201
12.75	* 155	** 166	** 172	** 178	*** 196
13.	** 151	** 162	** 168	** 174	*** 192
13.25	** 148	** 159	** 165	** 171	*** 188
13.5	** 145	** 155	** 161	*** 167	*** 184
13.75	** 142	** 152	*** 158	*** 163	*** 180
14.	** 139	*** 149	*** 154	*** 160	*** 176
14.25	** 136	*** 146	*** 151	*** 157	*** 172
14.5	*** 133	*** 143	*** 148	*** 153	*** 169
14.75	*** 129	*** 140	*** 145	*** 150	*** 165
15.		*** 137	*** 142	*** 147	*** 162
15.25		*** 135	*** 139	*** 144	*** 159
15.5		*** 132	*** 137	*** 142	*** 156
15.75		*** 130	*** 134	*** 139	*** 153
16.		*** 126	*** 132	*** 136	*** 150
16.25			*** 129	*** 134	*** 147
16.5			*** 127	*** 131	*** 144

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-NKX-18/20 or QL-TKX-18/20



SECTION PROPERTIES
Steel Unit Only

I_s = 1.951
(+) S_t = .884
(+) S_b = 1.717
(−) S_t = .843
(−) S_b = 1.118

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	45.6	51.7	57.7	63.8	69.8
V_R Lbs.	1109	1204	1305	1410	1518
I_c	10.499	13.203	16.311	19.829	23.765
S_{cc}	5.943	6.943	8.033	9.206	10.458
S_{bc}	3.661	4.194	4.750	5.322	5.909

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.5	233	253	274	296	319
9.75	227	247	267	289	311
10.	221	240	261	282	303
10.25	216	235	254	275	296
10.5	211	229	248	268	289
10.75	206	224	242	262	282
11.	201	219	237	256	276
11.25	197	214	232	250	269
11.5	193	209	227	245	** 218
11.75	188	205	222	240	** 213
12.	184	200	217	** 194	** 207
12.25	181	196	213	** 189	** 202
12.5	177	192	** 172	** 184	** 197
12.75	174	188	** 168	** 180	*** 193
13.	170	** 153	** 164	*** 176	*** 188
13.25	167	** 149	** 160	*** 171	*** 184
13.5	** 136	** 146	*** 156	*** 168	*** 179
13.75	** 133	** 143	*** 153	*** 164	*** 175
14.	** 130	*** 139	*** 149	*** 160	*** 171
14.25	** 128	*** 136	*** 146	*** 157	*** 167
14.5	** 125	*** 133	*** 143	*** 153	*** 164
14.75	*** 122	*** 131	*** 140	*** 150	*** 160
15.		*** 128	*** 137	*** 147	*** 157
15.25		*** 125	*** 134	*** 144	*** 153
15.5		*** 123	*** 131	*** 141	*** 150
15.75		*** 120	*** 129	*** 138	*** 147
16.		*** 118	*** 126	*** 135	*** 144
16.25			*** 124	*** 132	*** 141
16.5			*** 121	*** 130	*** 138

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

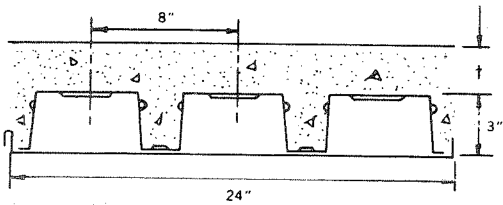
	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	35.8	40.4	42.7	45	51.3
V_R Lbs.	1112	1198	1244	1291	1429
I_c	8.939	11.247	12.537	13.918	18.199
S_{cc}	4.401	5.124	5.513	5.919	7.119
S_{bc}	3.434	3.940	4.203	4.471	5.232

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.5	234	252	261	271	300
9.75	228	245	255	264	293
10.	222	239	248	258	285
10.25	216	233	242	252	278
10.5	211	228	236	246	272
10.75	206	222	231	240	265
11.	202	217	226	234	259
11.25	197	213	221	229	254
11.5	193	208	216	224	248
11.75	189	203	211	219	243
12.	185	199	207	215	238
12.25	181	195	203	210	233
12.5	177	191	199	206	228
12.75	174	187	195	202	224
13.	171	184	191	198	** 187
13.25	167	180	187	194	** 183
13.5	159	177	184	** 163	** 179
13.75	150	174	** 154	** 160	** 175
14.	142	** 146	** 151	** 156	** 171
14.25	135	** 143	** 148	** 153	*** 168
14.5	128	** 141	** 145	** 150	*** 164
14.75	** 122	** 138	** 142	*** 147	*** 161
15.		** 135	*** 139	*** 144	*** 158
15.25		** 132	*** 137	*** 141	*** 154
15.5		*** 130	*** 134	*** 138	*** 151
15.75		*** 126	*** 131	*** 136	*** 149
16.		*** 120	*** 129	*** 133	*** 146
16.25			*** 127	*** 131	*** 143
16.5			*** 122	*** 128	*** 140

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

———— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



QL-NKX-18/18 or QL-TKX-18/18

SECTION PROPERTIES

Steel Unit Only

I_s = 2.125
(+) S_t = .909
(+) S_b = 2.055
(−) S_t = .885
(−) S_b = 1.434

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	46.4	52.4	58.5	64.5	70.5
V_R Lbs.	1121	1216	1318	1423	1531
I_c	12.432	15.598	19.229	23.333	27.920
S_{cc}	6.500	7.585	8.765	10.033	11.384
S_{bc}	4.551	5.194	5.861	6.547	7.248

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.5	236	256	277	299	322
9.75	230	249	270	291	314
10.	224	243	263	284	306
10.25	218	237	257	277	298
10.5	213	231	251	271	291
10.75	208	226	245	264	284
11.	203	221	239	258	278
11.25	199	216	234	253	272
11.5	195	211	229	247	266
11.75	190	207	224	242	** 215
12.	186	202	219	** 195	** 209
12.25	183	198	215	** 190	** 204
12.5	179	194	** 173	** 186	** 199
12.75	175	190	** 169	** 181	** 194
13.	172	** 154	** 165	** 177	*** 189
13.25	169	** 151	** 161	*** 173	*** 185
13.5	166	** 147	** 158	*** 169	*** 181
13.75	** 135	** 144	*** 154	*** 165	*** 177
14.	** 132	** 141	*** 151	*** 161	*** 173
14.25	** 129	** 138	*** 147	*** 158	*** 169
14.5	** 126	*** 135	*** 144	*** 154	*** 165
14.75	** 124	*** 132	*** 141	*** 151	*** 161
15.		*** 129	*** 138	*** 148	*** 158
15.25		*** 127	*** 135	*** 145	*** 155
15.5		*** 124	*** 132	*** 142	*** 151
15.75		*** 121	*** 130	*** 139	*** 148
16.		*** 119	*** 127	*** 136	*** 145
16.25		*** 117	*** 125	*** 133	*** 142
16.5			*** 122	*** 131	*** 139

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	36.5	41.1	43.4	45.7	52
V_R Lbs.	1122	1209	1255	1303	1440
I_c	10.463	13.142	14.635	16.232	21.177
S_{cc}	4.782	5.565	5.983	6.420	7.710
S_{bc}	4.260	4.872	5.188	5.510	6.421

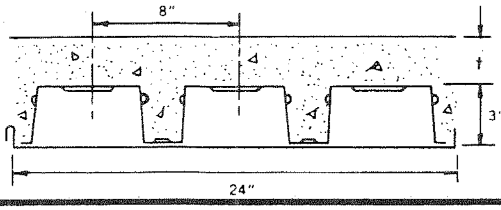
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.5	236	254	264	274	303
9.75	230	248	257	267	295
10.	224	241	251	260	288
10.25	219	235	244	254	281
10.5	213	230	239	248	274
10.75	208	224	233	242	268
11.	204	219	228	236	261
11.25	199	214	223	231	256
11.5	195	210	218	226	250
11.75	191	205	213	221	245
12.	187	201	209	217	240
12.25	183	197	204	212	235
12.5	179	193	200	208	230
12.75	176	189	196	204	225
13.	172	186	193	200	** 188
13.25	169	182	189	196	** 184
13.5	166	179	185	193	** 180
13.75	163	175	182	** 161	** 176
14.	160	172	** 153	** 158	** 172
14.25	157	** 145	** 149	** 154	** 169
14.5	150	** 142	** 146	** 151	*** 165
14.75	** 131	** 139	** 143	** 148	*** 162
15.		** 136	** 141	*** 145	*** 159
15.25		** 134	** 138	*** 142	*** 156
15.5		** 131	*** 135	*** 140	*** 152
15.75		*** 128	*** 133	*** 137	*** 150
16.		*** 126	*** 130	*** 134	*** 147
16.25		*** 124	*** 128	*** 132	*** 144
16.5			*** 125	*** 129	*** 141

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-NKX-16/16 or QL-TKX-16/16



SECTION PROPERTIES
Steel Unit Only

I_s = 2.888
(+) S_t = 1.26
(+) S_b = 2.62
(−) S_t = 1.122
(−) S_b = 1.935

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	48	54	60	66.1	72.1
V_R Lbs.	1132	1221	1317	1418	1523
I_c	14.345	17.971	22.146	26.882	32.193
S_{cc}	7.017	8.158	9.405	10.751	12.191
S_{bc}	5.475	6.248	7.054	7.886	8.740

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
9.5	238	257	277	298	320
9.75	232	250	270	290	312
10.	226	244	263	283	304
10.25	220	238	257	276	297
10.5	215	232	250	270	290
10.75	210	227	245	263	283
11.	205	222	239	257	276
11.25	201	217	234	252	270
11.5	196	212	229	246	264
11.75	192	207	224	241	259
12.	188	203	219	236	253
12.25	184	199	215	231	248
12.5	181	195	210	226	243
12.75	177	191	206	222	238
13.	174	187	202	218	234
13.25	170	184	198	214	229
13.5	167	180	195	210	225
13.75	164	177	191	206	** 175
14.	161	174	188	** 160	** 171
14.25	158	171	184	** 157	*** 167
14.5	156	168	** 144	** 153	*** 163
14.75	153	165	** 141	*** 150	*** 160
15.		162	** 138	*** 147	*** 156
15.25		** 127	** 135	*** 144	*** 153
15.5		** 124	*** 132	*** 141	*** 150
15.75		** 122	*** 130	*** 138	*** 147
16.		*** 119	*** 127	*** 135	*** 144
16.25		*** 117	*** 124	*** 132	*** 141
16.5			*** 122	*** 130	*** 138

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	38.1	42.7	45	47.3	53.6
V_R Lbs.	1145	1221	1264	1308	1438
I_c	11.954	14.987	16.674	18.483	24.105
S_{cc}	5.154	5.973	6.409	6.866	8.221
S_{bc}	5.097	5.832	6.210	6.596	7.694

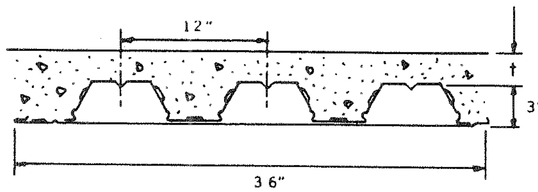
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
9.5	241	257	266	275	302
9.75	234	250	259	268	295
10.	229	244	252	261	287
10.25	223	238	246	255	280
10.5	218	232	240	249	274
10.75	213	227	235	243	267
11.	208	222	229	237	261
11.25	203	217	224	232	255
11.5	199	212	219	227	250
11.75	194	207	215	222	244
12.	190	203	210	218	239
12.25	186	199	206	213	234
12.5	183	195	202	209	230
12.75	179	191	198	205	225
13.	176	187	194	201	221
13.25	172	184	190	197	217
13.5	169	180	187	193	213
13.75	166	177	183	190	209
14.	163	174	180	186	205
14.25	160	171	177	183	201
14.5	157	168	174	180	198
14.75	155	165	171	177	195
15.		162	168	174	191
15.25		160	165	171	** 155
15.5		157	163	168	** 152
15.75		155	160	** 137	** 149
16.		152	** 131	** 135	*** 146
16.25		** 125	** 129	** 132	*** 143
16.5			** 126	** 130	*** 141

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-WKX-20/20



SECTION PROPERTIES
Steel Unit Only

I_s = 1.505
(+) S_t = .649
(+) S_b = 1.538
(−) S_t = .668
(−) S_b = .899

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	46.5	52.5	58.6	64.6	76.7
V_R Lbs.	2109	2291	2484	2685	3104
I_c	9.966	12.512	15.430	18.725	26.472
S_{cc}	5.294	6.183	7.149	8.188	10.467
S_{bc}	3.09	3.491	3.907	4.334	5.212

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.5	410	463	518	565	* 603
9.75	386	437	489	543	** 586
10.	365	412	462	513	** 570
10.25	345	390	437	* 482	** 555
10.5	327	369	* 413	** 459	** 541
10.75	310	350	** 392	** 435	*** 527
11.	293	* 332	** 371	** 412	*** 514
11.25	279	** 315	** 353	** 391	*** 495
11.5	* 266	** 299	** 335	*** 389	*** 470
11.75	** 252	** 284	** 318	*** 370	*** 447
12.	** 239	** 270	*** 316	*** 352	*** 426
12.25	** 227	** 257	*** 301	*** 335	*** 405
12.5	** 216	*** 254	*** 287	*** 319	*** 385
12.75	** 205	*** 242	*** 273	*** 304	*** 367
13.	*** 195	*** 230	*** 261	*** 290	*** 350
13.25	*** 186	*** 219	*** 249	*** 277	*** 334
13.5	*** 177	*** 209	*** 237	*** 264	*** 319
13.75		*** 199	*** 227	*** 252	*** 304
14.		*** 189	*** 216	*** 241	*** 291
14.25		*** 181	*** 207	*** 230	*** 278
14.5		*** 172	*** 197	*** 220	*** 265
14.75		*** 164	*** 189	*** 210	*** 254
15.			*** 180	*** 201	*** 243
15.25			*** 172	*** 192	*** 232
15.5			*** 165	*** 183	*** 222
15.75			*** 158	*** 176	*** 212
16.			*** 151	*** 168	*** 203
16.25			*** 144	*** 161	*** 194
16.5				*** 154	*** 186

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	36.1	40.7	45.3	47.6	56.2
V_R Lbs.	2109	2276	2457	2552	2923
I_c	8.638	10.864	13.421	14.830	20.902
S_{cc}	3.949	4.604	5.317	5.696	7.237
S_{bc}	2.957	3.344	3.745	3.950	4.743

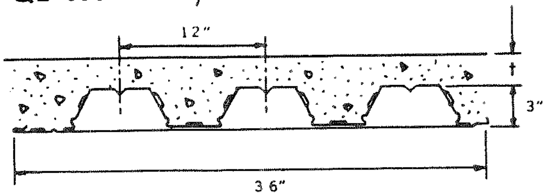
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.5	400	453	507	535	615
9.75	378	428	479	506	599
10.	358	405	454	479	576
10.25	339	383	429	453	545
10.5	321	363	407	430	517
10.75	304	345	386	408	* 491
11.	284	327	367	387	** 466
11.25	265	311	349	368	** 443
11.5	248	296	332	** 350	** 421
11.75	233	282	** 316	** 333	** 401
12.	218	* 268	** 301	** 318	** 382
12.25	205	** 256	** 287	** 303	*** 381
12.5	* 193	** 243	** 274	** 289	*** 363
12.75	** 182	** 229	** 261	** 276	*** 347
13.	** 172	** 216	** 250	*** 274	*** 332
13.25	** 162	** 204	*** 248	*** 262	*** 317
13.5	** 153	** 193	*** 237	*** 251	*** 303
13.75		*** 183	*** 226	*** 240	*** 290
14.		*** 173	*** 214	*** 230	*** 278
14.25		*** 164	*** 203	*** 220	*** 266
14.5		*** 156	*** 192	*** 211	*** 255
14.75		*** 148	*** 183	*** 202	*** 244
15.			*** 174	*** 192	*** 234
15.25			*** 165	*** 183	*** 224
15.5			*** 157	*** 174	*** 215
15.75			*** 150	*** 166	*** 207
16.			*** 143	*** 158	*** 199
16.25			*** 137	*** 151	*** 191
16.5				*** 144	*** 183

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-WKX-20/18



SECTION PROPERTIES
Steel Unit Only

I_s = 1.614
(+) S_t = .66
(+) S_b = 1.846
(−) S_t = .693
(−) S_b = 1.177

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	47	53	59	65.1	77.2
V_R Lbs.	2125	2309	2503	2704	3123
I_c	11.285	14.143	17.412	21.101	29.761
S_{cc}	5.655	6.599	7.623	8.724	11.134
S_{bc}	3.612	4.068	4.540	5.023	6.016

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.5	447	486	527	569	657
9.75	435	473	513	554	** 590
10.	425	461	500	540	** 574
10.25	411	450	488	* 485	** 559
10.5	389	438	476	** 473	** 544
10.75	369	416	* 428	** 461	** 530
11.	351	* 375	** 417	** 449	*** 517
11.25	333	* 356	** 407	** 438	*** 505
11.5	* 287	** 337	** 393	** 428	*** 492
11.75	** 273	** 320	** 373	*** 418	*** 481
12.	** 259	** 304	** 355	*** 408	*** 470
12.25	** 246	** 289	*** 337	*** 389	*** 459
12.5	** 234	** 275	*** 321	*** 370	*** 449
12.75	** 223	*** 262	*** 306	*** 353	*** 436
13.	** 212	*** 250	*** 291	*** 336	*** 416
13.25	*** 202	*** 238	*** 277	*** 321	*** 398
13.5	*** 192	*** 227	*** 265	*** 306	*** 380
13.75		*** 216	*** 252	*** 292	*** 363
14.		*** 206	*** 241	*** 279	*** 348
14.25		*** 196	*** 230	*** 266	*** 333
14.5		*** 187	*** 219	*** 254	*** 319
14.75		*** 179	*** 210	*** 243	*** 305
15.			*** 200	*** 232	*** 292
15.25			*** 191	*** 222	*** 280
15.5			*** 183	*** 212	*** 268
15.75			*** 175	*** 203	*** 258
16.			*** 167	*** 194	*** 247
16.25			*** 160	*** 186	*** 237
16.5				*** 178	*** 227

N=14

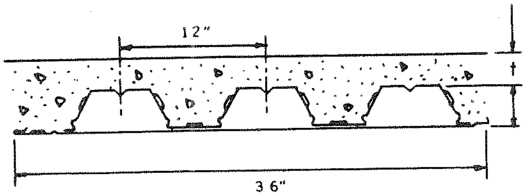
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	36.6	41.2	45.7	48	56.6
V_R Lbs.	2124	2292	2474	2569	2940
I_c	9.693	12.193	15.042	16.610	23.360
S_{cc}	4.194	4.895	5.649	6.048	7.673
S_{bc}	3.451	3.898	4.352	4.584	5.480

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.5	447	482	520	540	619
9.75	435	470	507	527	603
10.	423	458	494	513	588
10.25	394	447	482	501	573
10.5	366	430	471	489	560
10.75	341	408	456	478	* 510
11.	319	388	433	457	** 498
11.25	298	369	412	434	** 486
11.5	279	351	393	* 414	** 474
11.75	261	329	* 374	** 394	** 464
12.	245	* 309	** 357	** 376	** 450
12.25	230	* 290	** 340	** 359	** 430
12.5	* 217	** 273	** 325	** 343	*** 428
12.75	* 204	** 257	** 311	** 327	*** 409
13.	** 193	** 243	** 297	** 313	*** 391
13.25	** 182	** 229	** 283	*** 311	*** 375
13.5	** 172	** 217	*** 267	*** 295	*** 359
13.75		*** 205	*** 253	*** 279	*** 344
14.		*** 194	*** 240	*** 265	*** 329
14.25		*** 184	*** 227	*** 251	*** 316
14.5		*** 175	*** 216	*** 238	*** 303
14.75		*** 166	*** 205	*** 226	*** 291
15.			*** 195	*** 215	*** 279
15.25			*** 185	*** 205	*** 268
15.5			*** 176	*** 195	*** 258
15.75			*** 168	*** 186	*** 248
16.			*** 160	*** 177	*** 238
16.25			*** 153	*** 169	*** 229
16.5				*** 161	*** 221

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = 1.894
(+) S_t = .929
(+) S_b = 1.754
(−) S_t = .872
(−) S_b = 1.076

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	47.3	53.3	59.3	65.4	77.5
V_R Lbs.	2093	2265	2450	2645	3053
I_c	10.973	13.805	17.070	20.774	29.532
S_{cc}	5.535	6.458	7.468	8.559	10.986
S_{bc}	3.498	3.965	4.452	4.955	5.994

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.5	440	476	515	556	642
9.75	429	464	502	542	626
10.	418	453	490	529	610
10.25	396	442	478	516	595
10.5	375	426	466	503	581
10.75	356	404	454	492	568
11.	338	383	431	480	555
11.25	321	364	409	456	542
11.5	305	346	389	434	** 480
11.75	290	329	370	413	** 469
12.	276	313	352	393	** 458
12.25	261	298	336	** 374	*** 448
12.5	246	285	** 313	** 357	*** 438
12.75	231	271	** 297	** 341	*** 428
13.	218	** 242	** 283	** 325	*** 413
13.25	206	** 231	** 270	*** 313	*** 394
13.5	195	** 220	** 257	*** 298	*** 377
13.75		** 210	*** 245	*** 284	*** 360
14.		** 200	*** 234	*** 271	*** 345
14.25		*** 190	*** 223	*** 259	*** 330
14.5		*** 182	*** 213	*** 247	*** 316
14.75		*** 173	*** 203	*** 236	*** 302
15.			*** 194	*** 226	*** 289
15.25			*** 185	*** 216	*** 277
15.5			*** 177	*** 206	*** 266
15.75			*** 169	*** 197	*** 255
16.			*** 162	*** 189	*** 244
16.25			*** 154	*** 180	*** 234
16.5				*** 172	*** 225

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

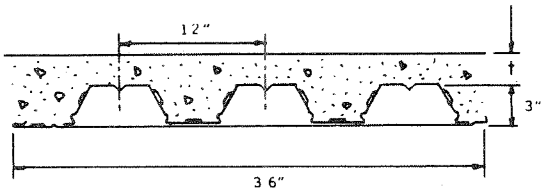
	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	36.9	41.5	46	48.3	56.9
V_R Lbs.	2107	2260	2431	2521	2879
I_c	9.424	11.881	14.706	16.268	23.038
S_{cc}	4.12	4.798	5.536	5.930	7.541
S_{bc}	3.327	3.780	4.246	4.486	5.418

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.5	443	475	511	530	606
9.75	429	463	498	517	590
10.	406	452	486	504	575
10.25	383	438	474	492	561
10.5	356	415	463	480	548
10.75	332	394	443	469	535
11.	310	375	421	446	523
11.25	289	356	401	424	511
11.5	271	339	382	403	489
11.75	254	320	364	384	466
12.	238	301	347	367	444
12.25	224	283	331	350	424
12.5	211	266	316	334	405
12.75	199	251	302	319	** 387
13.	187	236	288	305	** 370
13.25	177	223	276	292	** 354
13.5	167	211	261	** 279	** 339
13.75		200	** 247	** 268	*** 338
14.		189	** 234	** 256	*** 324
14.25		** 179	** 222	** 246	*** 310
14.5		** 170	** 211	** 233	*** 298
14.75		** 162	** 200	*** 222	*** 286
15.			*** 190	*** 211	*** 274
15.25			*** 181	*** 200	*** 263
15.5			*** 173	*** 191	*** 253
15.75			*** 164	*** 182	*** 243
16.			*** 157	*** 173	*** 234
16.25			*** 150	*** 166	*** 225
16.5				*** 158	*** 216

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
_____ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-WKX-18/18



SECTION PROPERTIES
Steel Unit Only

I_s = 2.033
(+) S_t = .946
(+) S_b = 2.07
(–) S_t = .901
(–) S_b = 1.331

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	47.8	53.9	59.9	66	78
V_R Lbs.	2112	2285	2471	2666	3075
I_c	12.221	15.349	18.943	23.016	32.634
S_{cc}	5.866	6.839	7.901	9.046	11.567
S_{bc}	4.009	4.531	5.073	5.631	6.784

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.5	444	481	520	561	647
9.75	433	468	506	546	630
10.	422	457	494	533	615
10.25	412	445	482	520	600
10.5	402	435	470	507	585
10.75	393	425	459	496	572
11.	384	415	449	484	559
11.25	374	406	439	474	546
11.5	352	397	429	463	** 484
11.75	330	383	420	453	** 472
12.	309	365	409	444	** 461
12.25	291	348	390	** 393	** 451
12.5	274	332	372	** 384	*** 441
12.75	258	317	** 318	** 368	*** 431
13.	243	303	** 303	** 351	*** 422
13.25	230	** 248	** 289	*** 334	*** 413
13.5	217	** 236	** 276	*** 319	*** 404
13.75		** 225	*** 263	*** 305	*** 396
14.		** 215	*** 251	*** 291	*** 380
14.25		** 205	*** 240	*** 278	*** 363
14.5		*** 196	*** 229	*** 266	*** 348
14.75		*** 187	*** 219	*** 254	*** 333
15.		*** 178	*** 209	*** 243	*** 318
15.25			*** 200	*** 232	*** 305
15.5			*** 191	*** 222	*** 292
15.75			*** 183	*** 212	*** 280
16.			*** 175	*** 203	*** 268
16.25			*** 167	*** 194	*** 257
16.5				*** 186	*** 246

N=14

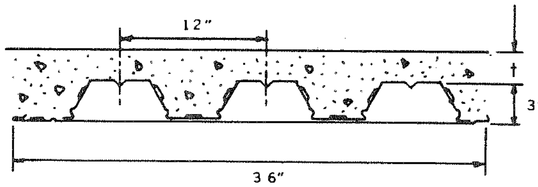
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	37.4	42	46.6	48.9	57.5
V_R Lbs.	2125	2279	2450	2541	2899
I_c	10.413	13.128	16.225	17.935	25.334
S_{cc}	4.343	5.064	5.838	6.250	7.934
S_{bc}	3.809	4.320	4.840	5.106	6.140

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.5	447	479	515	535	610
9.75	436	467	502	521	594
10.	425	455	490	508	579
10.25	414	444	478	495	565
10.5	394	434	466	484	552
10.75	367	424	455	472	539
11.	342	414	445	462	527
11.25	320	403	435	451	515
11.5	299	378	426	441	504
11.75	281	354	417	432	493
12.	263	332	401	423	483
12.25	248	312	383	404	473
12.5	233	294	363	386	463
12.75	220	277	342	369	446
13.	207	261	323	353	** 409
13.25	196	247	305	337	** 400
13.5	185	233	288	319	** 391
13.75		221	273	** 302	** 375
14.		209	** 259	** 286	*** 374
14.25		198	** 245	** 271	*** 359
14.5		** 188	** 233	** 257	*** 345
14.75		** 179	** 221	** 244	*** 331
15.		** 170	** 210	*** 232	*** 318
15.25			*** 200	*** 221	*** 306
15.5			*** 190	*** 210	*** 294
15.75			*** 181	*** 201	*** 283
16.			*** 173	*** 191	*** 270
16.25			*** 165	*** 183	*** 258
16.5				*** 174	*** 247

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only
I_s = 2.15
(+) S_t = .96
(+) S_b = 2.381
(−) S_t = .928
(−) S_b = 1.662

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	48.3	54.4	60.4	66.4	78.5
V_R Lbs.	2125	2299	2486	2681	3090
I_c	13.408	16.827	20.741	25.172	35.623
S_{cc}	6.161	7.183	8.292	9.487	12.116
S_{bc}	4.519	5.098	5.694	6.308	7.574

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.5	447	484	523	564	650
9.75	436	471	510	550	633
10.	425	459	497	536	618
10.25	414	448	485	523	603
10.5	404	438	473	510	588
10.75	395	427	462	498	574
11.	386	418	452	487	561
11.25	377	408	442	476	549
11.5	369	399	432	466	** 486
11.75	361	391	423	456	** 475
12.	339	383	414	446	** 464
12.25	319	375	405	** 395	** 453
12.5	300	367	397	** 386	** 443
12.75	283	355	** 337	** 378	*** 433
13.	267	335	** 321	** 370	*** 424
13.25	252	** 263	** 307	** 354	*** 415
13.5	238	** 251	** 293	*** 338	*** 406
13.75		** 239	** 279	*** 323	*** 398
14.		** 228	*** 267	*** 309	*** 390
14.25		** 218	*** 255	*** 295	*** 382
14.5		*** 208	*** 243	*** 282	*** 368
14.75		*** 199	*** 233	*** 270	*** 352
15.		*** 190	*** 223	*** 258	*** 338
15.25			*** 213	*** 247	*** 323
15.5			*** 204	*** 236	*** 310
15.75			*** 195	*** 226	*** 297
16.			*** 186	*** 217	*** 285
16.25			*** 178	*** 208	*** 273
16.5				*** 199	*** 262

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

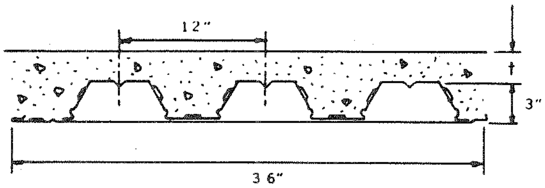
	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	37.9	42.5	47.1	49.3	57.9
V_R Lbs.	2138	2292	2464	2554	2912
I_c	11.338	14.301	17.666	19.517	27.522
S_{cc}	4.539	5.298	6.109	6.538	8.289
S_{bc}	4.286	4.858	5.433	5.726	6.862

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.5	450	482	518	537	613
9.75	438	470	505	524	597
10.	427	458	492	510	582
10.25	417	447	480	498	568
10.5	407	436	469	486	554
10.75	397	426	458	475	541
11.	373	416	448	464	529
11.25	348	407	438	454	517
11.5	326	398	428	444	506
11.75	306	386	419	434	495
12.	287	362	410	425	485
12.25	270	340	402	417	475
12.5	254	320	394	408	466
12.75	239	302	373	400	456
13.	226	285	352	389	** 411
13.25	213	269	332	367	** 402
13.5	201	254	314	347	** 394
13.75		240	297	** 328	** 386
14.		228	** 282	** 311	** 379
14.25		216	** 267	** 295	*** 371
14.5		** 205	** 253	** 280	*** 364
14.75		** 195	** 241	** 266	*** 358
15.		** 185	** 229	*** 253	*** 351
15.25			*** 218	*** 241	*** 339
15.5			*** 207	*** 229	*** 323
15.75			*** 198	*** 218	*** 308
16.			*** 188	*** 208	*** 294
16.25			*** 180	*** 199	*** 280
16.5				*** 190	*** 268

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
______ For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

QL-WKX-16/16



SECTION PROPERTIES
Steel Unit Only

I_s = 2.557
(+) S_t = 1.183
(+) S_b = 2.574
(–) S_t = 1.139
(–) S_b = 1.82

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	49.2	55.2	61.3	67.3	79.4
V_R Lbs.	2121	2285	2464	2654	3053
I_c	14.25	17.917	22.119	26.895	38.210
S_{cc}	6.341	7.389	8.526	9.756	12.473
S_{bc}	4.90	5.546	6.211	6.898	8.321

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.5	446	481	518	558	642
9.75	435	468	505	544	626
10.	424	457	492	530	610
10.25	413	445	480	517	595
10.5	404	435	469	505	581
10.75	394	425	458	493	568
11.	385	415	448	482	555
11.25	377	406	438	471	542
11.5	368	397	428	461	531
11.75	361	389	419	451	519
12.	353	380	410	442	508
12.25	339	373	402	433	498
12.5	319	365	394	424	488
12.75	301	358	386	416	** 427
13.	284	351	379	408	** 418
13.25	268	337	372	400	** 409
13.5	253	319	365	** 349	** 401
13.75		301	358	** 333	** 392
14.		286	** 275	** 319	*** 384
14.25		271	** 263	** 305	*** 377
14.5		** 215	** 251	** 291	*** 369
14.75		** 206	** 240	*** 279	*** 362
15.		** 197	** 230	*** 267	*** 349
15.25			** 220	*** 255	*** 335
15.5			*** 210	*** 244	*** 321
15.75			*** 201	*** 234	*** 308
16.			*** 193	*** 224	*** 295
16.25			*** 184	*** 215	*** 283
16.5				*** 206	*** 271

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	38.7	43.3	47.9	50.2	58.8
V_R Lbs.	2148	2289	2451	2537	2883
I_c	11.982	15.126	18.714	20.687	29.257
S_{cc}	4.671	5.442	6.270	6.708	8.504
S_{bc}	4.626	5.259	5.901	6.228	7.497

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.5	452	481	516	534	607
9.75	440	469	502	520	591
10.	429	457	490	507	576
10.25	419	446	478	495	562
10.5	409	436	466	483	549
10.75	399	425	456	472	536
11.	390	416	445	461	524
11.25	368	406	435	451	512
11.5	345	398	426	441	501
11.75	323	389	417	431	490
12.	303	381	408	422	480
12.25	285	360	400	414	470
12.5	268	339	392	406	461
12.75	253	319	384	398	452
13.	238	301	373	390	443
13.25	225	284	352	383	435
13.5	213	269	333	368	427
13.75		254	315	348	419
14.		241	298	330	411
14.25		228	283	313	** 367
14.5		217	268	297	** 360
14.75		206	255	282	** 353
15.		196	242	** 268	** 347
15.25			** 231	** 255	** 341
15.5			** 220	** 243	** 335
15.75			** 209	** 231	*** 328
16.			** 200	** 221	*** 312
16.25			** 191	** 211	*** 298
16.5				*** 201	*** 285

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

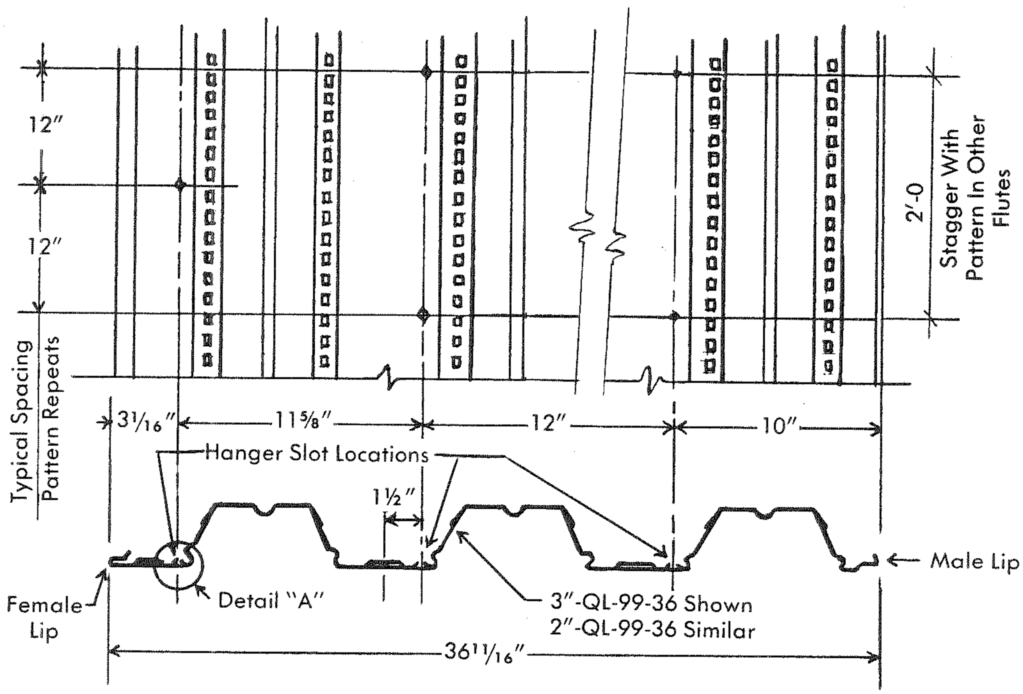
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

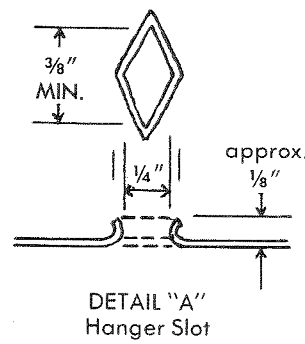
Hanger devices

Two types of hanger devices are available, when ordered, with Q-Lock Floor. Generally, these devices are intended for suspending acoustical ceilings, ductwork or other lightweight items. The location of these hanger devices with respect to the floor supports or across deck joints cannot be predicted or fixed although the hanger device pattern is constant within the sheet.

SLOTS FOR DROP-THROUGH HANGERS

Slots can be provided in 2"-QL-99 and 3"-QL-99 (24" and 36" widths) to allow #8 "pigtail" hanger wires to be dropped from the topside of the deck. When the "pigtails" are later embedded in the concrete slab, they provide a very reliable load support. Slots for Drop-Through ("pigtail") hangers are available in our standard pattern as shown below for the 36" wide units. (Drop-through hangers and labor by others.)

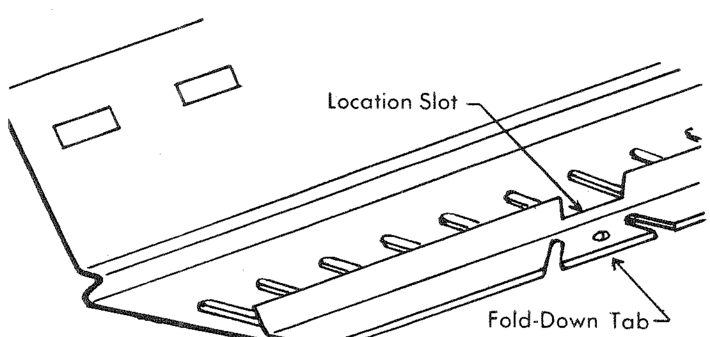


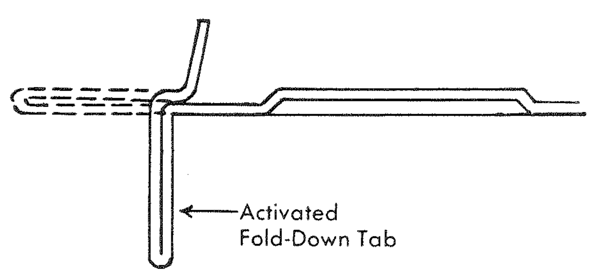


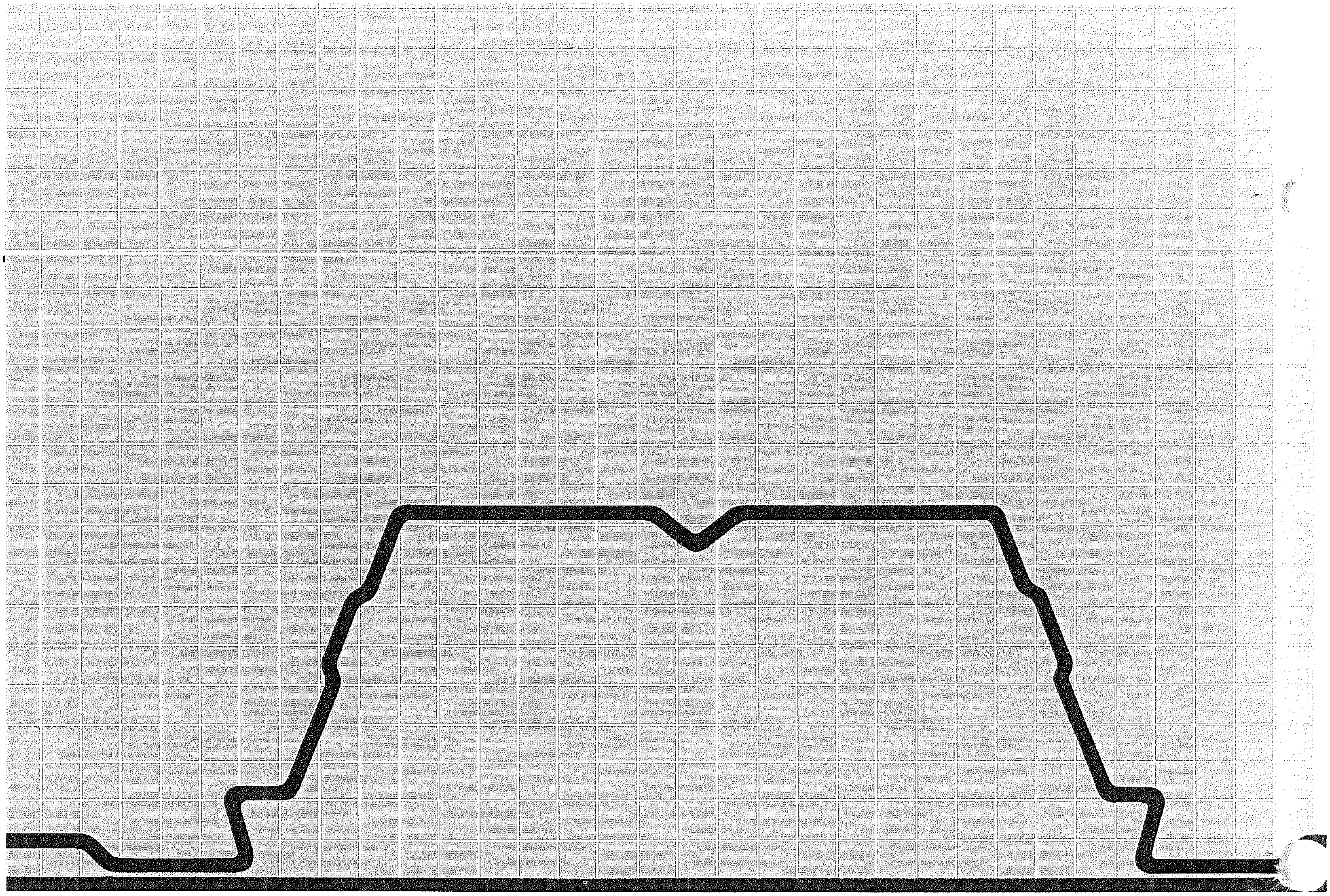
FOLD-DOWN HANGERS

The bottom lips of 2"-QL-99, 3"-QL-99, QL-AKX, and QL-WKX can be factory punched to provide fold-down hangers at 1'-0" centers along the lips. These hangers do not interfere with the erection of the steel floor and are activated, as required, to provide tabs which accept maximum #10 wires. The maximum static load capacity of each hanger is 100 pounds. Plastered ceilings shall not be hung from fold-down tabs.

A location slot is punched into the upstanding lip above the tab to prevent sidelap welding of the floor units at hanger locations.







H. H. Robertson Company provides this publication for use in detailing some of its products and procedures which are available at the time of printing. The Company reserves the right to change or withdraw any products or procedures without notice. Current information and specific details can be obtained from your Robertson Sales Representative.

Robertson

H. H. Robertson Company
400 Holiday Drive
Pittsburgh, Pennsylvania 15220

Printed in U.S.A.
Q-115-J
December 1978

H.H. Robertson Co.
April, 1968

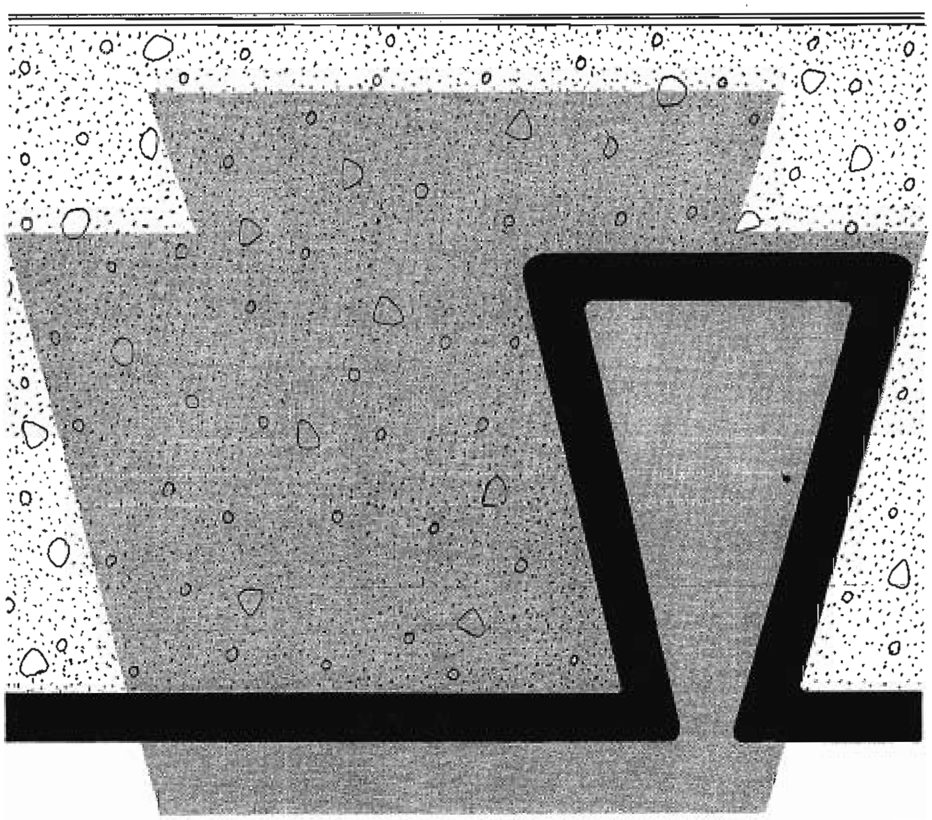
5 METAL DECKING
ribbed & fluted

ROBERTSON

Section 69

KEYSTONE

COMPOSITE FLOOR AND BEAM CONSTRUCTION



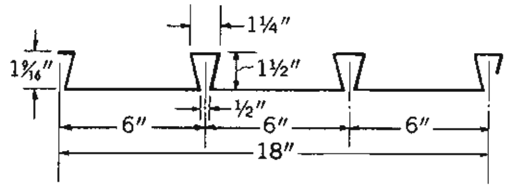
H.H. ROBERTSON COMPANY

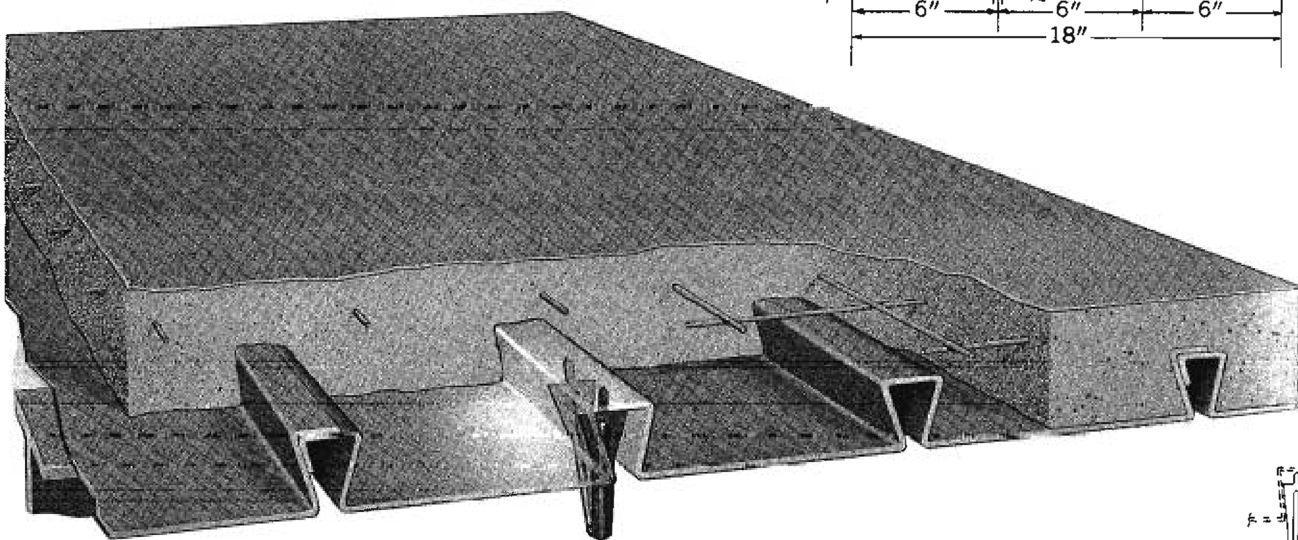
PITTSBURGH, PENNSYLVANIA

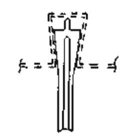
KEYSTONE DECK

Section 69

COMPOSITE FLOOR SYSTEM







The H-6 Hanger in place. Other hangers are available.

The Keystone composite floor system is a combination of steel reinforcing forms and concrete, using the structural qualities of both to the fullest advantage. The bottom plate of the Keystone deck becomes positive reinforcing steel held permanently in place at the lower extremities of the slab by the triangular shaped ribs bonded into the concrete. The compressive strength of concrete is fully utilized at the top surface (compression area) of the slab.

The more efficient use of the concrete and steel results in a decreased slab thickness and a savings in reinforcing steel. (See comparison with conventional slab, page 3.) Besides the savings in concrete, a shallower slab means longer spans without shoring, lighter structural steel, lighter foundations and a comparable savings in time and labor costs.

Keystone deck provides a rigid, uncluttered working surface for other trades. After the work of the other trades has been completed, the temperature mesh can then be properly installed to occur near the surface of the slab where it has maximum effects in control of shrinkage and also serves as additional reinforcing.

The Keystone composite floor system decreases the cost of fireproofing, since a smaller quantity of material is required to cover the flat underside of Keystone deck than would be needed to cover a fluted or corrugated deck.

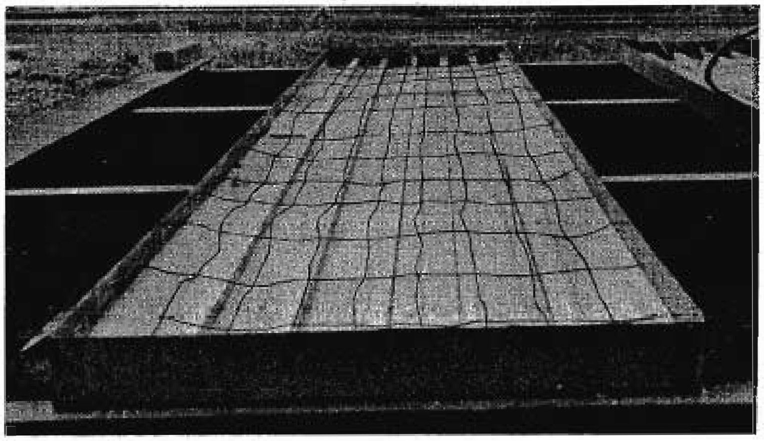
40′-0″ sheet lengths

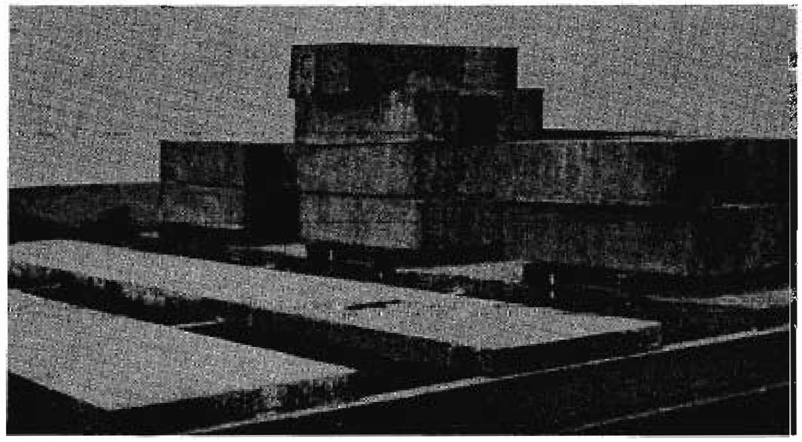
Gauges—16, 18, 20, 22

Coverage—1′-6″ per sheet.

Robertson's steel Keystone reinforcing forms are available in sheet lengths to 40′-0″ and in gauges from 16 to 22. Long sheet length means multiple spanning for greater strength and fast erection. A choice of the gauge which will eliminate shoring often proves to be the most economical.

PAN-AM TEST





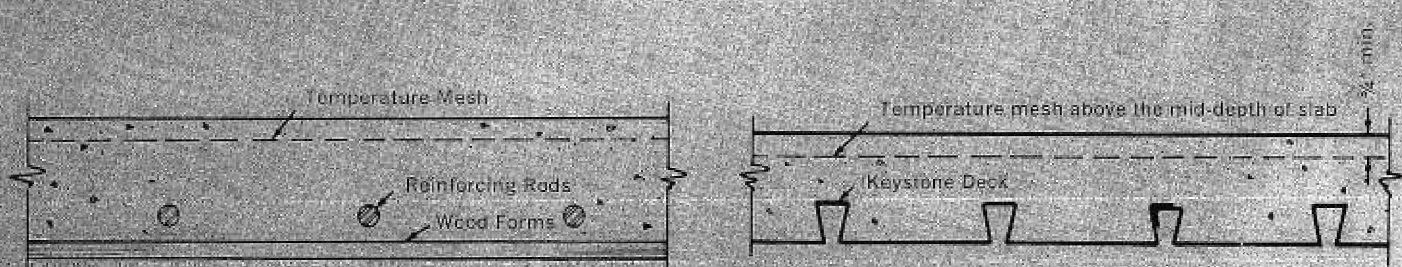
20 gauge Keystone deck, 4″ Lelite aggregate, 4 x 16-5/10 mesh, 7′-0″ beam spacings, triple span Keystone units.

Design Loads: Live Loads—50 and 100 psf

Total Loads—110 and 160 psf

Results:	Actual	Allowable L/360
Maximum deflection at 110 psf—	.008″	.233″
Maximum deflection at 160 psf—	.013″	.233″
First cracks over supports—	645 psf	
Ultimate load applied—	900 psf	No failure

Tests conducted by Pittsburgh Testing Laboratory. Test No. 660.

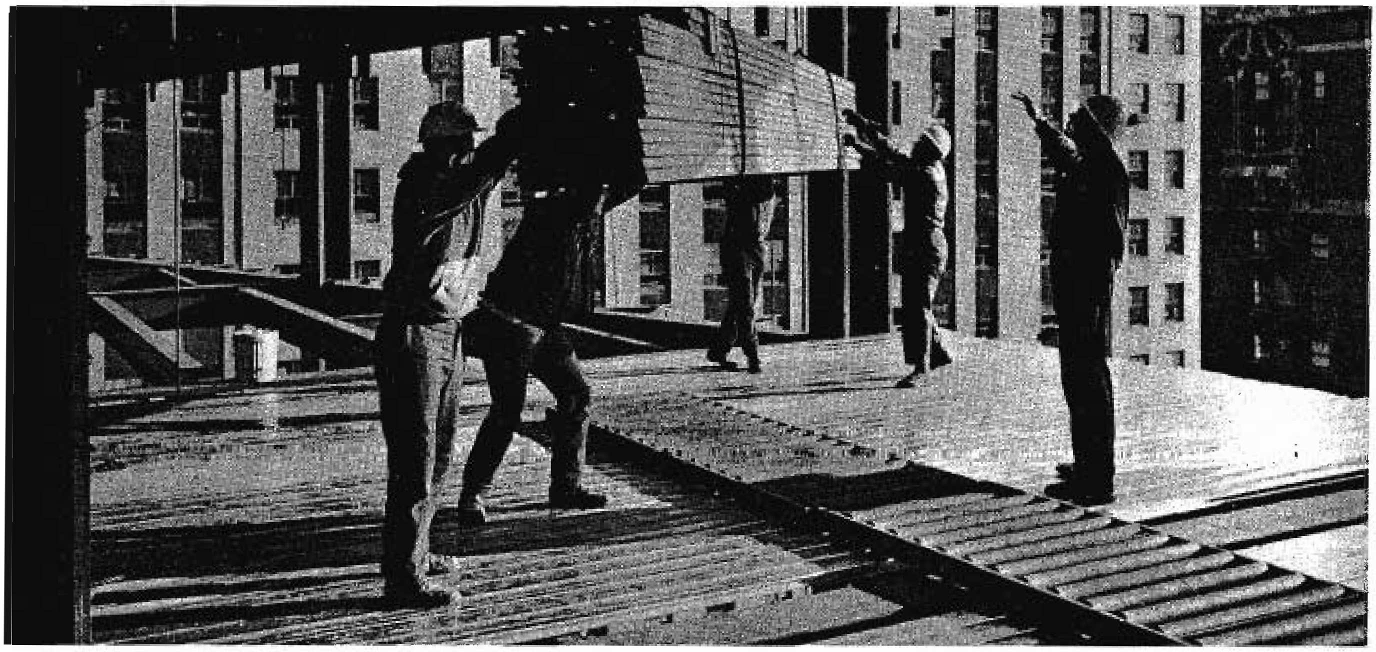


REINFORCED CONCRETE SLAB

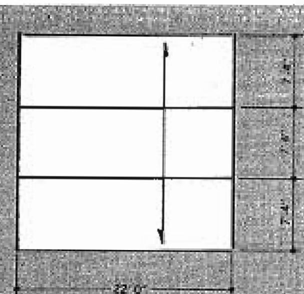
KEYSTONE COMPOSITE SLAB

EXAMPLE	Superimposed Slab				
	Forms	Span	Load	Thickness	Reinforcing
Reinfor. Concrete Slab	Wood	14′-0″	140 PSF	6″	No. 5 bars 10″ oc
Keystone Composite Slab	20 ga. Keystone	14′-0″	140 PSF	5½″	None

DESIGN PROCEDURE and EXAMPLE



PROBLEM: To determine the most economical Keystone Composite Slab for a given condition.



Loads		*Specifications*
Live Load	100 psf	Expanded Shale Concrete
Partitions	35 psf	f'_c = 3000 psi, 110 pcf
Ceiling	8 psf	A.C.I. Building Code
Fin. Floor	2 psf	
Total Superimposed Load	= 145 psf	

General Nomenclature

A_s—Cross-sectional area of one foot width of reinforcing form (sq. In.).

b—Unit width of slab (12 in.).

d—Effective Depth of Slab (in.)

E_s—Elastic Modulus of Steel (psi).

f'_c—28 day Strength of concrete mix in compression (psi).

f_c—Allowable concrete design stress—0.45f'c (psi).

f_s—Allowable design tensile stress in reinforcing bars = 20,000 psi.

f_t—Allowable design tensile stress in reinforcing form = 20,000 psi.

I_c—Least Moment of Inertia of composite section transformed into steel (in^4).

I_s—Moment of Inertia of reinforcing form section (in^4).

jd—Moment arm of composite slab section—see Design Properties (in.).

K—223 for 3000 psi concrete and n=9.

kd—Effective depth of concrete in compression—See Design Properties (in.).

L—Length of Span (feet).

M_w—Maximum positive Dead Load Moment from slab weight (ft. lbs.).

M_2—Maximum positive moment with superimposed load if no shoring is used; total load if shoring is used (ft. lbs.).

M_p—Maximum construction load moment (ft. lbs.).

M_n—Negative Moment at interior supports for continuous spans with superimposed load if no shoring is used and with total load if shored (ft. lbs.).

S—Section Modulus of deck (in^3).

Σo—Reinforcing Form rib perimeter (=8 inches).

t—Total thickness of slab (inches).

V'—Vertical shear at discontinuous edge of slab with superimposed load without shoring; Total load with shoring. Here referred to as End Shear (lbs./ft.—width).

V"—Maximum vertical shear with Live Load without shoring, with Total Load when shoring is used (lbs./ft.—width).

w_l—Live Load (psf).

w_s—Superimposed load for unshored spans—Total Load where shoring is used (psf).

$\bar{y}$—Distance of Neutral Axis of reinforcing form section from its bottom fiber (inches).

Design Procedure	Calculations

Preliminary Design

Step 1 Preliminary Selection of Slab from Table 1 (directly or by interpolation).

Table 1:
3″ Slab—22 ga. Keystone
7′0″ Span—200 psf
8′0″ Span—138 psf

Step 2 Check Table 4 for shoring requirements. Check max. stress in Keystone deck with weight of concrete and a construction load of one man (200 lbs.) standing at midspan with his weight distributed over one Keystone deck unit (1′6″ wide).

For section properties, (S) see Table 5.

For one time temporary load use ⅓ stress increase.

Table 4:
Allowable clear span 7′9″.
No shoring required.

P w 1′0″ wide strip

w = Weight of Slab = 28 psf
$P = 200/1.5 = 133$ lbs.
Moments: (maximum)

$M_w = 0.080\ wL^2 = 1444$ in-lbs
$M_P = 0.2042\ PL = 2389$ in-lbs
Total: $M = 3833$ in-lbs

Stress:

$$f = \frac{M}{S} = \frac{3833}{.171} = 22{,}415 \text{ psi} < 20{,}000 \times 1.33 = 26{,}600$$

Temporary Load
O.K.

Step 3 Find tensile stress in bottom fiber of Keystone Reinforcing Form from the weight of concrete.

For section properties, (I_s, $\bar{y}$) see Table 5.

$$f_1 = \frac{M_w \bar{y}}{I_s} = \frac{1444 \times 0.43}{0.189} = 3285 \text{ psi}$$

(for shored spans $f_1 = o$)

Step 4 Find maximum tensile stress in composite slab from the superimposed load.

For moment coefficients, (M_2) see Table 7.

For slab properties, (jd, kd) see Table 6.

For deck section properties, (A_s) see Table 5.

$$f_2 = \frac{M_2}{jd \times A_s}$$

$$M_2 = \frac{{}^{*}wL^2}{11} = \frac{145 \times 7.33^2}{11} = 708 \text{ ft lbs}$$

$= 8500$ in lbs

$$f_2 = \frac{8500}{2.2 \times 0.59} = 6545 \text{ psi}$$

Step 5 Check total tensile stress.

$f_t = f_1 + f_2 = 3285 + 6545 = 9830$ psi
$< 20{,}000$ psi O.K.

Step 6 Check max. compression stress in concrete.

For slab properties, (jd, kd) see Table 6.

**

$$f_c = \frac{M_2}{\tfrac{1}{2}\ kd \times jd \times b} = \frac{8496}{\tfrac{1}{2} \times 1.13 \times 2.2 \times 12} =$$

570 psi < 1350 psi O.K.

Step 7 Check max. bond stress.

Allowable values:

16 ga. Keystone	60 psi
18 ga. Keystone	60 psi
20 ga. Keystone	60 psi
22 ga. Keystone	40 psi

Perimeter of Keystone
$\Sigma_o = 8$ inches

For shear coefficient, (V') see Table 7.

$$u = \frac{V'}{\Sigma_o \times jd} =$$

$V' = 2/5\ wL = 2/5 \times 145 \times 7.33 = 425$#

$$u = \frac{425}{8 \times 2.2} = 24.1 \text{ psi} < 40 \text{ psi} \quad \text{O.K.}$$

*For shored spans use w=total load. For unshored spans use w=total load less weight of slab.

**Example is based on 3000 psi concrete, however any structural concrete can be used.

Design Procedure	Calculations
Step 8 Check shear stress in concrete. Allowable value $0.03 f'_c$. For shear coefficients, (V'') see Table 7.	$v=\frac{V''}{12\times jd}$ $V''=\frac{1.15}{2}\,wL=\frac{1.15}{2}\times145\times7.33=611$ lbs. $v=\frac{611}{12\times2.2}=23.14<90$ psi O.K.
Step 9 Select least required negative reinforcing for the maximum negative moment from Table 8 or by calculating the required cross-section of reinforcing steel.	Max. negative moment $=M_n=\frac{{}^{*}wL^2}{12}$ $M_n=\frac{145\times7.33^2}{12}=649$ ft lbs Table 9: #3 Bars 6″-o.c. or: $A_n=\frac{12\times M_n}{f_s\times0.874(2'')^{***}}=0.22$ in²
Step 10 Check negative moment capacity of slab with negative reinforcing. $K=223$ for 3000 psi concrete.	M_n (allowable) $=K\,(d)^2=223\times2^2=892$ ft lbs $649<892$ O.K.
From the result obtained in Step #5 it can be seen that the allowable steel stress of 20,000 psi was not reached. To realize a possible saving by eliminating negative reinforcing, a simple span analysis follows.	
Step 11 Bottom fiber stress in Keystone form from weight of concrete remains as in Step #3.	$f_1=3285$ psi
Step 12 Maximum tensile stress in composite slab from superimposed load. For moment coefficient see Table 7.	$M_2=\frac{w^{*}L^2}{8}$ $M_2=\frac{145\times7.33^2}{8}\times12=11686$ in-lbs $f_2=\frac{M_2}{jd\times A_s}=\frac{11686}{2.2\times0.59}=9003$ psi
Step 13 Check total tensile stresses.	$f_t=f_1+f_2=3285+9003=12{,}288$ psi $<20{,}000$ psi O.K.
Step 14 Check max. compression stress in concrete.	$f_c=\frac{M_2}{\frac{1}{2}\,kd\times jd\times b}=\frac{11{,}686}{\frac{1}{2}\times1.13\times2.2\times12}$ $=783$ psi <1350 psi O.K.
Step 15 Check max. bond stress.	$V'=\frac{wL}{2}=\frac{145\times7.33}{2}=531$ # $u=\frac{V'}{\Sigma_o\times jd}=\frac{531}{8\times2.2}=30.2$ psi <40 psi O.K.
Step 16 Check shear stress in concrete.	$V''=V'=531$ # $v=\frac{V''}{12\times jd}=\frac{531}{12\times2.2}=20.1$ psi <90 psi O.K.
Since simple span assumptions produce adequate results negative steel is not required unless other considerations require it.	
Step 17 Check maximum deflection under superimposed load. See Table 6 for composite moment of Inertia "I_c."	$\Delta=\frac{5}{384}\left(\frac{wL^4}{E_s\,I_c}\right)=$ $\frac{5}{384}\left(\frac{145\times7.33^4\times12^3}{30\times10^6\times2.08}\right)=0.15$ inches $<L/360=0.24$

*For shored spans use w=total load. For unshored spans use w=total load less weight of slab.

***Effective depth for slab with negative reinforcing "d."

ALLOWABLE LOAD TABLES (FOR 20,000 PSI DESIGN STRESS)

Total Superimposed Load Lbs. Per Sq. Ft.

Sand and Gravel Concrete—3000 psi strength
Lightweight concrete—see footnote.

Table 1 – Without Negative Reinforcement

Span (Ft.)	Over-all Slab Depth (In.)	Gauge			
		16	18	20	22
5	2½	314	314	314	223
	3	398	398	398	281
6	2½	262	262	262	186
	3	332	332	332	234
	3½	403	403	403	282
7	3	284	284	284	200
	3½	345	345	345	242
	4	407	407	372	284
	4½	468	468	398	271
8	3	238	228	197	138
	3½	302	302	222	169
	4	356	356	235	199
	4½	410	410	355	230
	5	464	464	403	261
9	3½	259	226	189	145
	4	316	316	252	172
	4½	353	309	309	199
	5	363	352	352	226
	5½	394	394	394	253
10	4	226	213	195	150
	4½	273	273	249	175
	5	310	310	309	197
	5½	348	348	348	221
	6	386	386	386	245
	6½	424	424	424	268
11	4	178	167	152	132
	4½	231	216	196	152
	5	271	271	245	173
	5½	310	310	279	194
	6	344	344	309	216
	6½	379	379	340	237
	7	413	413	370	258
12	4½	186	173	156	135
	5	234	217	196	154
	5½	273	265	224	173
	6	310	310	248	192
	6½	334	330	273	210
	7	371	371	297	230
13	5	190	176	158	127
	5½	234	217	181	147
	6	274	260	201	158
	6½	306	306	221	173
	7	336	336	241	190
14	5½	192	178	147	113
	6	232	214	163	126
	6½	275	253	179	139
	7	300	284	196	152
15	5½	159	146	119	90
	6	193	177	133	100
	6½	229	210	146	111
	7	268	236	160	121
16	6	161	147	108	79
	6½	192	175	119	88
	7	225	197	120	96
17	6½	161	146	96	69
	7	190	165	106	76
18	7	160	138	85	

Table 2 – With Negative Reinforcement

Span (Ft.)	Over-all Slab Depth (In.)	16 Gauge		18 Gauge		20 Gauge		22 Gauge	
		2-Span	3-Span	2-Span	3-Span	2-Span	3-Span	2-Span	3-Span
5	2½	314	314	314	314	314	314	261	261
	3	398	398	398	398	398	398	374	351
6	2½	262	262	262	262	262	262	186	186
	3	332	332	332	332	332	332	312	292
	3½	488	488	488	488	488	488	377	353
7	3	284	284	284	284	284	284	232	232
	3½	358	358	358	358	358	358	323	260
	4	498	498	498	498	498	498	329	306
	4½	624	585	624	585	624	585	379	302
8	3	238	238	228	228	197	197	143	143
	3½	302	302	302	302	222	222	231	222
	4	392	392	392	392	353	353	282	262
	4½	531	512	531	512	476	457	325	301
	5	619	580	619	580	558	519	369	342
9	3½	259	259	226	226	189	189	145	145
	4	316	316	267	267	267	267	245	227
	4½	419	419	364	364	364	364	283	262
	5	484	455	484	455	484	455	321	297
	5½	548	507	548	507	548	507	359	333
10	4	226	226	213	213	202	202	202	202
	4½	285	285	285	285	285	285	249	240
	5	381	381	381	381	381	381	283	261
	5½	487	452	487	452	487	452	317	293
	6	539	501	539	501	539	501	350	324
	6½	592	550	592	550	592	550	384	355
11	4	178	178	167	167	152	152	132	132
	4½	231	231	216	216	196	196	152	179
	5	271	271	271	271	245	245	213	232
	5½	310	310	310	310	279	279	278	260
	6	352	399	352	399	352	399	312	288
	6½	434	491	434	491	434	491	342	316
	7	525	537	525	537	525	537	373	344
12	4½	186	186	173	173	156	156	122	141
	5	234	234	217	217	196	196	165	194
	5½	273	273	265	265	224	255	223	232
	6	303	324	303	324	284	324	280	258
	6½	352	400	352	400	352	400	307	283
	7	427	484	427	484	427	484	334	308
13	5	190	190	176	176	158	158	135	157
	5½	234	234	217	217	181	207	180	207
	6	274	274	260	260	231	265	231	232
	6½	306	329	306	329	288	329	277	255
	7	351	400	351	400	351	364	293	278
14	5½	192	192	178	178	146	170	146	170
	6	232	232	214	214	189	218	189	201
	6½	275	275	253	273	238	246	221	221
	7	300	333	291	333	291	302	239	239
15	5½	159	159	146	146	119	139	119	139
	6	193	193	177	181	156	181	156	165
	6½	229	229	210	228	197	228	182	182
	7	268	279	243	279	243	252	199	199
16	6	161	161	147	150	128	150	128	137
	6½	192	192	175	190	163	190	151	151
	7	225	235	203	235	203	211	164	164
17	6½	161	161	146	160	136	160	124	124
	7	190	198	170	198	170	177	136	136
18	7	160	168	143	168	143	149		

No Shoring
1 Line of Shoring
2 Lines of Shoring
3 Lines of Shoring

Based on Continuous Span (1 Line of Shoring, 2 Lines of Shoring)

For Simp e Span—Tables 3 and 4, page 8 (2 Lines of Shoring, 3 Lines of Shoring)

†Negative reinforcement is used primarily to control cracking over supports. It will increase load carrying capacity in thick slabs only.

Lightweight Concrete (3000 psi):
Unshored—Capacity same as sand and gravel concrete (Tables 2 and 3)
Shored—Add weight difference to value in Tables 2 and 3.

The above loads may be used with the floor units on simple or continuous spans. Composite slab design to be based upon simple span analysis. Shoring requirements are based on 200 lb. concentrated construction load at midspan plus the

MAXIMUM SPANS WITHOUT SHORING

TABLE 3 Sand and gravel concrete (145 pcf)

Span	Gage	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
Simple	16	9'-0"	8'-6"	8'-3"	7'-9"	7'-6"	7'-3"	7'-3"	6'-9"	6'-9"	6'-6"
	18	8'-6"	8'-0"	7'-6"	7'-3"	7'-0"	6'-9"	6'-6"	6'-6"	6'-3"	6'-0"
	20	7'-9"	7'-3"	7'-0"	6'-9"	6'-6"	6'-3"	6'-0"	5'-9"	5'-9"	5'-6"
	22	7'-3"	6'-9"	6'-6"	6'-3"	6'-0"	5'-9"	5'-9"	5'-6"	5'-6"	5'-3"
Double and Contin.	16	11'-0"	10'-6"	10'-0"	9'-6"	9'-3"	9'-0"	8'-9"	8'-6"	8'-3"	8'-0"
	18	10'-0"	9'-6"	9'-0"	8' 9"	8' 6"	8' 3"	8' 0"	7' 9"	7' 6"	7'-3"
	20	9'-0"	8'-6"	8'-0"	7'-9"	7'-6"	7'-3"	7'-0"	6'-9"	6'-9"	6'-6"
	22	8'-0"	7'-6"	7'-3"	7'-0"	6'-9"	6'-6"	6'-3"	6'-0"	6'-0"	5'-9"

MAXIMUM SPANS WITHOUT SHORING

TABLE 4 Lightweight Concrete (110 pcf)

Span	Gage	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
Simple	16	10'-0"	9'-3"	9'-0"	8'-6"	8'-3"	8'-0"	8'-0"	7'-9"	7'-6"	7'-3"
	18	9'-3"	8'-9"	8'-6"	8'-0"	8'-0"	7'-9"	7'-6"	7'-3"	7'-0"	6'-9"
	20	8'-6"	8'-0"	7'-9"	7'-6"	7'-3"	7'-0"	6'-9"	6'-6"	6'-3"	6'-0"
	22	8'-0"	7'-6"	7'-3"	7'-0"	6'-9"	6'-6"	6'-3"	6'-3"	6'-0"	5'-9"
Double and Contin.	16	11'-0"	11'-0"	10'-9"	10'-6"	10'-3"	10'-0"	9'-6"	9'-3"	9'-0"	8'-9"
	18	10'-6"	10'-3"	10'-0"	9'-9"	9'-3"	9'-0"	8'-9"	8'-6"	8'-3"	8'-0"
	20	9'-9"	9'-3"	9'-0"	8'-6"	8'-3"	8'-0"	7'-9"	7'-6"	7'-3"	7'-3"
	22	8'-0"	7'-9"	7'-6"	7'-3"	7'-0"	6'-9"	6'-6"	6'-6"	6' 3"	6' 3"

No shoring is required up to the spans listed.

Shoring tables are based on 200# concentrated construction load plus the weight of wet concrete. Deflection under weight of concrete does not exceed L/240 of the span. To speed concrete placement, runways for concrete buggies are recommended.

TABLE 5 Section Properties—Keystone Deck.

Gage	A_s	$\bar{y}$	Weight	I_s	S
	In.²	(To Bottom) In.	Lbs.	In.⁴	In.³
16	1.18	0.51	4.17	0.372	0.333
18	0.95	0.49	3.19	0.300	0.270
20	0.71	0.46	2.47	0.226	0.206
22	0.59	0.43	2.06	0.189	0.171

Properties computed in accordance with A.I.S.I. specifications for the design of light gauge cold-formed steel structural members. 1962 Edition.

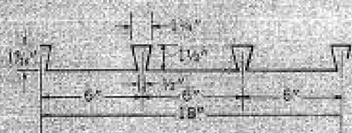


TABLE 7 Moment and Shears for uniform loads.

		Units	Simple Span	Double Span	Continuous Span
*Max. Pos. Moment		+M	$\frac{WL^2}{8}$ ft-lbs	$\frac{WL^2}{11}$ ft-lbs	$\frac{WL^2}{11}$ ft-lbs
*Max. Negative Moment	Spans to 10 ft	−M	0	$\frac{WL^2}{12}$ ft-lbs	$\frac{WL^2}{12}$ ft-lbs
	Spans over 10 ft	−M	0	$\frac{WL^2}{9}$ ft-lbs	$\frac{WL^2}{10}$ ft-lbs
End Shear		V'	$\frac{WL}{2}$ lbs	$\frac{3\ WL}{8}$ lbs	$\frac{2\ WL}{5}$ lbs
*Max. Shear		V"	$\frac{WL}{2}$ lbs	$\frac{1.15\ WL}{2}$ lbs	$\frac{1.15\ WL}{2}$ lbs

*ACI Building Code—June 1963

TABLE 6 Section Properties of Concrete Slab.

Slab t	Gage	d In.	kd In.	jd In.	I_c * In.⁴	Weight of Slab: Sand and Gravel Concrete (145 pcf)	Weight of Slab: Light-weight (110 pcf)
2½	16	2.05	1.21	1.64	2.00	31 psf	23 psf
	18	2.05	1.14	1.67	1.77		
	20	2.06	1.04	1.71	1.48		
	22	2.08	.98	1.75	1.33		
3	16	2.55	1.41	2.07	3.16	37 psf	28 psf
	18	2.55	1.32	2.11	2.78		
	20	2.56	1.20	2.15	2.32		
	22	2.58	1.13	2.20	2.08		
3½	16	3.05	1.60	2.51	4.68	43 psf	32 psf
	18	3.05	1.49	2.56	4.11		
	20	3.06	1.35	2.61	3.41		
	22	3.08	1.27	2.65	3.04		
4	16	3.55	1.77	2.95	6.58	49 psf	37 psf
	18	3.55	1.65	3.00	5.76		
	20	3.56	1.48	3.06	4.74		
	22	3.58	1.39	3.11	4.22		
4½	16	4.05	1.93	3.40	8.87	55 psf	41 psf
	18	4.05	1.79	3.45	7.74		
	20	4.06	1.61	3.52	6.34		
	22	4.08	1.51	3.57	5.62		
5	16	4.55	2.09	3.85	11.56	61 psf	46 psf
	18	4.55	1.93	3.91	10.05		
	20	4.56	1.73	3.98	8.21		
	22	4.58	1.62	4.04	7.25		
5½	16	5.05	2.23	4.30	14.67	67 psf	50 psf
	18	5.05	2.06	4.37	12.72		
	20	5.06	1.85	4.44	10.35		
	22	5.08	1.72	4.50	9.11		
6	16	5.55	2.37	4.73	18.21	73 psf	55 psf
	18	5.55	2.19	4.82	15.74		
	20	5.56	1.96	4.90	12.77		
	22	5.58	1.82	4.97	11.20		
6½	16	6.05	2.50	5.21	22.17	79 psf	60 psf
	18	6.05	2.31	5.28	19.11		
	20	6.06	2.06	5.37	15.46		
	22	6.08	1.92	5.44	13.54		
7	16	6.55	2.63	5.67	26.57	85 psf	64 psf
	18	6.55	2.43	5.74	22.85		
	20	6.56	2.16	5.83	18.44		
	22	6.58	2.01	5.91	16.11		

$$jd = d - \frac{kd}{3}$$

$$\frac{(kd)^2}{2} \times b = n \cdot A_s \cdot (d - kd)$$

$$I_c = \frac{4\ (kd)^3}{n} + A_s\,(d - kd)^2 + I_s$$

$$d = t - \bar{y}$$

$n = 9$
$f_c = 3000$ psi

*For deflection calculation of sand and gravel concrete slab.

TABLE 8 Moment Resistance of Slab with negative reinforcing. (ft. lbs.)

Slab Depth in Inches										Bar Size and Spacing
2½	3	3½	4	4½	5	5½	6	6½	7	
									7530	No. 6 @ 6″
								6408	6992	No. 4 @ 3″
							5352	5892	6434	No. 5 @ 5″
						4386	4866	5346	5826	No. 3 @ 2″
						4008	4460	4910	5362	No. 5 @ 6″
					3495	3933	4371	4806	5244	No. 4 @ 4″
					3312	3738	4165	4593	5020	No. 6 @ 9″
					3048	3435	3823	4209	4596	No. 5 @ 7″
				2448	2796	3146	3497	3845	4195	No. 4 @ 5″
				2328	2667	3006	3345	3682	4021	No. 5 @ 8″
			1964	2284	2604	2924	3244	3564	3884	No. 3 @ 3″
			1768	2069	2370	2672	2973	3273	3575	No. 5 @ 9″
			1748	2040	2330	2622	2914	3204	3496	No. 4 @ 6″
		1321	1591	1862	2134	2405	2676	2946	3217	No. 5 @ 10″
		1248	1498	1748	1997	2247	2498	2746	2996	No. 4 @ 7″
		1230	1473	1713	1953	2193	2433	2673	2913	No. 3 @ 4″
			1326	1552	1778	2004	2230	2455	2681	No. 5 @ 12″
	874	1092	1311	1530	1747	1966	2185	2403	2662	No. 4 @ 8″
	801	1015	1229	1442	1656	1869	2083	2298	2510	No. 6 @ 18″
	792	984	1178	1370	1562	1754	1946	2138	2330	No. 3 @ 5″
		881	1061	1242	1422	1603	1784	1964	2145	No. 5 @ 15″
	700	837	1049	1224	1398	1573	1748	1922	2098	No. 4 @ 10″
			994	1164	1333	1503	1672	1841	2011	No. 5 @ 16″
500	660	820	982	1142	1302	1462	1622	1782	1942	No. 3 @ 6″
			884	1035	1185	1336	1488	1637	1787	No. 5 @ 18″
437	583	728	874	1020	1165	1311	1457	1602	1748	No. 4 @ 12″
		703	842	979	1116	1253	1390	1527	1664	No. 3 @ 7″
403	538	672	807	941	1075	1210	1345	1479	1613	No. 4 @ 13″
374	500	624	749	874	998	1123	1249	1373	1498	No. 4 @ 14″
350	466	582	699	816	932	1049	1166	1282	1398	No. 4 @ 15″
328	437	546	655	765	874	983	1093	1201	1311	No. 4 @ 16″
308	411	514	617	720	822	925	1029	1131	1234	No. 4 @ 17″
300	396	492	589	852	781	877	973	1069	1165	No. 3 @ 10″
273	360	447	536	663	710	797	885	972	1059	No. 3 @ 11″

- Capacities are based on 3000 psi concrete and ¾″ of concrete cover over bars.
- Most efficient combination of bar size and spacing is shown.
- Bar lengths should extend ¼ of the span each way from the center of the support. (Based on A.C.I. code, section 918e.)

TABLE 9 Minimum Requirements for Shrinkage Mesh (Sand and Gravel Concrete)

Depth of Slab	Suggested 6 x 6 Welded Wire Fabric
2½″	10/10
3″	9/9
3½″	9/9
4″	8/8
4½″	7/7
5″	6/6
5½″	6/6
6″	5/5
6½″	5/5
7″	4/4

SPECIFICATIONS

Keystone Composite Slab

1. GENERAL—All areas noted on the plans or specifications shall be covered with composite slabs, using Keystone deck as manufactured by H. H. Robertson Company. The Keystone deck shall serve as form, total positive reinforcement and temperature reinforcement for the lower half of the slab. Full scale tests by independent laboratory substantiating composite ability shall be submitted prior to approval.
2. MATERIAL—Keystone composite deck shall be formed of (select gauge) 16, 18, 20 or 22 USS Gauge Steel sheets conforming to ASTM-A-245-64. The steel shall have received before being formed, a metal protective coating of zinc conforming to ASTM-A-525-65T (wiped coating) and to Federal Specification QQ-S-775c, Type 1, class e.
3. CONSTRUCTION—To provide a positive key bond with the concrete the Keystone deck shall have integral pyramidal shaped ribs, all continuous and complete in cross-section, and spaced not more than 6″ on center. Ribs shall be formed to a depth of not less than 1½″ with an opening of not more than ½″ at the base and a width of not less than 1¾″ at the apex. Side laps shall be positive registering full depth side lap ribs placed in a manner to prevent the flow of concrete through the joints. The area of steel provided as positive reinforcement shall not be less than 0.59 sq. in./ft. The bottom of the sheets shall form a substantially flat and continuous surface.
4. DESIGN—Keystone composite slab construction shall be capable of supporting the specified uniform loads in accordance with the allowable live load table and design factors shown in the manufacturer's catalog for this product.
5. ERECTION—Keystone composite deck units shall be laid in strict accordance with the manufacturer's instructions and as shown on a layout prepared for the erector's use. At the end laps of the units attach the unit to the supporting members with puddle welds, one adjacent to each of the outside ribs. At intermediate supports, attach the unit to the supporting member with one puddle weld adjacent to the center rib.

   Deck units shall span 3 or more supports wherever practical. Concrete dams shall be provided and installed at ends of deck units by manufacturer where area of rib between top of beam exceeds 1½ square inches.

   Side joints shall be joined by welding with ½″ fillet welds at supports and at midspan for spans 4′ 0″ to 6′ 0″. For spans over 6′ 0″ weld joints at supports and at third points of the span.
6. WORK TO BE INCLUDED IN OTHER CONTRACT—Concrete for Keystone composite slab construction shall conform to the following specifications.

   a. Base Preparation—Prior to concreting, the surface of the sheets shall be cleaned of all debris, grease, oil and other deleterious substances to the satisfaction of the contractor and/or architect's representative.

   b. Materials and Mixture—(Architect shall provide specifications for cement, fine and coarse aggregates, water-cement ratio and mixing for concrete providing an ultimate compressive strength of 3,000 psi or other strength required). It is recommended that the specified mixture shall have a slump of from 4 to 5 inches, insuring sufficient moisture in the concrete to allow optimum bonding of the concrete to the deck surface and minimize shrinkage.

   Concrete with admixtures containing chloride salts is not to be used with Keystone Composite Deck.

   c. Reinforcement—Shrinkage and thermal stress reinforcement in the form of welded wire mesh and type suitable for the depth of the slab as called for in the manufacturer's catalog, shall be placed above the mid depth of the slab and at least 1″ below the top surface. This mesh is placed in the top part of the slab in order to provide optimum control of shrinkage at the exposed surface.

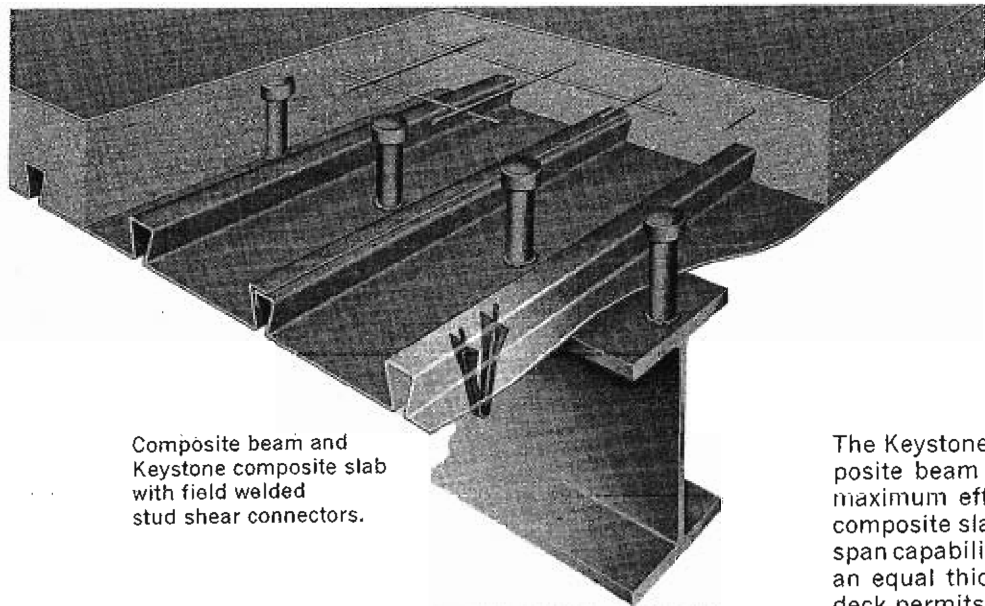
   d. Placement of Concrete—Concrete shall be mixed and placed in accordance with the American Concrete Institute's "Building Code Requirements for Reinforced Concrete" (ACI 318-63) Chapter 6.

   e. Curing—After placement, the concrete shall be allowed to cure, without being loaded, until it reaches 70% of the specified ultimate compressive strength. Curing shall be done in accordance with good concrete curing practice.

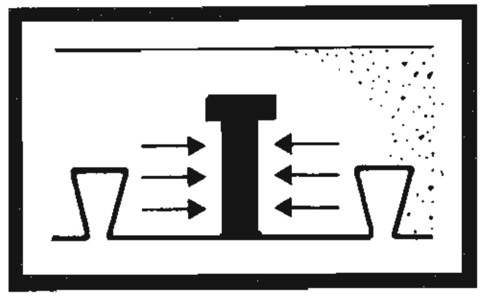
   f. Construction Joints—Construction joints shall be placed at midspan in accordance with the provisions of Section 704 of the above ACI Code.

   g. Shoring—When required, in conformance with the allowable shoring tables on page 4, the Keystone composite slab shall be temporarily shored. The design of the shoring shall be in accordance with local building code provisions. The shoring shall be left in place until the concrete attains 70% design compressive strength.

COMPOSITE BEAM DESIGN



Composite beam and Keystone composite slab with field welded stud shear connectors.



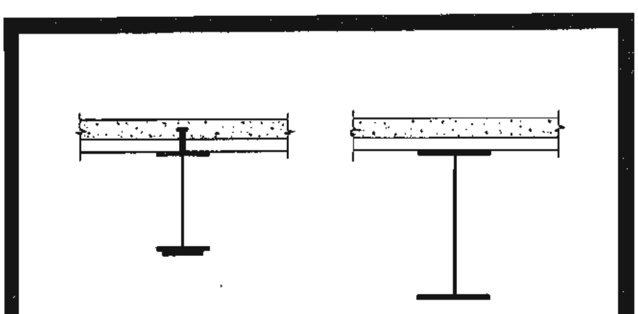
Use standard A.I.S.C. procedure for composite beam design.

The unrestricted use of composite design in building construction is a relatively recent occurrence. Architects and engineers considering the use of composite design find that they must also investigate the compatibility of related materials with the composite system. A critical look at all available concrete forming methods is imperative.

Composite beam design is accomplished by welding structural shear connectors to the top flange of a floor beam through single thickness of Keystone metallic coated deck so that the shear resistance of the connectors will cause the floor slab and the beam to act as a unit.

A composite beam will deflect only ⅓ to ⅙ as much as a non-composite beam under identical conditions. In practice this means lighter, shallower beams, reduced building height, and savings in all related material and labor.

The economy of composite design is best realized when each component is designed for maximum effectiveness. Girders and beams should be spaced as far apart as practicable. The maximum value of shear connectors is obtained when the concrete form system allows the slab to be in contact with the top flange of the beam around the roots of the shear connectors. The forms should also be capable of providing lateral support for the compression flange of the beams during construction.



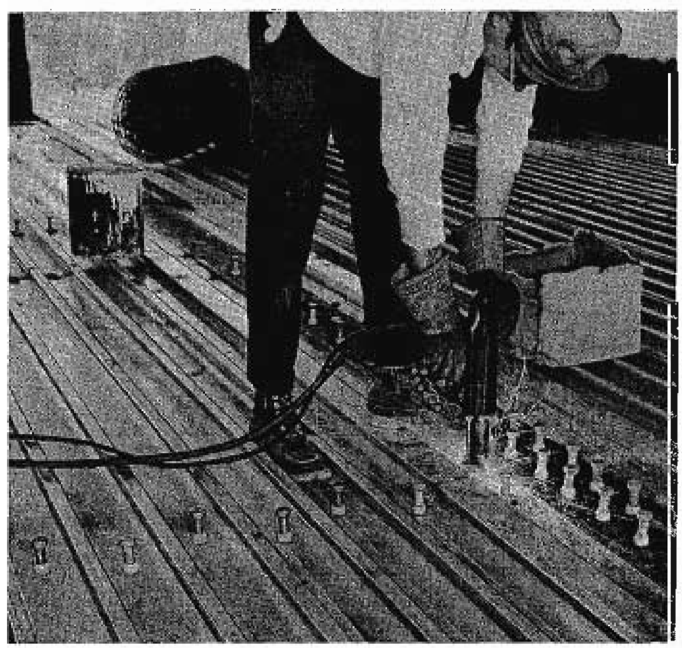
Composite
12WF27
5″ x 1″ plate
I=1030 in⁴

Conventional
18 WF 64
I=1046 in⁴

The Keystone system combines composite slab with composite beam construction to fulfill the requirements for maximum efficiency in composite design. The Keystone composite slab has, in independent tests, proven its long-span capabilities to be greater than any other system using an equal thickness of concrete. The design of Keystone deck permits the slab to be in full contact with the shear connectors. The ample slab space between the ribs assures the total effectiveness of the composite action between the beam and the slab. Standard A.I.S.C. Composite Design Procedure may be used. Refer to the section on "Composite Design for Building Construction" in your A.I.S.C. Manual.

Besides efficient structural design, economical construction demands efficient handling and installation of materials. The multiple span metallic coated Keystone sheets (up to 40′-0″ long) mean fast erection of a rigid, convenient working surface. Shear connectors, temperature mesh, and negative steel (when required) are installed last, so that they will not impede the work of other trades.

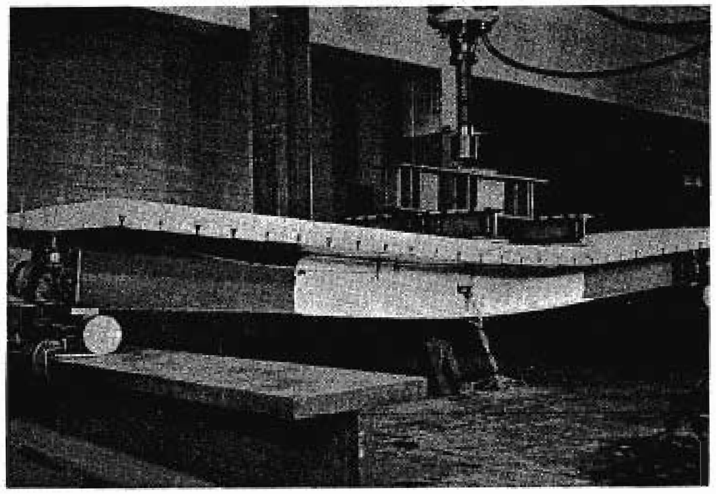
Complete information and details are available through your Robertson Representative. Robertson engineers are at your service.



A composite design floor using Keystone deck—section 69—and Stud Shear Connectors.

COMPOSITE BEAM TESTS

Purpose To check the performance of Keystone Composite Slabs used in conjunction with Composite Beam Design.



Test A Keystone Composite Slab—Composite Beam Design.
12 WF 27 on a 15'0" span, Keystone deck, ¾" diameter headed studs, 6 x 6—10/10 mesh, and 4" sand-gravel concrete slab.

Test B Identical to Test A except expanded shale concrete replaced the sand-gravel concrete.

	Test A	Test B
Actual Test Failure Moment (kip-in)	2927	2920
Calculated Ultimate Failure Moment (kip-in)	2750	2685

Conclusions Based on the above and test load-deflection curves the concrete slab can be considered as though it were solid concrete in computing elastic section properties for calculation of stresses and deflections. The Keystone composite deck section provides adequate concrete cover around headed studs to develop the full shear capacity of the studs. The composite beam design procedure published by A.I.S.C. may be used.

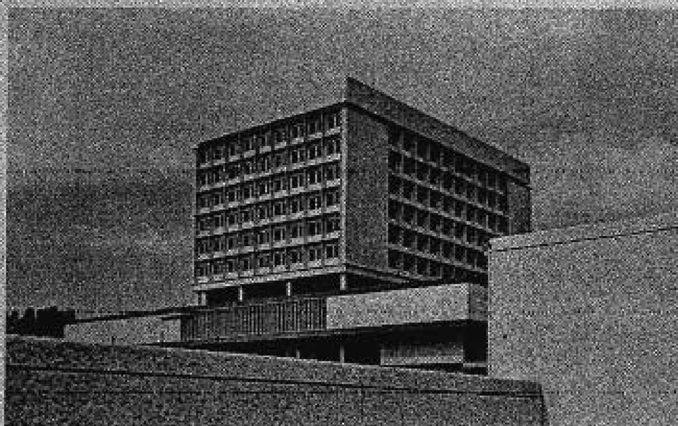
Tests conducted at Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa.

Keystone deck—section 69—used with composite beam design.

Headed Stud Shear Connectors	Allowable Horizontal Shear Load (kips) (Applicable only to concrete made with A.S.T.M. C33 aggregates)		
	f'c=3,000	f'c=3,500	f'c=4,000
½" dia. x 2"	5.1	5.5	5.9
⅝" dia. x 2½"	8.0	8.6	9.2
¾" dia. x 3"	11.5	12.5	13.3
⅞" dia. x 3½"	15.6	16.8	18.0

f'c=Specified compression strength of concrete at 28 days.

Typical Keystone Composite Floor Installations



HOSPITAL—NEBRASKA METHODIST HOSPITAL, OMAHA, NEB.
Henningson, Durham and Richardson, Designers
Mead and Mount Construction Co., Contractor
KEYSTONE COMPOSITE FLOOR

SCHOOL—SHARON SCHOOL BOARD AUTHORITY, SHARON, PA.
Hunter-Heiges & Associates, Architects and Structural Engineers
Mellon Stuart, Contractor
KEYSTONE COMPOSITE FLOOR

SHOPPING CENTER—PALM BEACH MALL, WEST PALM BEACH, FLA.
Edward J. DeBartolo Corp., Designer and Contractor
KEYSTONE COMPOSITE FLOOR

The information contained herein is not intended to be used for design purposes, and the H. H. Robertson Company reserves the right to change or withdraw such information, or the designs and details of the products upon which it is based, either wholly or in any portion thereof, without further notice. Specific information required for design and detailing of specific jobs is available upon request and should be obtained from your Robertson sales representative.

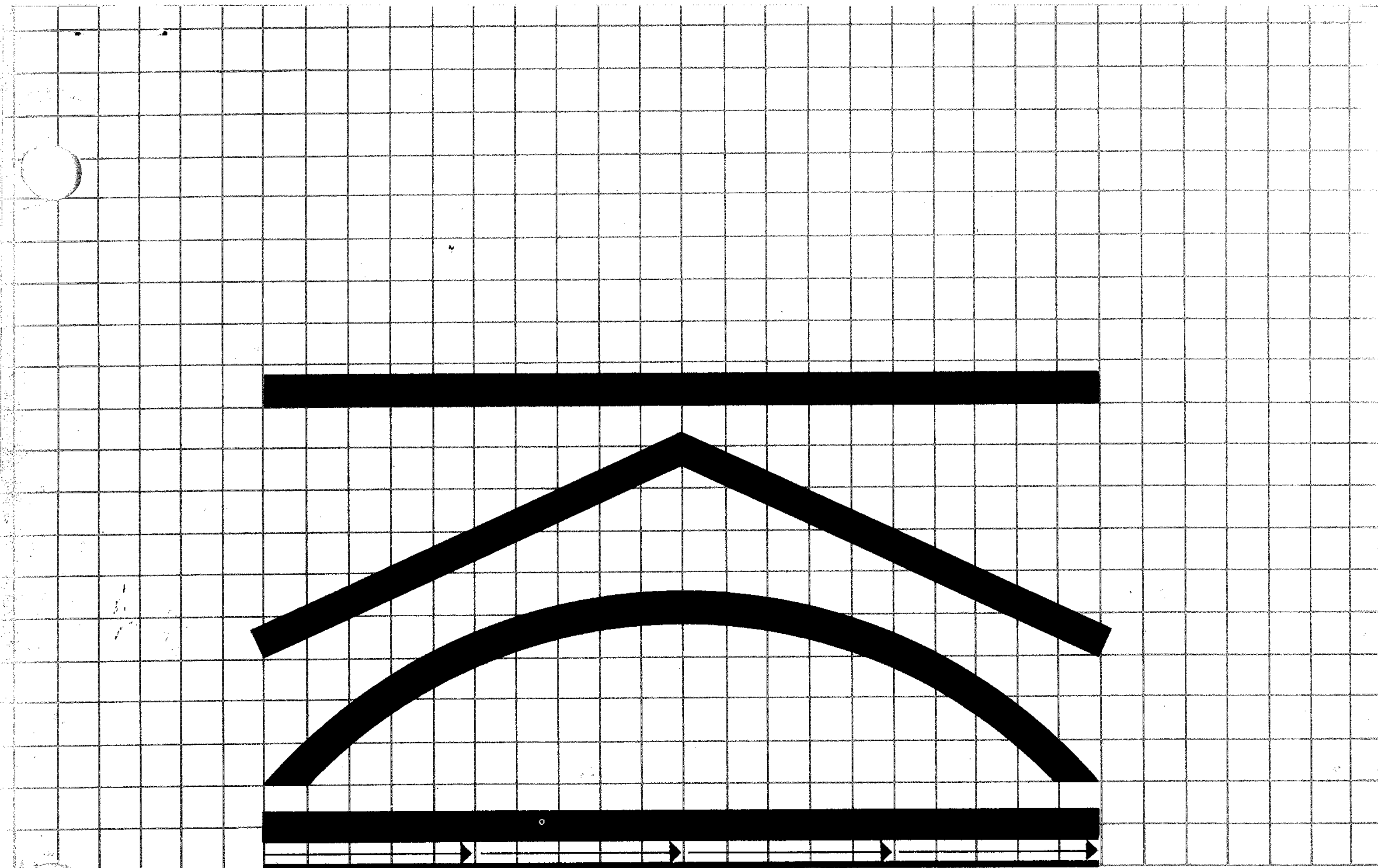
H. H. ROBERTSON COMPANY

PITTSBURGH, PA.

PLANTS IN AMBRIDGE & ZELIENOPLE, PA., CONNERSVILLE, IND., ST. LOUIS, MO., LOS ANGELES & STOCKTON, CAL.

SUBSIDIARIES, PLANTS OR SALES OFFICES IN THESE COUNTRIES: AUSTRALIA, AUSTRIA, BELGIUM, CANADA, DENMARK, FINLAND, FRANCE, GERMANY, HOLLAND, IRELAND, ITALY, NORWAY, SOUTH AFRICA, SWITZERLAND, SPAIN, SWEDEN, UNITED KINGDOM.

AGENTS IN ADEN, ARGENTINA, BAHAMAS, BAHRAIN, BARBADOS, BRAZIL, CEYLON, CHILE, COLOMBIA, FIJI ISLANDS, GREECE, GRENADA, GUAM, GUYANA, HONG KONG, ICELAND, INDIA, IRAN, IRAQ, JAMAICA, KUWAIT, LEBANON, LIBYA, MADAGASCAR, MALAYSIA (WESTERN), MAURITIUS, NEW ZEALAND, OKINAWA, PAKISTAN, PHILIPPINES, PORTUGAL, SAUDI ARABIA, SINGAPORE, SUDAN, THAILAND, TRINIDAD, TURKEY, VENEZUELA, VIETNAM.



Roof systems: Technical data guide

C. THOMAS FICARRA
H. H. ROBERTSON CO.
5133 N. CENTRAL AVE.
PHOENIX, ARIZ. (602) 277-9316

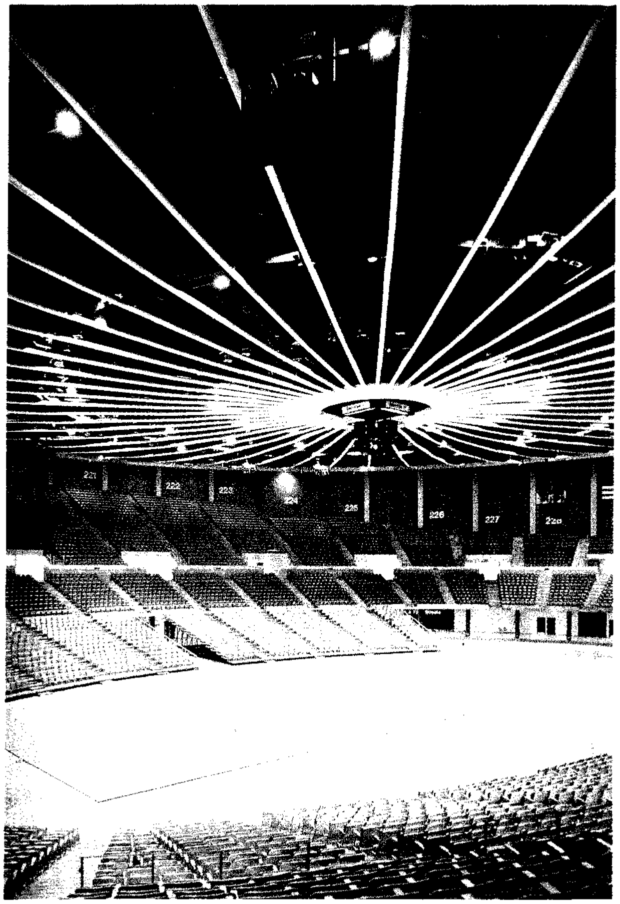
Robertson

Robertson Roofs

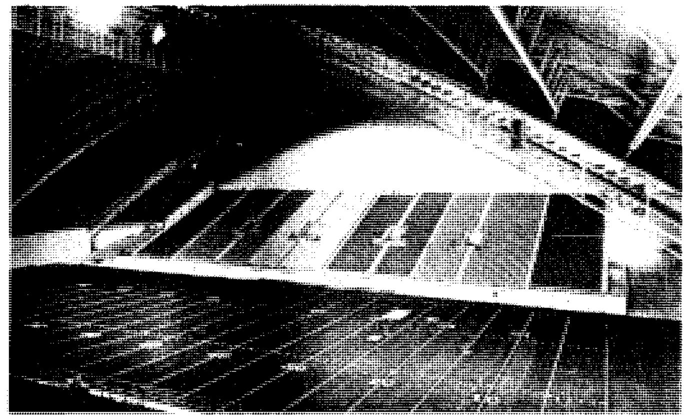
TABLE OF CONTENTS

Robertson Roofs

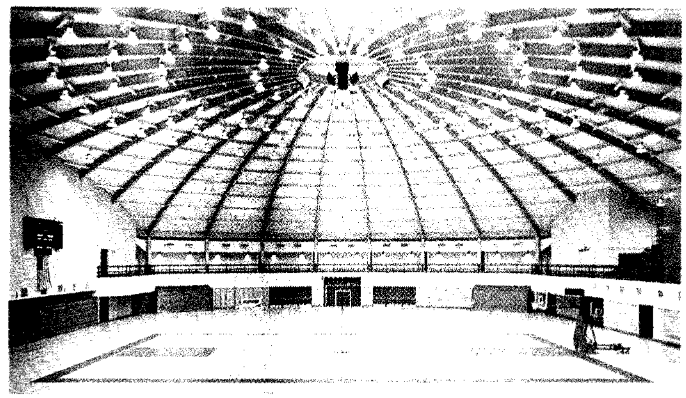
CONVENTION/COLISEUM FACILITIES



1

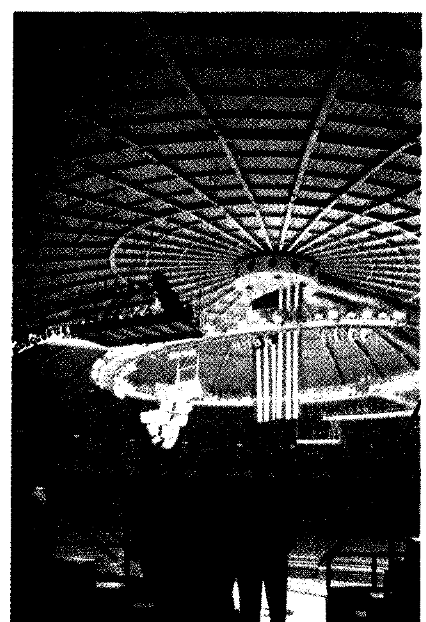


2



3

4

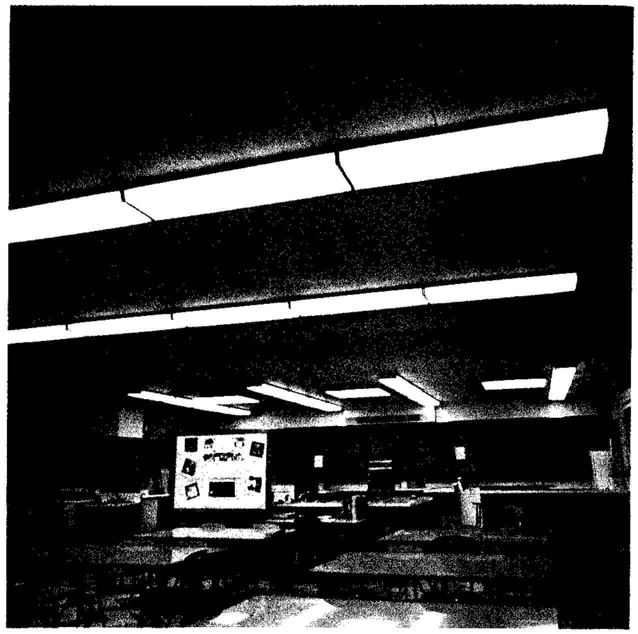


5

Robertson Roofs

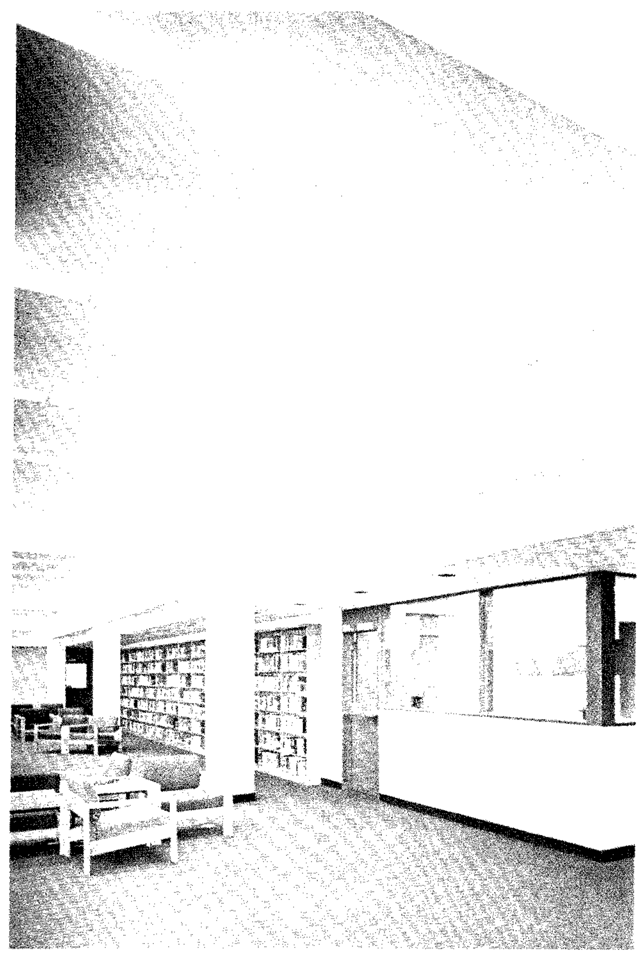
EDUCATIONAL INSTITUTIONS

6



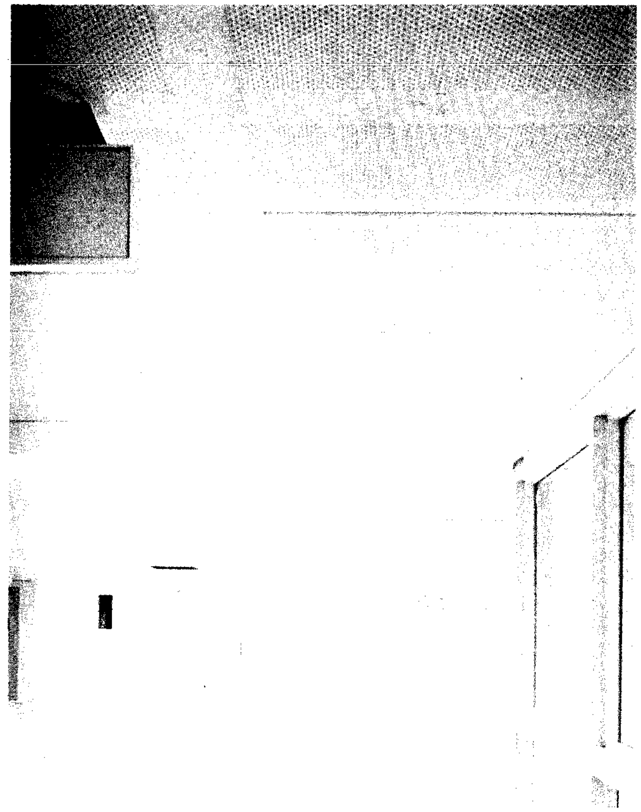
7

8

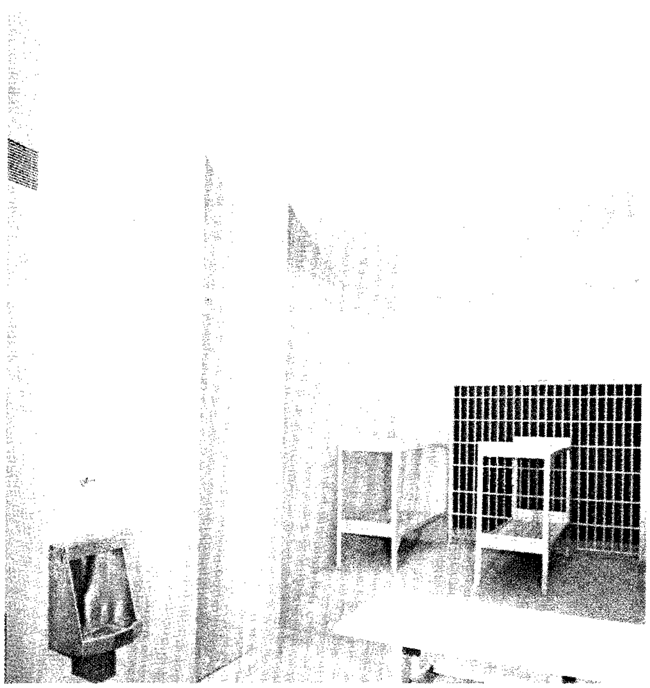


9

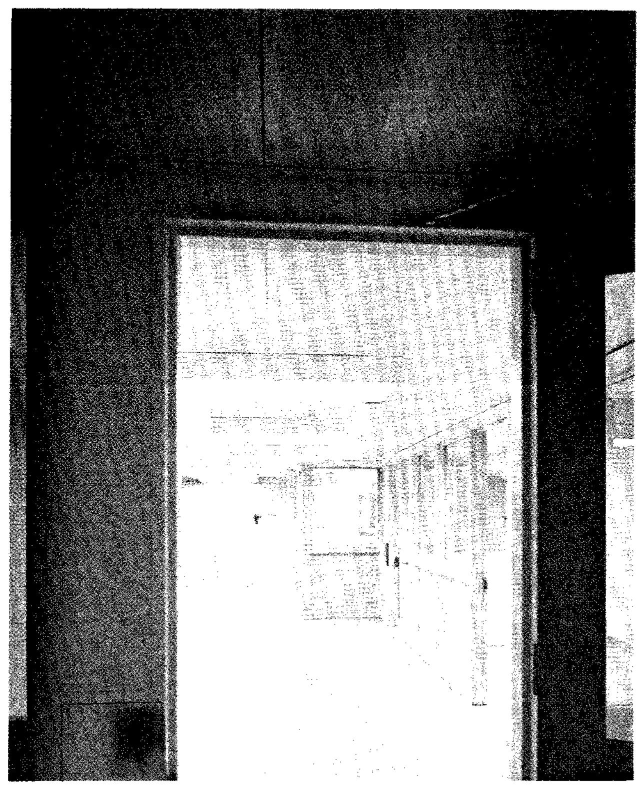
10



11

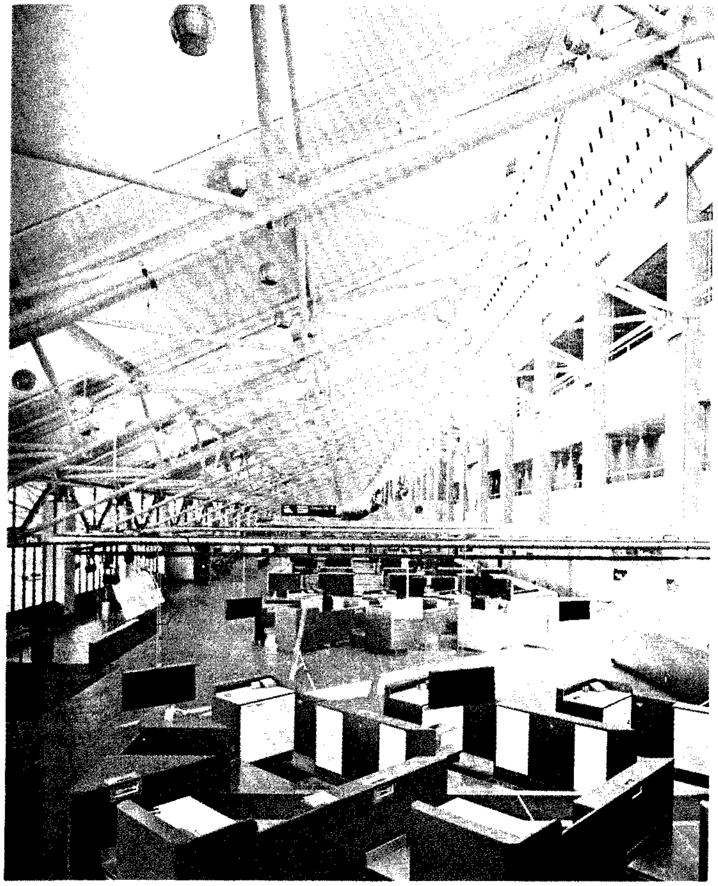


12

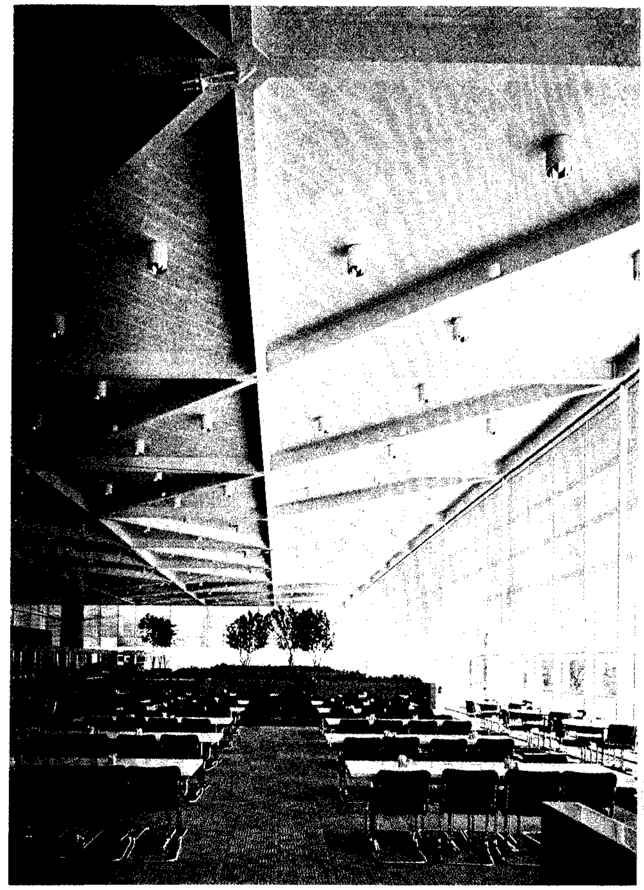


13

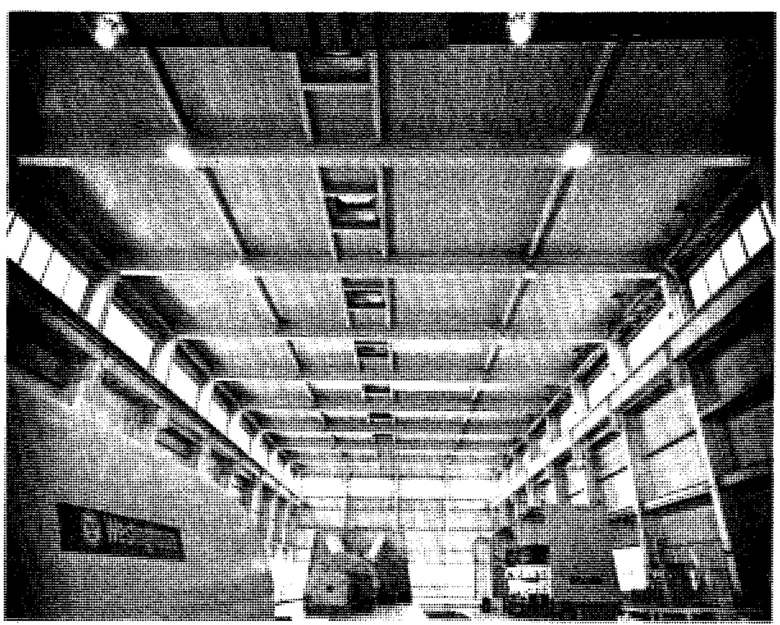
POWER PLANTS AND SPECIAL PURPOSE



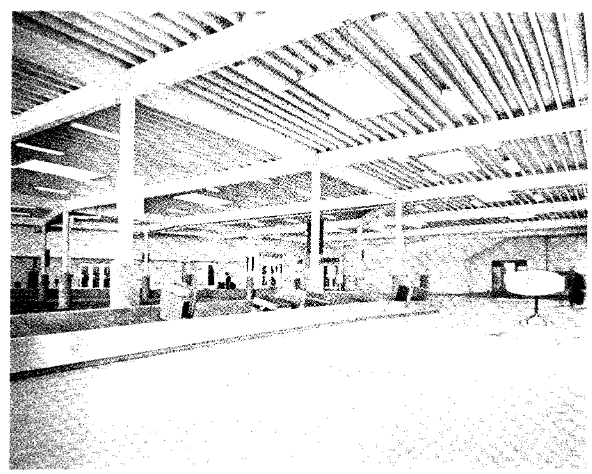
14



15



16



17

Robertson Roofs

ENGINEERING DATA - STRUCTURAL

SELECTING A ROBERTSON ROOF DECK SECTION

Designing a Robertson roof deck follows the procedure for any structural section. It is necessary to consider such items as the type of structure, type and degree of loading, span provisions, end bearing, and ceiling conditions, as well as humidity levels in the building.

The following data will enable the designer to select a steel roof deck. Most of the computation work normally required has been reduced to tabular form to simplify the selection of the appropriate deck unit.

1 — LOAD AND SPAN

A deck section must satisfy two basic requirements:
(a) Strength — indicated by Section Modulus "S".
(b) Deflection Resistance — indicated by Moment of Inertia "I".

The individual job and use of the deck will determine the dead and live load values. These are to be specified by the architect or designer and it is beneficial to have the values appear on the contract drawings. In addition, the architect will specify the type ceiling which will dictate the deflection criteria, normally 1/360 of the span for plastered ceilings and 1/240 of the span for unplastered ceilings. (Check local or state codes for accepted practice.)

2 — REACTION VALUES

End and intermediate reaction values are given in the Deck Section Property Table and are for 12" widths, the same as section property values. These values have been determined using web strength formulae promulgated by the American Iron and Steel Institute and are in full accordance with their accepted specification.

3 — LATERAL DIAPHRAGM DESIGN

Pertains to seismic, wind and bomb shock loadings. For further information see your local Robertson representative.

4 — LATERAL BRACING

Pertains to the stiffening of the compression flange of a beam. This should not be confused with Lateral Diaphragm Design.

5 — HUMIDITY

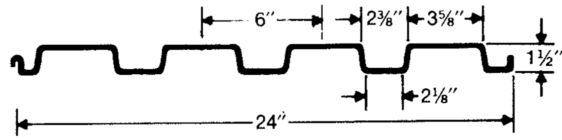
Higher-than-normal interior relative humidity can require special consideration for the design and application of the steel deck. Contact your local Robertson representative with specific conditions.

DESIGN CONSIDERATIONS FOR SECTION PROPERTY AND LOAD-SPAN TABLES

1. All section properties have been determined by use of American Iron and Steel Institute's Specifications for Design of Light Gage Cold-Formed Steel Structural Members.
2. All properties are based on a 12" width of deck, although the units may be wider.
3. Recommended end bearing is 3 inches for roofs.
4. Allowable loads (all spans loaded) shown in tables have been rounded down to the nearest whole number. This number includes a provision of 7 psf for built-up roofing materials, plus the actual weight of the specific deck unit. None of the loads shown will produce a stress greater than 20,000 psi, or exceed end or intermediate bearing values as shown in the section property tables, or a deflection due to live load greater than:
   a. Spans up to and including 20' center to center limited by a maximum deflection of L/240.
   b. Spans over 21' center to center limited by a maximum deflection of 1".
   c. Spans over 30' to be limited by the criteria of a maximum deflection of L/360.
5. End and intermediate reaction values vary with the length of bearing. For bearing lengths less than those shown in the catalog, consult AISC specifications or your local Robertson representative.
6. A moment coefficient of 1/10 has been used for 3 or more spans and 1/8 for two spans and simple spans.
7. A deflection coefficient of 2.65/384 has been used for 3 spans, and 2.08/384 for 2 spans and 5/384 for simple spans.
8. For cellular decks utilized in the inverted (flat-plate-up) position contact your Robertson representative.
9. Damage to the steel deck profile during the construction phase can significantly reduce its load carrying capacity. Deck erectors should exercise appropriate care to insure that any damaged deck is suitably strengthened or replaced. This is especially critical for decking placed on simple spans, since premature buckling caused by damaged deck can create a danger to workmen. For deck jobs where minor damage would be detrimental to underside appearance in the finished structure, suitably heavier deck gauges should be considered.
10. Roofs subject to water ponding and other similar phenomena (such as torrential rains) may need to be checked for load capacity. Because of the many factors involved, this responsibility rests with the structural designer.

Robertson Roofs

SECTION 3



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS + MOMENT in.³	SECTION MODULUS – MOMENT in.³	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER- * MEDIATE REACTION lbs./ft.
SECTION 3	3-22	1.8	1.530	0.18	0.20	0.22	589	1687
	3-20	2.2	1.536	0.23	0.27	0.27	950	2303
	3-18	2.9	1.548	0.34	0.40	0.38	1841	3719
	3-16	3.5	1.560	0.44	0.51	0.48	2972	5407
	3-14	4.4	1.575	0.56	0.63	0.59	4697	7863
	3-12	5.9	1.605	0.76	0.88	0.88	9231	13996

*End Bearing = 3″ Intermediate Bearing = 4″

LOAD-SPAN TABLES

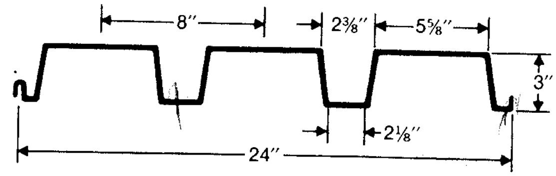
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET												
SECTION 3 MAX. LENGTH 40′-0″	22	1½″		5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0				
			SIMPLE	103	79	63										
			DOUBLE	116	96	81	69	59	51	45	40	36				
			TRIPLE	146	120	101	86	73	61	52	45	39				
	20	1½″		6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0				
			SIMPLE	78	64	53										
			DOUBLE	99	86	74	64	56	50	44	40	36				
			TRIPLE	126	107	92	76	64	55	48	42	37				
	18	1½″		6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0
			SIMPLE	112	90	74	62	53	45	40	35	31				
			DOUBLE	140	119	103	90	79	70	62	56	50	45	41	38	35
			TRIPLE	175	149	129	108	91	77	67	58	51	46	41	37	34
	16	1½″		6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	
			SIMPLE	115	94	79	67	57	50	44	39	35	32			
			DOUBLE	151	130	113	100	88	79	70	64	58	52	48	44	
			TRIPLE	189	163	140	117	99	85	74	65	57	51	46	42	

Note: For Factory Mutual Insured roofs, refer to FM 1-28 Bulletin for relevant design criteria.
Refer to page seven for additional design/erection considerations and limitations.

Robertson
Roofs

SECTION 21



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS + MOMENT in.³	SECTION MODULUS – MOMENT in.³	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER- * MEDIATE REACTION lbs./ft.
SECTION 21	21-22	2.1	3.030	0.67	0.39	0.47	403	1190
	21-20	2.6	3.036	0.85	0.50	0.58	663	1648
	21-18	3.5	3.048	1.26	0.76	0.79	1316	2706
	21-16	4.2	3.060	1.70	0.98	0.99	2154	3972
	21-14	5.2	3.075	2.26	1.26	1.23	3441	5820
	21-12	6.9	3.105	3.38	1.82	1.70	6841	10448

*End Bearing = 3″ Intermediate Bearing = 4″

LOAD-SPAN TABLES

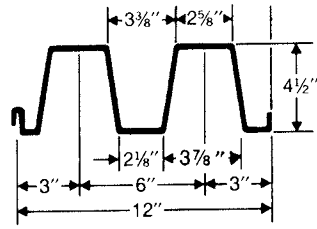
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET										
SECTION 21 MAX. LENGTH 40′-0″	22	3″		8.0	9.0	10.0	11.0	12.0						
			SIMPLE	81										
			DOUBLE	97	77	62	51							
			TRIPLE	122	96	78	64	54						
	20	3″		8.0	9.0	10.0	11.0	12.0	13.0					
			SIMPLE	104	82	65								
			DOUBLE	120	95	77	63	53	45					
			TRIPLE	151	119	96	79	67	57					
	18	3″		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0		
			SIMPLE	92	72	58	48	40	34					
			DOUBLE	105	87	73	62	53	46	41	36	32		
			TRIPLE	131	108	91	77							
	16	3″		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
			SIMPLE	122	95	75	62	51	44	38	33			
			DOUBLE	132	109	91	78	67	58	51	45	40	36	33
			TRIPLE	165	136	114	97							

Note: For Factory Mutual Insured roofs, refer to FM 1-28 Bulletin for relevant design criteria.
Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

SECTION 12



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS + MOMENT in.³	SECTION MODULUS – MOMENT in.³	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER- * MEDIATE REACTION lbs./ft.
SECTION 12	12-20	3.6	4.536	2.93	1.13	1.06	772	2281
	12-18	4.9	4.548	4.08	1.61	1.53	1577	3763
	12-16	5.9	4.560	5.19	2.11	2.04	2622	5518
	12-14	7.3	4.575	6.18	2.69	2.57	4239	8054
	12-12	10.0	4.605	8.59	3.43	3.60	8541	14338

*End Bearing = 3″ Intermediate Bearing = 5″

LOAD-SPAN TABLES

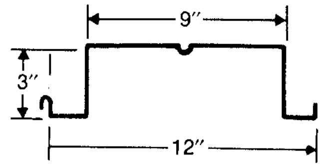
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET										
SECTION 12 MAX. LENGTH 40′-0″	20	4½″		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
			SIMPLE	150	124	104	88	76	66	57	49	43	38	34
			DOUBLE	140	117	98	83	72	62	55	48	43	39	35
			TRIPLE	176	145	122	104							
	18	4½″		12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0
			SIMPLE	149	127	109	91	77	66	57	50	45	39	34
			DOUBLE	142	121	104	90	79	70	63	56	51		
			TRIPLE	177	151									
	16	4½″		13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0
			SIMPLE	166	136	113	96	82	71	62	55	47	41	37
			DOUBLE	160	138	120	106	94	83	75	67			
			TRIPLE	200										

Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

SECTION 5-3.0



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS + MOMENT in.³	SECTION MODULUS – MOMENT in.³	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER- * MEDIATE REACTION lbs./ft.
SECTION 5-3.0	5-3.0-20	2.7	3.036	0.85	0.49	0.59	449	1289
	5-3.0-18	3.6	3.048	1.30	0.73	0.79	892	2085
	5-3.0-16	4.5	3.060	1.75	0.95	0.98	1459	3023
	5-3.0-14	5.4	3.075	2.26	1.20	1.22	2344	4402

*End Bearing = 3″ Intermediate Bearing = 5″

LOAD-SPAN TABLES

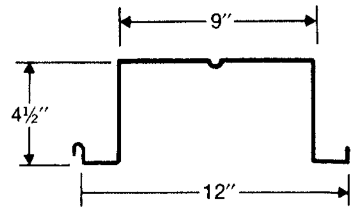
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET										
SECTION 5-3.0 MAX. LENGTH 40′-0″	20	3″		8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0			
			SIMPLE	101	80	64	51	41	35					
			DOUBLE	123	97	78	65	54	46	40	34			
			TRIPLE	153	121	98	81	68	57					
	18	3″		8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
			SIMPLE	153	120	95	74	59	49	41	35	31		
			DOUBLE	164	129	105	87	72	62	53	46	41	36	32
			TRIPLE	205	162	131	108	91	77					
	16	3″		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
			SIMPLE	126	97	77	63	53	45	39	34			
			DOUBLE	130	107	90	77	66	58	51	45	40	36	32
			TRIPLE	163	134	113	96							

Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

SECTION 5-4.5



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA $in.^4$	SECTION MODULUS + MOMENT $in.^3$	SECTION MODULUS – MOMENT $in.^3$	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER-* MEDIATE REACTION lbs./ft.
SECTION 5-4.5	5-4.5-20	3.1	4.536	2.20	0.85	1.03	408	1367
	5-4.5-18	4.1	4.548	3.25	1.27	1.37	833	2227
	5-4.5-16	5.1	4.560	4.38	1.64	1.71	1384	3232
	5-4.5-14	6.5	4.575	5.68	2.08	2.12	2237	4669

*End Bearing = 3″ Intermediate Bearing = 6″

LOAD-SPAN TABLES

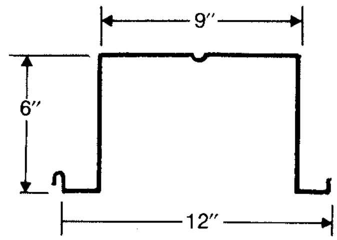
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET											
SECTION 5-4.5 MAX. LENGTH 40′-0″	20	4½″		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	
			SIMPLE	82	74	68	63	52	42	35					
			DOUBLE	109	99	91	81	70	61	53	47	42	38	34	
			TRIPLE	124	113	103	95								
	18	4½″		10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0
			SIMPLE	166	139	118	100	86	74	63	54	47	42	37	33
			DOUBLE	178	150	126	100	93	81	71	63	56	50	45	
			TRIPLE	202	184	158	135								
	16	4½″		12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	
			SIMPLE	151	129	111	96	82	70	61	53	48	41	36	
			DOUBLE	158	134	116	101	88	78	70	63	56			
			TRIPLE	197	168										

Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

SECTION 5-6.0



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS + MOMENT in.³	SECTION MODULUS – MOMENT in.³	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER- * MEDIATE REACTION lbs./ft.
SECTION 5-6.0	5-6.0-18	4.6	6.048	6.30	1.88	2.04	775	2117
	5-6.0-16	5.7	6.060	8.47	2.43	2.54	1310	3108
	5-6.0-14	7.2	6.075	10.99	3.09	3.16	2144	4528

* End Bearing = 3″ Intermediate Bearing = 6″

LOAD-SPAN TABLES

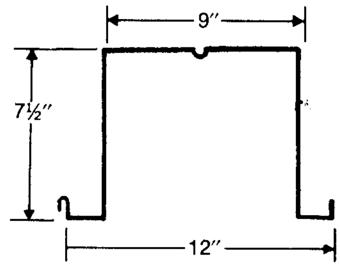
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET									
SECTION 5-6.0 MAX. LENGTH 40′-0″	18	6″		16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0
			SIMPLE	97	86	77	69	62	54	46	41	36	32
			DOUBLE	106	94	83	75	67					
	16	6″		16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0
			SIMPLE	126	111	99	89	80	69	60	52	46	41
			DOUBLE	132	117	104	93	84					

Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

SECTION 5-7.5



PROPERTIES

DECK DESIGNATION	SECTION AND GAUGE	ACTUAL WT./SQ. FOOT POUNDS	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS + MOMENT in.³	SECTION MODULUS – MOMENT in.³	ALLOWABLE END * REACTION lbs./ft.	ALLOWABLE INTER- * MEDIATE REACTION lbs./ft.
SECTION 5-7.5	5-7.5-18	5.1	7.548	10.59	2.56	2.79	716	2332
	5-7.5-16	6.4	7.560	14.21	3.31	3.48	1236	3428
	5-7.5-14	7.9	7.575	18.44	4.22	4.33	2051	4981
	5-7.5-13	9.4	7.590	22.36	5.11	5.19	3059	6757
	5-7.5-12	10.9	7.605	26.35	6.03	6.03	4246	8729

* End Bearing = 3″ Intermediate Bearing = 7½″

LOAD-SPAN TABLES

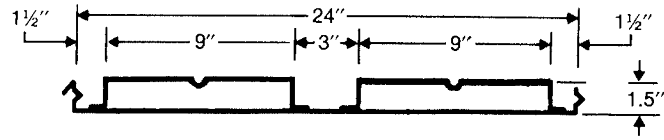
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

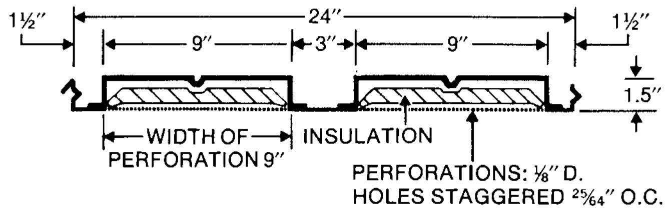
DECK SECTION	GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET											
SECTION 5-7.5 MAX. LENGTH 40′-0″	18	7½″		16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0		
			SIMPLE	89	84	79	75	72	68	65	61	53	47		
			DOUBLE	117	110	104	98	92							
	16	7½″		20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0
			SIMPLE	110	100	91	80	69	61	54	48	43	39	36	33
			DOUBLE	115											

Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

DC-1.5
ADC-1.5





PROPERTIES

SECTION AND GAUGE	DC-ACTUAL WT./SQ. FOOT POUNDS[1]	OVER-ALL DEPTH in.	DC DECK MOM. OF INERTIA $in.^4$	DC DECK SECTION MODULUS +MOMENT $in.^3$	DC DECK SECTION MODULUS −MOMENT $in.^3$	ADC DECK MOM. OF INERTIA $in.^4$	ADC DECK SECTION MODULUS +MOMENT $in.^3$	ADC DECK SECTION MODULUS −MOMENT $in.^3$	ALLOWABLE END* REACTION lbs./ft.	ALLOWABLE INTER-* MEDIATE REACTION lbs./ft.
1.5-20/18	4.0	1.584	0.36	0.26	0.48	0.34	0.25	0.44	490	1188
1.5-18/18	4.6	1.596	0.52	0.43	0.53	0.50	0.42	0.49	950	1919
1.5-18/16	5.1	1.608	0.56	0.43	0.64	0.54	0.43	0.60	950	1919
1.5-16/18	5.2	1.608	0.67	0.63	0.58	0.65	0.62	0.53	1533	2790
1.5-16/16	5.8	1.620	0.73	0.64	0.72	0.70	0.63	0.65	1533	2790
1.5-16/14	6.4	1.635	0.79	0.65	0.81	0.76	0.65	0.79	1533	2790
1.5-14/16	6.5	1.635	0.91	0.89	0.78	0.87	0.88	0.71	2423	4057
1.5-14/14	7.2	1.649	0.99	0.91	0.97	0.95	0.90	0.85	2423	4057
1.5-13/16	7.3	1.650	1.06	1.13	.084	1.01	1.12	0.77	3505	5541

[1]ADC weights are approximately 4% less.

*End Bearing = 3″ Intermediate Bearing = 4″

LOAD-SPAN TABLES

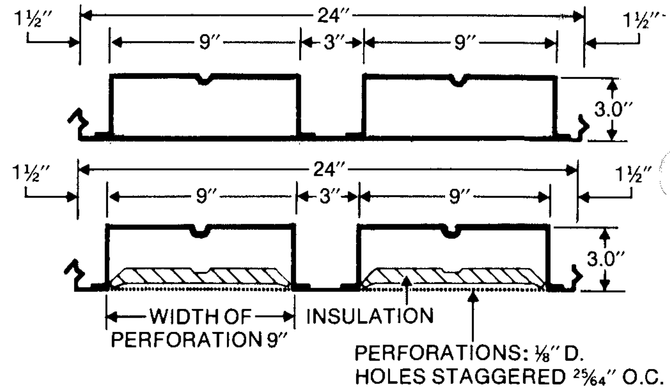
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

GAUGE	RIB DEPTH	TYPE OF SPAN	DC-1.5 PURLIN SPACING IN FEET							ADC-1.5 PURLIN SPACING IN FEET								
20/18	1½″		7.0	7.5	8.0	8.5	9.0	9.5	10.0	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
		SIMPLE	69	60	53	47	42	37	34	69	60	52	46	41	37	33		
		DOUBLE	130	114	100	88	78	70	63	119	104	91	81	72	64	58	52	48
		TRIPLE	140	116	97	83	72	62	55	122	99	92	79	68	58	52	47	42
18/18	1½″		7.0	7.5	8.0	8.5	9.0	9.5	10.0	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
		SIMPLE	110	92	78	66	58	51	45	106	88	75	64	56	49	44	39	35
		DOUBLE	145	126	111	98	87	78	71	132	115	101	89	80	71	64	58	53
		TRIPLE	180	157	137	116	99	86	75	165	144	126	112	96	83	73	64	57
18/16	1½″		8.0	8.5	9.0	9.5	10.0	10.5	11.0	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0
		SIMPLE	83	71	62	54	48	43	39	80	69	60	53	47	42	38	35	
		DOUBLE	133	118	105	94	85	77	70	124	110	98	88	79	72	65	60	55
		TRIPLE	147	124	107	92	81	71	64	142	120	103	89	78	69	62	55	50
16/18	1½″		8.5	9.0	9.5	10.0	10.5	11.0	11.5	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5
		SIMPLE	84	72	63	56	50	45	41	80	69	61	54	48	43	39	36	33
		DOUBLE	107	95	86	77	70	64	58	98	87	78	71	64	58	53	49	45
		TRIPLE	134	119	107	95	84	75	67	123	109	98	89	80	72	64	58	52
16/16	1½″		9.0	9.5	10.0	10.5	11.0	11.5	12.0	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0
		SIMPLE	78	68	60	54	48	44	40	75	66	58	52	47	42	39	36	33
		DOUBLE	118	106	96	87	79	72	66	106	95	86	78	71	65	59	55	51
		TRIPLE	137	118	103	91	81	72	65	131	114	99	87	77	69	62	57	52

For spans not shown on charts, please consut your Robertson sales representative.
Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

DC-3.0
ADC-3.0



PROPERTIES

SECTION AND GAUGE	DC-ACTUAL WT./SQ. FOOT POUNDS[1]	OVER-ALL DEPTH in.	DC DECK MOM. OF INERTIA $in.^4$	DC DECK SECTION MODULUS +MOMENT $in.^3$	DC DECK SECTION MODULUS −MOMENT $in.^3$	ADC DECK MOM. OF INERTIA $in.^4$	ADC DECK SECTION MODULUS +MOMENT $in.^3$	ADC DECK SECTION MODULUS −MOMENT $in.^3$	ALLOWABLE END* REACTION lbs./ft.	ALLOWABLE INTER-* MEDIATE REACTION lbs./ft.
3.0-20/18	4.4	3.084	1.56	0.60	1.04	1.50	0.59	0.99	449	1289
3.0-18/18	5.1	3.096	2.22	0.97	1.35	2.14	0.96	1.11	892	2085
3.0-18/16	5.7	3.108	2.38	0.99	1.39	2.30	0.98	1.35	892	2085
3.0-16/18	5.8	3.108	2.85	1.42	1.33	2.74	1.40	1.24	1459	3023
3.0-16/16	6.4	3.120	3.09	1.44	1.62	2.96	1.43	1.47	1459	3023
3.0-16/14	7.1	3.135	3.33	1.46	1.76	3.20	1.45	1.72	1459	3023
3.0-14/16	7.3	3.135	3.80	1.98	1.77	3.64	1.96	1.62	2344	4402
3.0-14/14	8.0	3.149	4.13	2.01	2.15	3.96	2.00	1.94	2344	4402
3.0-13/16	8.2	3.150	4.41	2.50	1.92	4.22	2.48	1.77	3393	5946

[1]ADC weights are approximately 4% less.

*End Bearing = 3″ Intermediate Bearing = 5″

LOAD-SPAN TABLES

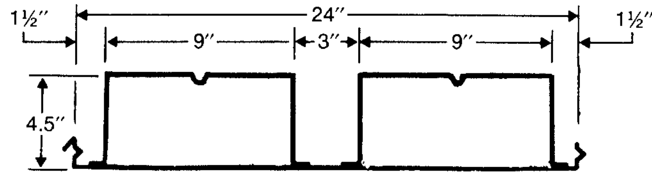
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

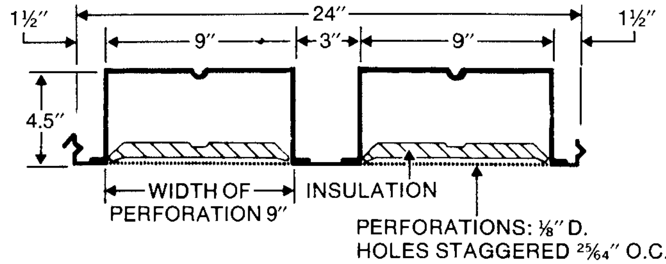
GAUGE	RIB DEPTH	TYPE OF SPAN	DC-3.0 PURLIN SPACING IN FEET							ADC-3.0 PURLIN SPACING IN FEET							
			8.0	9.0	10.0	11.0	12.0	13.0	14.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
20/18	3″	SIMPLE	112	98	79	65	55	47	40	112	97	79	65	54	46	40	35
		DOUBLE	129	114	103	98	86	79	73	129	114	103	98	86	79	73	68
		TRIPLE	146	130	117	106	97	90		146	130	117	106	97	90		
			9.0	10.0	11.0	12.0	13.0	14.0	15.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0
18/18	3″	SIMPLE	159	129	106	89	76	65	55	158	127	105	89	75	62	53	46
		DOUBLE	185	166	148	124	106	91	79	182	147	122	103	87	75	66	58
		TRIPLE	210	189	172	156	124			210	189	152	128	109			
			9.0	10.0	11.0	12.0	13.0	14.0	15.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0
18/16	3″	SIMPLE	162	131	108	90	77	67	58	160	130	107	90	77	66	56	49
		DOUBLE	185	166	148	128	109	94	82	185	166	148	124	106	90	80	70
		TRIPLE	210	189	172	158	133			210	189	172	156	129			
			11.0	12.0	13.0	14.0	15.0	16.0	17.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
16/18	3″	SIMPLE	153	121	97	80	68	58	50	147	116	94	77	65	56	49	43
		DOUBLE	146	123	105	90	78	69	61	136	114	97	84	73	64	47	50
		TRIPLE	183	154	131					170	143	121					
			11.0	12.0	13.0	14.0	15.0	16.0	17.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
16/16	3″	SIMPLE	158	130	105	87	73	62	54	157	125	101	83	70	60	52	46
		DOUBLE	178	150	127	110	96	84	74	162	136	116	100	87	76	68	60
		TRIPLE	223	187	159					203	170	145					

For spans not shown on charts, please consult your Robertson sales representative.
Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

DC-4.5
ADC-4.5





PROPERTIES

			DC DECK			ADC DECK			ALLOWABLE	
SECTION AND GAUGE	DC-ACTUAL WT./SQ. FOOT POUNDS[1]	OVER-ALL DEPTH in.	MOM. OF INERTIA in.⁴	SECTION MODULUS +MOMENT in.³	SECTION MODULUS −MOMENT in.³	MOM. OF INERTIA in.⁴	SECTION MODULUS +MOMENT in.³	SECTION MODULUS −MOMENT in.³	END* REACTION lbs./ft.	INTER-* MEDIATE REACTION lbs./ft.
4.5-20/18	4.6	4.584	3.80	1.03	1.66	3.67	1.02	1.62	408	1367
4.5-18/18	5.4	4.596	5.32	1.62	1.97	5.12	1.61	1.83	833	2227
4.5-18/16	5.9	4.608	5.71	1.65	2.23	5.50	1.63	2.19	833	2227
4.5-16/18	6.5	4.608	6.77	2.32	2.19	6.50	2.30	2.05	1384	3232
4.5-16/16	6.8	4.620	7.31	2.37	2.63	7.03	2.34	2.41	1384	3232
4.5-16/14	7.4	4.635	7.88	2.41	2.82	7.58	2.39	2.76	1384	3232
4.5-14/16	8.1	4.635	8.97	3.22	2.90	8.60	3.18	2.68	2237	4669
4.5-14/14	8.4	4.649	9.71	3.28	3.45	9.31	3.24	3.15	2237	4669
4.5-13/16	9.2	4.650	10.39	4.04	3.16	9.96	4.00	2.95	3282	6324

[1]ADC weights are approximately 4% less.

*End Bearing = 3" Intermediate Bearing = 6"

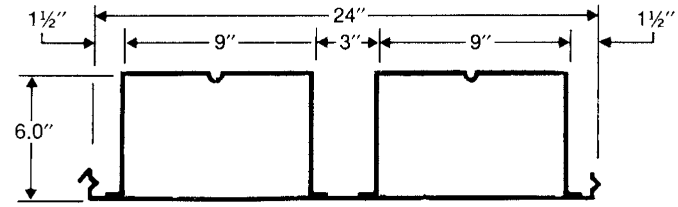
LOAD-SPAN TABLES
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

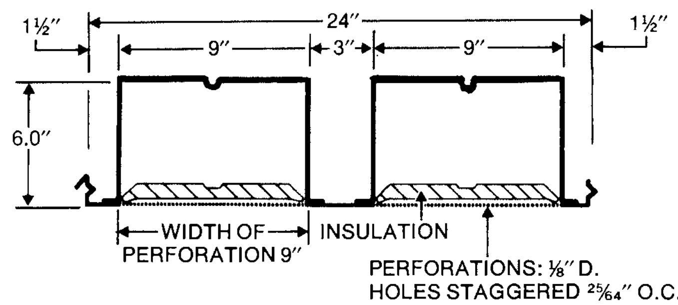
			DC-4.5							ADC-4.5						
GAUGE	RIB DEPTH	TYPE OF SPAN	PURLIN SPACING IN FEET							PURLIN SPACING IN FEET						
			12.0	13.0	14.0	15.0	16.0	17.0	18.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
20/18	4½"	SIMPLE	68	63	58	54	51	47	42	68	63	58	54	51	46	41
		DOUBLE	91	84	78	73	68	64	61	91	84	78	73	68	64	61
		TRIPLE	103	95						103	95					
			12.0	13.0	14.0	15.0	16.0	17.0	18.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
18/18	4½"	SIMPLE	150	127	110	96	84	74	66	148	126	109	95	83	74	66
		DOUBLE	148	137	127	116	102	90	81	148	137	124	108	95	84	75
		TRIPLE	168	156						168	156					
			12.0	13.0	14.0	15.0	16.0	17.0	18.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
18/16	4½"	SIMPLE	152	130	112	97	85	76	67	151	128	111	96	85	75	67
		DOUBLE	148	137	127	119	111	102	91	148	137	127	119	111	101	90
		TRIPLE	168	156						168	156					
			14.0	15.0	16.0	17.0	18.0	19.0	20.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
16/18	4½"	SIMPLE	158	137	120	103	89	78	69	156	136	117	100	86	75	66
		DOUBLE	149	129	114	101	90	80	73	139	121	106	94	84	75	68
			15.0	16.0	17.0	18.0	19.0	20.0	21.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0
16/16	4½"	SIMPLE	140	123	109	96	83	73	63	138	122	107	92	80	71	61
		DOUBLE	155	130	121	108	97	87		142	125	111	99	89	80	

For spans not shown on charts, please consult your Robertson sales representative.
Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

DC-6.0
ADC-6.0





PROPERTIES

SECTION AND GAUGE	DC-ACTUAL WT./SQ. FOOT POUNDS[1]	OVER-ALL DEPTH in.	DC DECK MOM. OF INERTIA in.⁴	DC DECK SECTION MODULUS +MOMENT in.³	DC DECK SECTION MODULUS −MOMENT in.³	ADC DECK MOM. OF INERTIA in.⁴	ADC DECK SECTION MODULUS +MOMENT in.³	ADC DECK SECTION MODULUS −MOMENT in.³	ALLOWABLE END* REACTION lbs./ft.	ALLOWABLE INTER-* MEDIATE REACTION lbs./ft.
6.0-18/18	6.0	6.096	10.00	2.37	2.81	9.63	2.34	2.63	775	2117
6.0-18/16	6.4	6.108	10.74	2.41	3.15	10.35	2.39	3.09	775	2117
6.0-16/18	7.1	6.108	12.65	3.34	3.15	12.16	3.30	2.97	1310	3108
6.0-16/16	7.3	6.120	13.64	3.41	3.73	13.11	3.37	3.45	1310	3108
6.0-16/14	8.0	6.135	14.70	3.48	3.98	14.13	3.44	3.89	1310	3108
6.0-14/16	8.9	6.135	16.67	4.58	4.15	16.01	4.53	3.87	2144	4528
6.0-14/14	9.1	6.149	18.01	4.68	4.86	17.29	4.63	4.49	2144	4528
6.0-13/16	10.0	6.150	19.30	5.72	4.56	18.53	5.65	4.28	3170	6168

[1]ADC weights are approximately 4% less.

*End Bearing = 3″ Intermediate Bearing = 6″

LOAD-SPAN TABLES

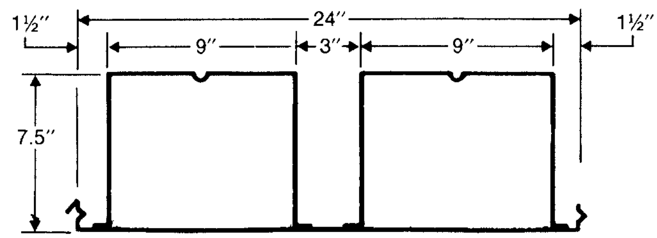
ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

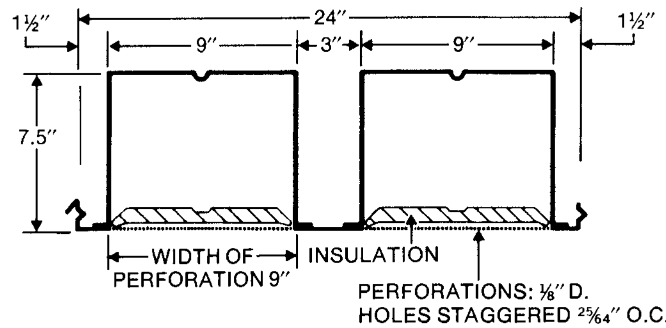
GAUGE	RIB DEPTH	TYPE OF SPAN	DC-6.0 PURLIN SPACING IN FEET								ADC-6.0 PURLIN SPACING IN FEET							
18/18	6″		15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0
		SIMPLE	103	97	91	86	80	77	71	65	103	97	91	86	81	77	70	64
		DOUBLE	112	106	99	94	89	84			112	106	99	94	89	84		
18/16	6″		15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0
		SIMPLE	103	97	91	86	81	77	71	66	103	97	91	86	81	77	71	65
		DOUBLE	112	106	99	94	89	84			112	106	99	94	89	84		
16/18	6″		19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0
		SIMPLE	123	111	99	84	73	64	56	50	121	110	95	81	70	61	54	48
		DOUBLE	111	105							109	98						
16/16	6″		19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0
		SIMPLE	125	113	103	90	78	68	60	53	124	112	101	87	75	66	58	51
		DOUBLE	111	105							111	105						

For spans not shown on charts, please consult your Robertson sales representative.
Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

DC-7.5
ADC-7.5





PROPERTIES

SECTION AND GAUGE	DC-ACTUAL WT./SQ. FOOT POUNDS[1]	OVER-ALL DEPTH in.	DC DECK MOM. OF INERTIA in.⁴	DC DECK SECTION MODULUS +MOMENT in.³	DC DECK SECTION MODULUS −MOMENT in.³	ADC DECK MOM. OF INERTIA in.⁴	ADC DECK SECTION MODULUS +MOMENT in.³	ADC DECK SECTION MODULUS −MOMENT in.³	ALLOWABLE END* REACTION lbs./ft.	ALLOWABLE INTER-* MEDIATE REACTION lbs./ft.
7.5-18/18	6.6	7.595	16.44	3.20	3.73	15.83	3.16	3.50	716	2332
7.5-18/16	6.9	7.608	17.66	3.27	4.14	17.01	3.23	4.06	716	2332
7.5-16/18	7.7	7.608	20.68	4.46	4.21	19.90	4.40	3.99	1236	3428
7.5-16/16	8.0	7.620	22.28	4.56	4.92	21.42	4.50	4.57	1236	3428
7.5-16/14	9.2	7.635	23.99	4.66	5.23	23.08	4.61	5.12	1236	3428
7.5-14/16	9.6	7.635	27.15	6.07	5.52	26.11	6.00	5.17	2051	4981
7.5-14/14	10.0	7.649	29.29	6.21	6.38	28.14	6.14	5.94	2051	4981
7.5-13/16	11.0	7.650	31.44	7.55	6.11	30.25	7.45	5.76	3059	6757

[1]ADC weights are approximately 4% less.

*End Bearing = 3" Intermediate Bearing = 7½"

LOAD-SPAN TABLES

ALLOWABLE UNIFORM TOTAL LOADS IN POUNDS PER SQUARE FOOT

GAUGE	RIB DEPTH	TYPE OF SPAN	DC-7.5 PURLIN SPACING IN FEET								ADC-7.5 PURLIN SPACING IN FEET							
18/18			15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0
	7½"	SIMPLE	95	89	84	79	75	71	68	65	95	89	84	79	75	71	68	65
		DOUBLE	124	116	110	103	98	93			124	116	110	103	98	93		
18/16			15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0
	7½"	SIMPLE	95	89	84	79	75	71	68	65	95	89	84	79	75	71	68	65
		DOUBLE	124	116	110	103	98	93			124	116	110	103	98	93		
16/18			22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0
	7½"	SIMPLE	112	107	96	84	74	65	58	53	112	107	93	81	71	63	56	51
16/16			22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0
	7½"	SIMPLE	112	107	103	88	78	69	62	56	112	107	99	86	76	67	60	54

For spans not shown on charts, please consult your Robertson sales representative.
Refer to page seven for additional design/erection considerations and limitations.

Robertson Roofs

CANTILEVER GUIDE & SELECTION TABLE

FORMULA FOR DETERMINING REQUIRED SECTION PROPERTIES FOR CANTILEVER SELECTION

1. Anchor span governs when $L < 0.414A$

   $\text{Req'd. } S = 0.000075 \frac{W_T}{A^2} (A+L)^2(A-L)^2$

   $\text{Req'd. } I = 0.00000305\, W_L A\,(5A^2 - 12L^2)$

   Note—Formula for req'd. I based on simplifying assumption that Δmax occurs at A/2

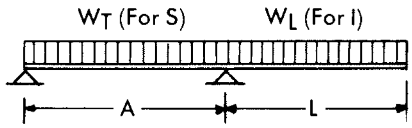
2. Cantilever governs when $L > 0.414A$

   $\text{Req'd. } S = 0.0003\, W_T L^2$

   $\text{Req'd. } I = 0.0000244\, W_L (4L^2A - A^3 + 3L^3)$

   W_T = total load in psf
   W_L = live load in psf
   A = anchor span in feet
   L = cantilever overhang in feet

In deriving the above formula, f_b = 20000 psi and E = 29,500,000 psi maximum deflection: for cantilever Δmax = L/120 and for anchor span, Δmax = A/240.



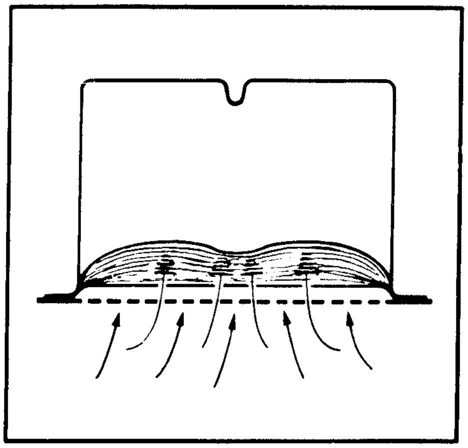
Total Load 45 psf
Live Load 30 psf
Deflection L/120 (or A/240)
L = 0.866 x A

L (ft.)	REQUIRED S (in.^{3})	REQUIRED I (in.^{4})	SELECTION TABLE • REQUIRED SECTION		
5	0.34	0.55	21-18 3-14	5-3.0-20	DC-3.0-20/18 DC-1.5-18/16
6	0.49	0.95	21-18 12-20	5-3.0-18	DC-3.0-20/18
7	0.66	1.50	12-20 21-16	5-4.5-20	DC-3.0-18/18
8	0.86	2.24	12-20 21-14	5-4.5-18	DC-3.0-18/16
9	1.09	3.19	12-18 21-12	5-4.5-18	DC-4.5-18/18 DC-3.0-16/14
10	1.35	4.38	12-16	5-4.5-16	DC-4.5-18/18 DC-3.0-13/16
11	1.63	5.83	12-14	5-6.0-18	DC-4.5-16/18
12	1.94	7.56	12-12	5-6.0-16	DC-6.0-18/18 DC-4.5-16/14 DC-4.5-14/16
13	2.28	9.62		5-7.5-18 5-6.0-14	DC-6.0-18/18 DC-4.5-14/14
14	2.65	12.01		5-7.5-16	DC-6.0-16/18
15	3.04	14.77		5-7.5-14	DC-7.5-18/18 DC-6.0-14/16

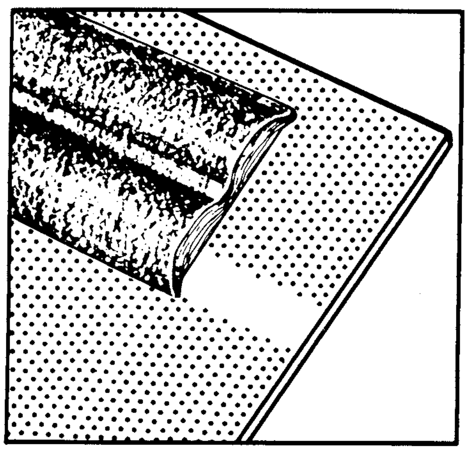
• For the listed sections, web crippling and weld strength are not critical for wind uplift forces less than 30 psf.

Robertson Roofs

ENGINEERING DATA - ACOUSTICAL



After it penetrates the perforated metal surface, sound energy is absorbed by the glass fiber pad and the air space above. The use of "metal pan" acoustical ceilings is well known and is recognized as one of the more effective acoustic ceiling methods. The arch shape of the sound absorbing element insures its support above the perforations to permit the sound energy to penetrate the pad. This self-supporting shape holds the pad above the holes to prevent clogging during subsequent field painting operations.



Long Span Acoustical ADC units combine a perforated plate, which also becomes the finished ceiling, with an internal sound absorbing element. The plate is perforated with paths of 1/8" diameter holes, providing approximately 10% open area. A specially formed arched pad of extra fine glass fibers is provided as the sound absorbing medium. It is field installed above the perforated plate. The high degree of acoustical correction is readily seen in the adjoining table which summarized NRC values.

Sound absorption

	FREQUENCIES						
DECK	125	250	500	1000	2000	4000	NRC
	COEFFICIENTS						
ADC-1.5	.24	.45	.65	.93	.75	.52	.70
ADC-3.0	.62	.61	.82	.83	.66	.60	.75
ADC-4.5	.37	.79	.98	.81	.70	.50	.80
ADC-6.0	.63	.94	.93	.74	.70	.48	.85
ADC-7.5	.67	1.09	.87	.67	.70	.47	.85

All of the above data, with exception of ADC-60, is from actual tests conducted at recognized acoustical laboratories following the provisions of ASTM C423-66 and using a number 4 mounting. All tests were conducted using the standard perforation pattern for ADC and standard thermally molded arched glass fiber insulation pads. Should values in excess of those shown be required, changes in the depth and density of the insulation can be made. Values for ADC-60 have been interpolated.

Sound transmission

The transmission of sound from one room to another can readily occur when partitions stop at the underside of a ceiling. Sound waves can enter the plenum and be transmitted to adjoining areas unless properly blocked.

In a suspended acoustical ceiling, it is generally costly and difficult to effect a sound barrier in the plenum above partitions. However, this is readily handled within the confines of the cells of Long Span units.

Directly over non-load-bearing partitions, sound barriers of formed glass fiber are inserted in the deck cells. Above load bearing partitions, specially formed glass fiber cells closures are inserted in the deck ends. Sound transmission from room to room is reduced to a level equal to or less than that of the walls.

ENGINEERING DATA - AIR DIFFUSION

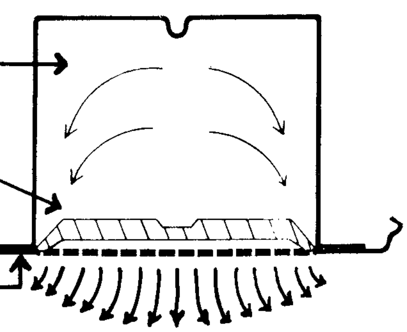
ADC Deck provides concealed delivery of conditioned air

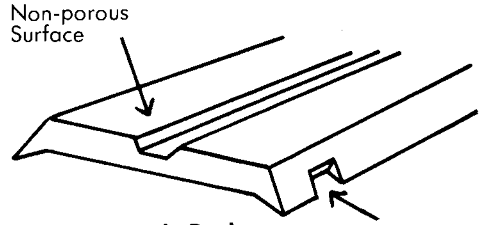
One additional function that can be obtained from the cellular floor or roof section is the transfer and diffusion of conditioned air into an interior space. The large cross section of the deck affords a generous "air duct," and the perforations provide the diffusing medium. The result is an air delivery method that eliminates branch duct work, and exposed grilles and provides for a uniform delivery of air across the entire width of the room. No hot or cold spots — no uncomfortable or drafty location. Utilizing the structural decking also reduces site assembly and connections and makes the "system" truly functional in nature.

ADC Deck as an Air Ceiling is simply a pressurized plenum that diffuses cool or warm air into a space spanned by the deck assembly above. The specially notched and coated acoustic pad is the "metering device" that transfers air from the upper distributing chamber into the lower diffusing chamber. The static pressure of the mechanical system, the notch pattern and the continuous perforation pattern in the ceiling plate combine to deliver air to the space below in a most uniform fashion the entire span length. Cooling or heating loads for individual room requirements will determine the number of cells to be activated for air diffusion.

Air capacities are a direct function of the depth of the deck. Depth is usually governed by structural considerations. Adjustment of each deck gauges can also be helpful in providing an optimum of structural/air handling criteria.

Air capacities could have been calculated by standard ASHRAE formulae. However, because the air cell, metering device and perforations act in series, it was considered essential to run actual tests to check flow patterns, velocities and other aspects. Various lengths, different depths of deck, methods of air supply, location of closures and baffles were tested to arrive at the indicated design information summarized below.





Acoustic Pad

AIR QUANTITY CAPACITIES

ADC DECK DEPTH	AREA OF EQUIVALENT ROUND	MAXIMUM CAPACITIES*
4.5"	5.5" (above metering pad)	100 cfm
6.0"	6.9" (above metering pad)	200 cfm
7.5"	8.0" (above metering pad)	320 cfm

Design Notes:

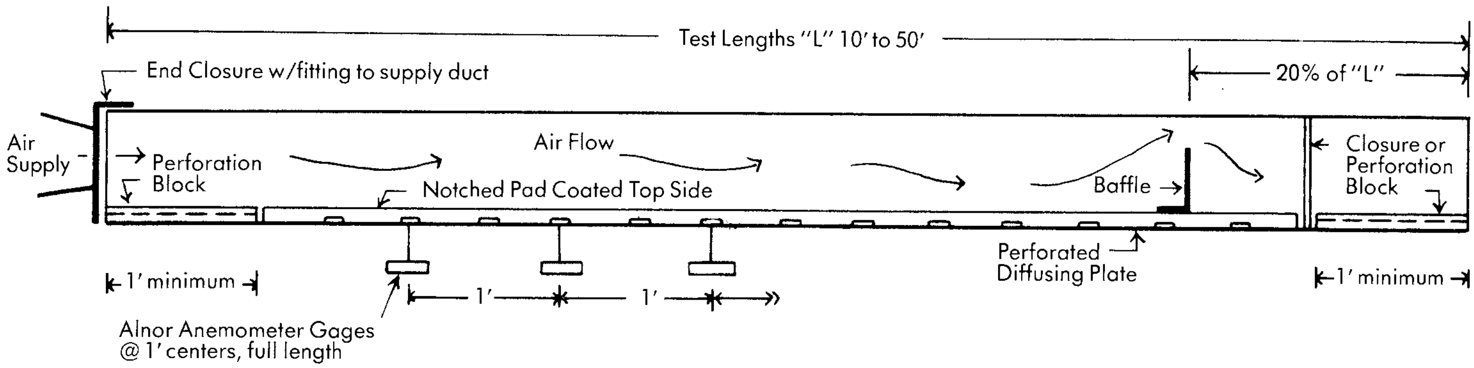
1. Flow Range — Maintain between 3 and 10 cfm/lineal foot.
2. Place perforation blocks or closures to keep air diffusion a minimum of 1' from any wall.
3. When used in ceiling/roof construction — insulate voids to each side of ADC Air Cell.
4. At the indicated capacities* there is no detectable sound level of inlet air or diffused air.

Robertson Roofs

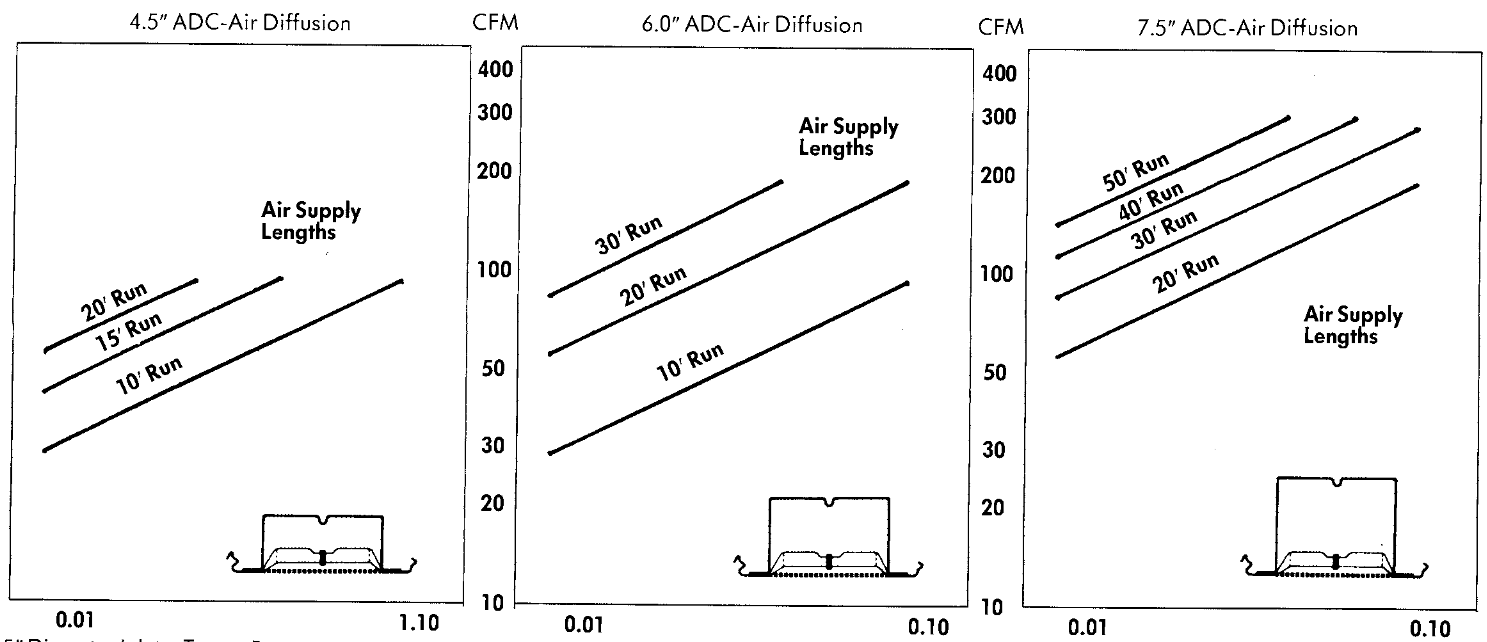
ENGINEERING DATA-AIR DISTRIBUTION

Test procedures and design value

The schematic drawing below shows the basic test assembly. Alnor Thermal Anemometers spaced 1′ along the air cells were the instrumentation. Velocity readings and variations were taken as a direct measure of volume delivery. The total volume variation at 3 cfm per lineal foot, measured +1.5% to −2% along the length. At 10 cfm per lineal foot, volume variation measured +9.0% to −6.0% along the length. The most efficient location of the baffle detail was found to be constant for all lengths of air cell, at a position equal to 20% of the total length mesured from the end opposite the delivery.



Friction loss charts—Required inlet static pressure, inches water.

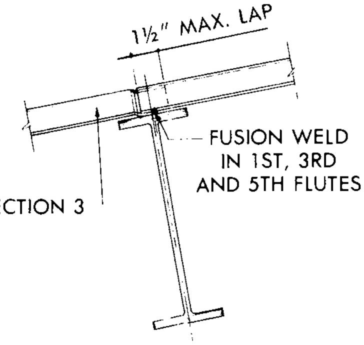


5″ Diameter Inlet—Top or Bottom* | 6″ Diameter Inlet—Top or Bottom* | 8″ Diameter Inlet—Top or Bottom*

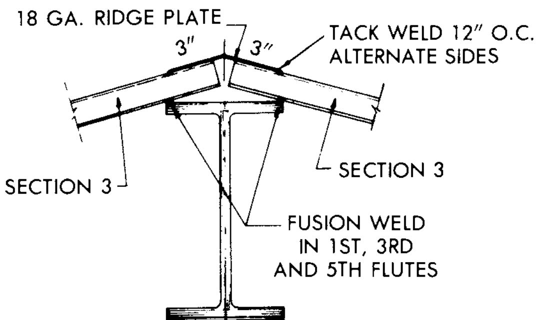
*Static pressure required for air supply through an end inlet is less than for a top or bottom inlet. Use equivalent rectangular area for size of end inlet fitting.

TYPICAL DETAILS - STRUCTURAL

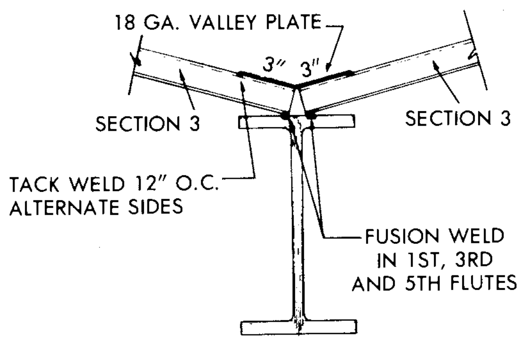
Sections 3, 21 and 12



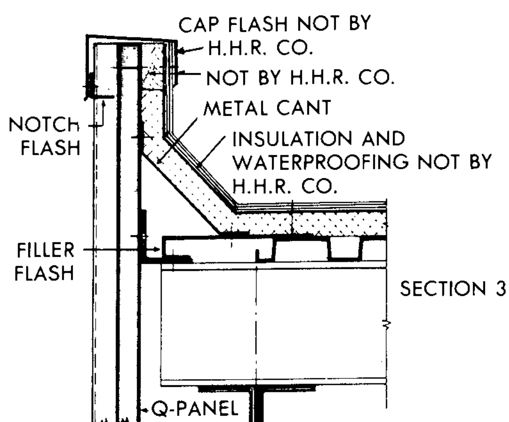
TYPICAL END JOINT DETAIL SHOWING LAP OVER ROOF PURLIN



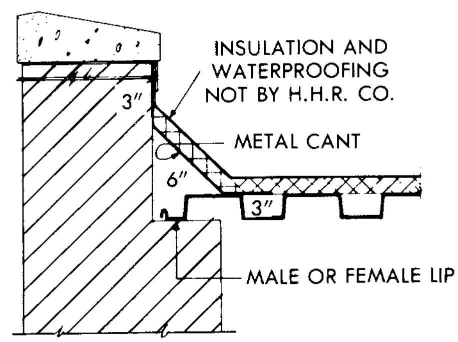
RIDGE DETAIL—ROOF



VALLEY DETAIL—ROOF



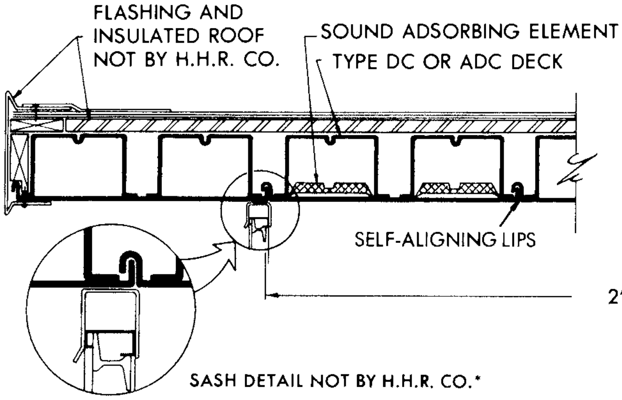
ROOF CELLS PARALLEL TO PARAPET WALL (Q-PANEL)

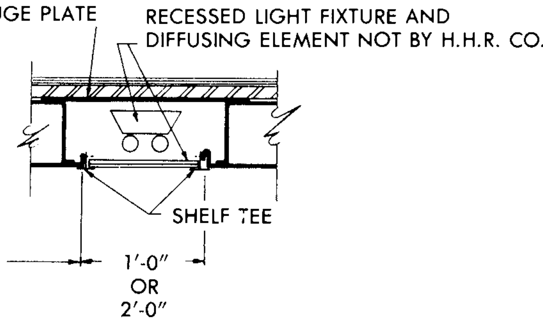


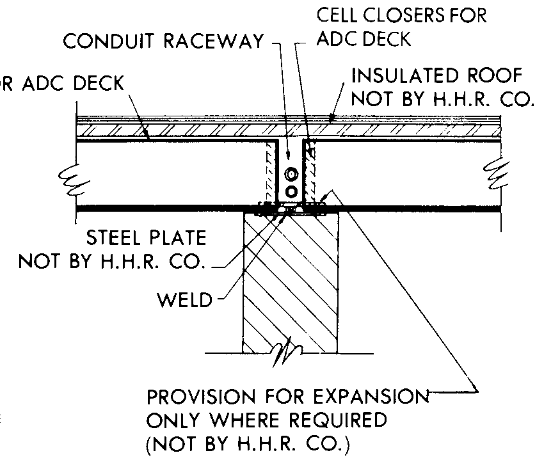
ROOF CELLS PARALLEL TO PARAPET WALL (MASONRY)

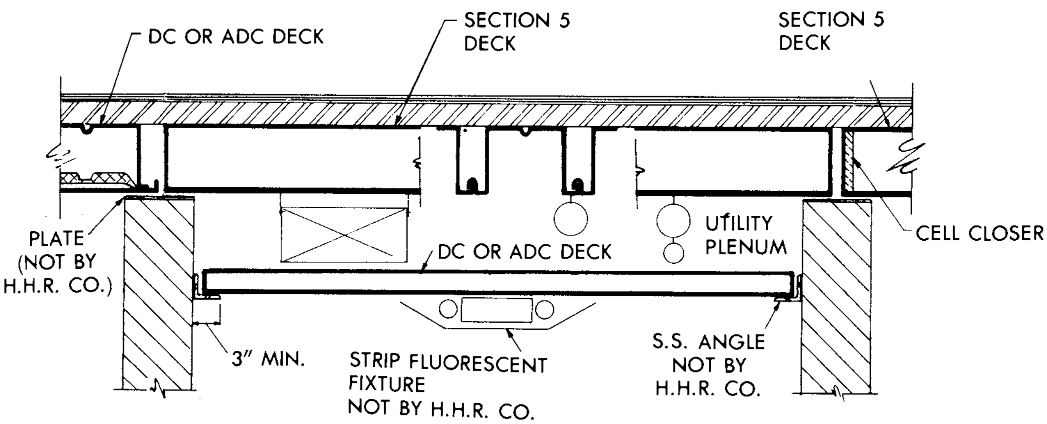
TYPICAL DETAILS - STRUCTURAL

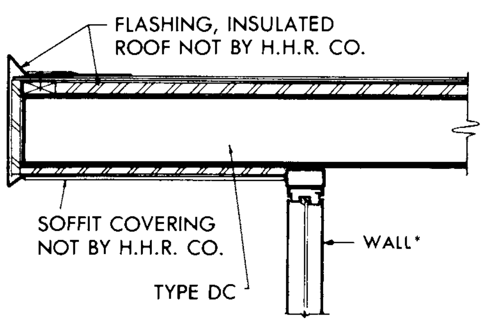
DC/ADC DECK

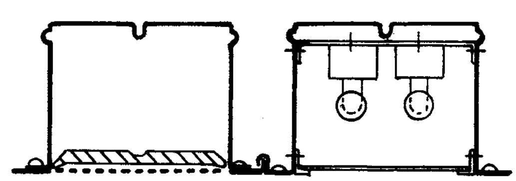










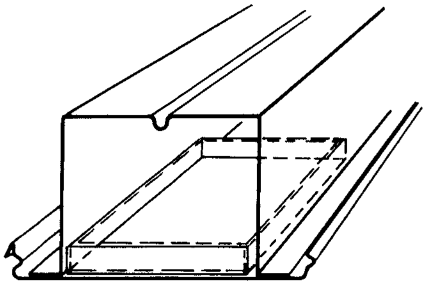


Robertson single unit (#5)
is inserted in deck construction
where simple installation of
recessed lighting is desired.

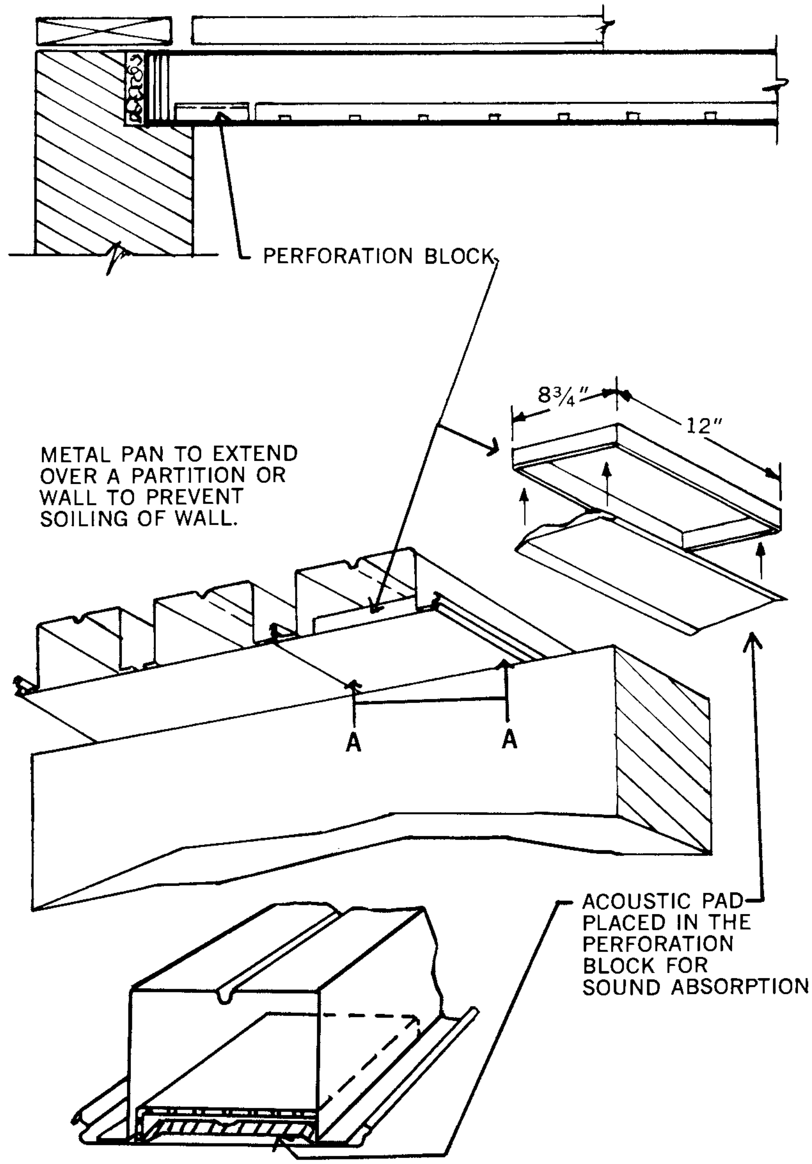
***Designer should consider deck deflection & its influence on this detail.**

Robertson Roofs TYPICAL DETAILS - STRUCTURAL

ADC AIR CEILING

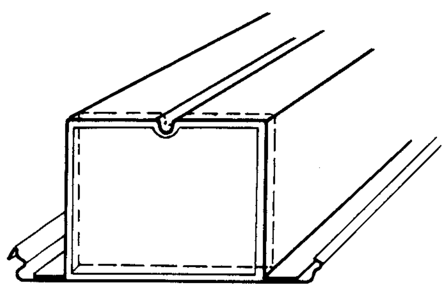


PERFORATION-BLOCK

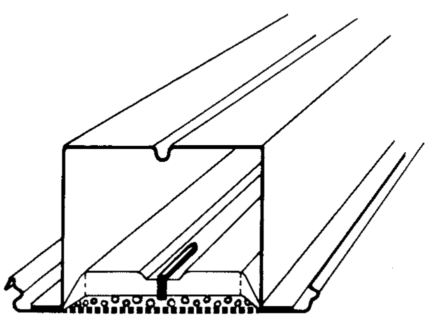


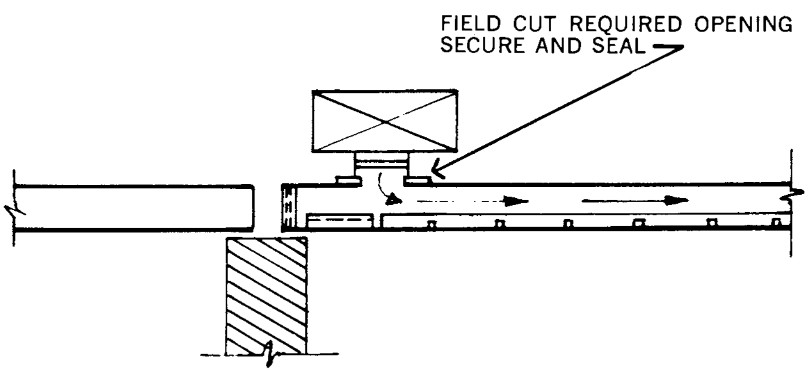
SECTION A-A

PAD AND PERFORATION-BLOCK



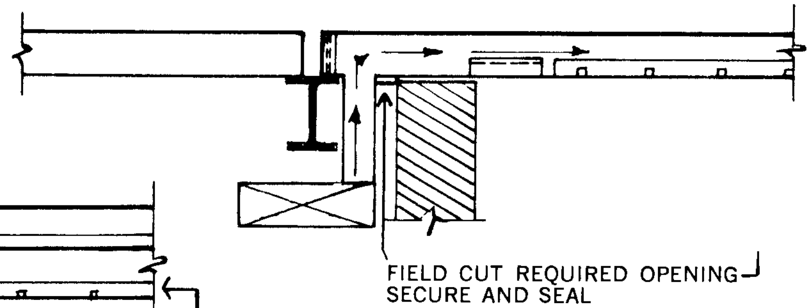
END CLOSURE



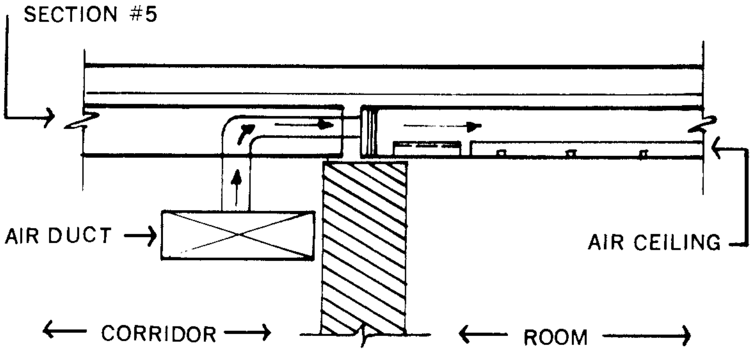


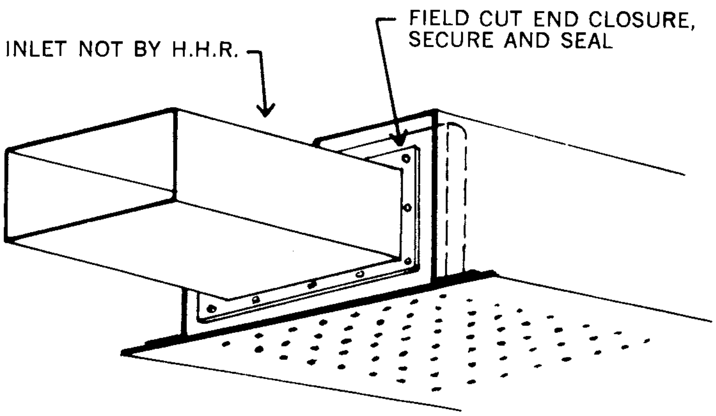
AIR SUPPLY THROUGH THE TOP

ADC AIR CEILING

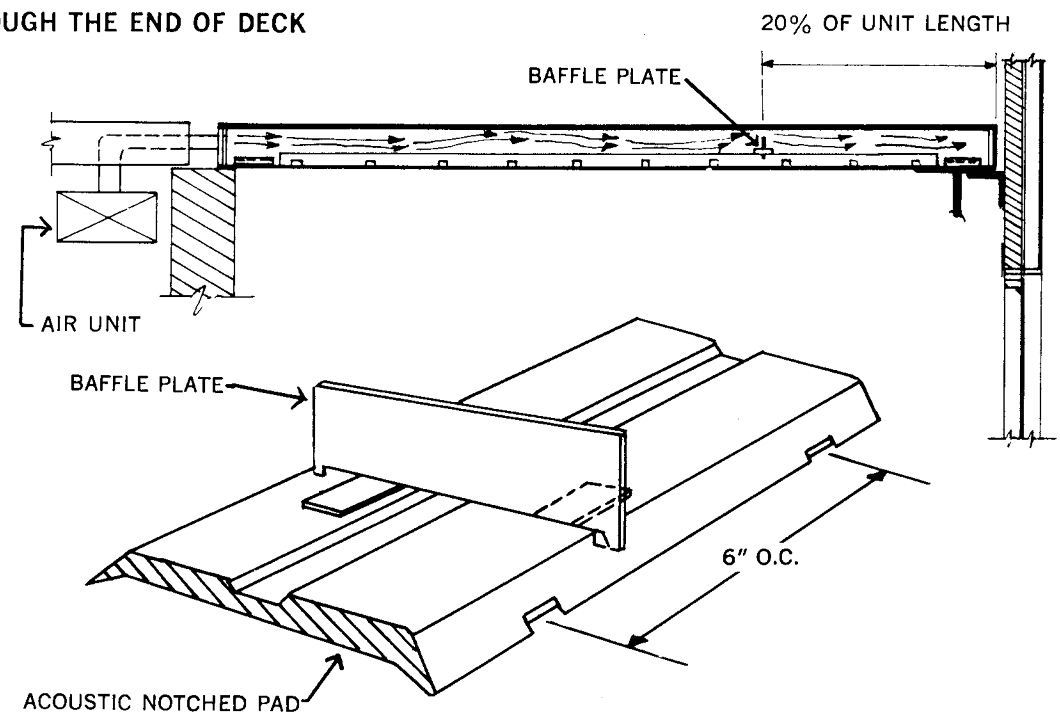


AIR SUPPLY THROUGH THE BOTTOM





AIR SUPPLY THROUGH THE END OF DECK



BAFFLE PLATE

Robertson Roofs

SPECIFICATIONS

UCI SECTION 05310
METAL ROOF DECK
ROBERTSON SECTIONS 3, 21 and 12

PART 1—GENERAL

1.01 DESCRIPTION:

Provide all structural metal roof decking and sheet metal accessories specified in this section.

1.02 SHOP DRAWINGS:

The metal roof deck sub-contractor shall prepare and submit to the general contractor for approval by designer and contractor, erection/shop drawings which show the type of deck and gauge of steel being supplied, where it is to be located, necessary field fabrication, erection sequence and detail interface of deck with adjacent materials. These drawings shall also call or show all flashing which is to be supplied by the metal roof deck contractor. Drawings shall be submitted in ________ sets of prints for approval; after approval ________ sets shall be supplied for files and distribution.

PART 2—PRODUCTS

2.01 MATERIALS:

The steel deck and all flashing shall be formed from steel sheets, conforming to ASTM 446-76. The steel shall have received before being formed, a metal protective coating of zinc conforming to ASTM-A525-79 Class G-30 and to Federal Specifications QQ-S-775E.

2.02 DESIGN:

a. The American Iron and Steel Institute's latest "Specification for the Design of cold formed steel Structural Members" shall govern the design of all roof deck units. The deck units shall be provided with an interlocking side lap. [Ends of deck units shall be countersunk to provide a smooth top surface at overlapping ends (except 14 and 12 ga.).] Roof deck units shall be in lengths to span over three or more supports wherever possible.

b. Section #3 — Material shall be roll formed in sections 24″ wide with custom cut lengths up to 40′. The units shall have four flutes 6″ on center. The deck units shall be fabricated from (22—12 gauge, choose one) steel and be capable of supporting a live load of ________ psf, a dead load of ________ psf and maintaining a deflection of less than ________ (L/240 or L/360).

c. Section #21 — Material shall be roll formed in sections 24″ wide with custom cut lengths up to 40′. The units shall have three flutes 8″ on center. The deck units shall be fabricated from (22—12 gauge, choose one) steel and be capable of supporting a live load of ________ psf, a dead load of ________ psf and maintaining a deflection of less than ________ (L/240 or L/360.

d. Section #12 — Material shall be roll formed in sections 12″ wide with custom cut lengths up to 40′. The units shall have two flutes 6″ on center. The deck units shall be fabricated from (20 — 12 gauge, choose one) steel and be capable of supporting a live load of ________ psf, a dead load of ________ psf and maintaining a deflection of less than________ (L/240 or L/360).

2.03 ACCESSORIES:

a. Ridge and valley plates, metal cant strips and metal sump pans, which must be attached directly to the steel decks in order to provide a finished surface for the application of insulation and roofing, shall be furnished by the deck manufacturer.

b. When decks rest on masonry walls or steel beams, over a partition or at an exterior wall, the hollow spaces between webs of the deck shall be closed with a pressed metal closure or die-cut neoprene filler where indicated on drawings. Closure or fillers shall be fastened to webs by means of sheet metal screws, welding or adhesive for neoprene fillers.

PART 3—EXECUTION

3.01 ERECTION

a. Section 3 — Roof deck sheets shall be fastened to the supporting roof steel by 3/4″ diameter fusion welds as follows:
   1. At outside edges of deck area, fasten in 1st, 3rd and 5th low corrugations. Fasten parallel edge 3′ on center.
   2. At joints, fasten in 1st, 3rd and 5th low corrugations.
   3. At intermediate supports, fasten in 2nd and 4th low corrugations if span is greater than 4′-0″.
   4. For spans of 4′-0″ or less, fasten in one low cell at each intermediate support. Use the 2nd and 4th low cells alternately.
   5. Fasten side joints by:
      a. Clinch side joints at 3′-0″ centers for units 16 gauge and lighter.
      b. One inch welds at 3′-0″ on centers between supports for 12 and 14 gauge units.

b. Section 21 — Roof deck sheets shall be fastened to the supporting roof steel by 3/4″ diameter fusion welds as follows:
   1. At outside edges of deck area, fasten in 1st, 2nd and 4th low corrugations. Fasten parallel edge 3′ on center.
   2. At joints, fasten in 1st, 2nd and 4th low corrugations.

(CONTINUED)

SPECIFICATIONS

ROBERTSON SECTIONS 3, 21 and 12

3. At intermediate supports, fasten in 1st and 3rd low corrugations.
4. Fasten side joints by:
   a. Clinch side joints at 3'-0" centers for units 16 gauge and lighter.
   b. One inch welds at 3'-0" on centers between supports for 12 and 14 gauge units.

c. Erection for Section 12 Deck-Roof deck sheets shall be fastened to the supporting roof steel by 3/4" diameter fusion welds as follows:
   1. Fasten units at each support locating one weld along side the female lip and one at the middle low corrugation.
   2. Fasten side joints by:
      a. Clinch side joints at 3'-0" maximum between centers for units 16 gauge and lighter.
      b. One inch welds at 3'-0" on centers between supports for 12 and 14 gauge units.

d. Cutting and flashing of openings other than framed openings shown on the structural drawings shall be framed, cut and flashed by others.

e. Erection will comply with manufacturer's standards and with specific requirements of the approved metal roof deck shop drawings. All accessories specified of those drawings to be supplied by deck supplier will be erected by metal roof deck erector.

f. Damage to steel deck profiles during the construction phase can significantly reduce their load carrying capacity. Deck erectors should exercise appropriate care to insure that any damaged deck is suitably strengthened or replaced.

Robertson Roofs

SPECIFICATIONS

UCI SECTION 05310
METAL ROOF DECK
ROBERTSON SECTIONS DC-ADC, AIR CEILING AND SECTION #5

PART 1—GENERAL

1.01 DESCRIPTION

Provide all structural metal roof decking and sheet metal accessories specified in this section.

1.02 SHOP DRAWINGS

The metal roof deck sub-contractor shall prepare and submit to the general contractor for approval by designer and contractor, erection/shop drawings which show the type of deck and gauge of steel being supplied, where it is to be located, necessary field fabrication, erection sequence and detail interface of deck with adjacent materials. These drawings shall also call or show all flashing which is to be supplied by the metal roof deck contractor. Drawings shall be submitted in ____________ sets of prints for approval; after approval ____________ sets shall be supplied for files and distribution.

PART 2—PRODUCTS

2.01 MATERIAL:

All of the deck units and associated flashing shall be fabricated from steel sheets conforming to ASTM-A446-76. The sheet shall have received a zinc coating conforming to ASTM-A525-79, Class A40.

2.02 DESIGN:

a. The American Iron and Steel Institute's latest "Specification for the design of cold formed steel structural members" shall govern the design of all roof deck units.

b. Type DC or ADC Roof Deck shall be composed of two identically formed beam sections with an integral stiffening rib rolled into the top flange of each section, and a flat plate. The flat plate shall have formed male and female self aligning side joints on opposite edges. These side joints shall be male-female type with continuous locking beads to insure positive vertical and lateral alignment of adjacent sections. The flat plate and the beam sections shall be assembled by electrical resistance spot welding to provide a structural cellular-beam unit. The flat plate for ADC Deck shall be perforated with 1/8" holes staggered 25/64" o.c. in two continuous paths 9" wide. The deck units shall be 24" in width and 1½", 3", 4½", 6" or 7½" in depth, designated as 1.5, 3.0, 4.5, 6.0 and 7.5. The following nomenclature should be used — type — depth — hat gauge/plate gauge — example: ADC-7.5 — 18/16.

c. Type "ADC Air Ceiling" deck shall be of identical construction as described for ADC deck except units shall be one single beam section mounted on a 12" width plate. Perforation pattern shall be such to permit the diffusion of air quantities as shown on mechanical drawing for specific areas. The type designation for these units shall be ADC "Air".

d. Stucco embossed steel shall be used for the flat plate sections of all DC-ADC units. This shall be accomplished in embossing rolls, prior to forming the side laps, to remove rolling stresses, camber and to insure flatness of the sheet when assembled. Samples of the embossed pattern shall be approved by the architect prior to bid date, as part of a total deck assembly.

e. After perforating and forming the side edges, the flat plate shall be degreased, steam cleaned and hot phosphate treated. The underside of the flat plate shall then receive a shop applied, oven cured prime coating compatible with standard field applied finish enamels.

f. The sound absorbing elements in ADC deck shall be self-supporting, arch shaped, pressure and thermally-molded fiberglass pads which provide an air space of ½" between the perforated steel plate and pad. Metal chair supports are not permissible. The Noise Reduction Coefficient of the complete assembly shall be as determined by standard tests conducted by recognized acoustical laboratories.

The sound absorbing elements in the ADC Air Ceiling units shall be as described above, except shall be notched along edge supports to permit the flow of pressurized air from chamber above the pad to the perforated plate. Notch pattern shall be of such dimension to provide the air quantities specified or shown on mechanical drawings. The top side of all arched pads in the ADC Air Ceiling units shall be coated with neoprene, foil or other material to prevent air passage through the pad itself.

g. Section #5 deck element shall consist of a single flute beam section 12" in width, with an integral stiffening rib rolled into the top flange. Bottom flanges shall have formed male and female side joints on opposite edges. Depth shall be 3", 4½", 6" or 7½", designated as 3.0, 4.5, 6.0 and 7.5. The following nomenclature should be used: Section #5 (depth) (gauge). Example: Section #5, 4.5-18.

2.03 ACCESSORIES:

a. Ridge and valley plates and metal cant strips, and metal sump pans which must be attached directly to the steel decks in order to provide a finished surface for the application of insulation and roofing shall be furnished by the deck manufacturer.

b. Cell end sound barrier closures of pressure and thermally-molded fiberglass shall be furnished by manufacturer wherever air-borne sound transmission can occur over walls and through deck cells at butt joint conditions. Closures shall be formed to cell profile to insure tight fit.

Where deck units are continuous over partition walls, sound barriers of 3"-thick, dimensionally oversize, laminar fiberglass shall be furnished for installation by the erector.

c. Provide necessary sheet metal closure accessories for "ADC Air Ceiling." These accessories to be installed by the sheet metal or mechanical contractor.

d. Provide glass fiber and metal closures, baffles and perforation blocks as shown on drawings to provide for air

SPECIFICATIONS
ROBERTSON SECTIONS DC-ADC, AIR CEILING AND SECTION #5

delivery through the ADC deck unit.

e. Recessed lighting troffers shall be located and erected as indicated on the contract drawings.

DC or ADC units adjacent to recessed lighting troffer opening shall be increased to gauges indicated on drawings to support the additional load.

Shelf tees required to support diffusers for troffer lighting shall be furnished by the deck manufacturer and installed as specified under "Carpentry" section of specifications.

PART 3—EXECUTION

3.01 ERECTION:

Erection shall be by manufacturer or his qualified erector with proven experience and competence. Inaccuracies in alignment or level of bearing plates and structural supports shall be brought to the attention of proper parties and corrected by others before placement of deck. Proper bearing shall be provided at supporting members.

Units shall be attached to steel supports with three ½" fillet welds per unit end. All welding shall be electric arc welding performed by competent welders. Side joint welding, when necessary due to heavy gauge deck or diaphragm shear requirements, should be carefully made in the upper region of the side lap to minimize damage to underside coating below the weld area. All welds upon cooling shall be given a touch-up coat of paint top side only. Self-aligning side joints shall be integrated by button punching on 3' centers.

All holes or openings shall be cut and reinforced as shown in manufacturer's layout drawings.

3.02 WORK NOT INCLUDED:

a. Painting — The touch-up of scuffs and abrasions due to transit or erection, the touch-up of charred points on the underside of the sidelap weld areas, as well as the field paint to the exposed surface of the galvanized steel deck shall be under the general painting specifications.

For those deck manufacturers who do not conform to the preparation and primer processes described by para. 2.01 Material, this contractor shall clean down the exposed flat surfaces, field prime with a suitable primer for galvanized metal and then apply the specified number of finished coats.

b. Steel Framing—All structural steel and structural steel attachments required to support the deck shall be furnished by the steel contractor. All steel framing shall be erected in conformance with tolerances set forth in AISC Standard Code of Practice.

c. Built-up Roofing—Insulation—(24" Type DC (ADC) flat plate down)—Insulation shall be rigid type roof insulation ____________ thick (minimum thickness and application based on roofer's standard recommendations) to span the 3" opening.

d. Openings (not covered under Design)
Electrical—plumbing—heating—ventilating.

(1) All trades whose work involves the cutting of holes, reinforcing or drilling the deck shall furnish all work and labor necessary and at the cost of that trade whose work is affected. All such work shall be done in a neat, workman-like manner, without adversely affecting the structural value of the deck or finished appearance of exposed surfaces.

(2) At the option of the various sub-contractors whose work involves the cutting of holes, reinforcing or drilling the deck, the deck contractor shall furnish all work and labor necessary only during the time of his work at the job site, at the cost to the sub-contractor whose work is affected and at prices to be agreed upon by both parties.

e. Electrical Work—The electrical contractor shall inspect all light troffer installations to assure that the opening width and height dimensions are acceptable for fixture installation and diffuser attachment.

f. Mechanical Work—When the ADC Air Ceiling units are to be used for air conditioning the mechanical contractor shall include all necessary cutting preparation and attachment of ducts to air cells and coordinate them with the AC system.

Photo Credits

Page Three

1. St. Paul Civic Center, St. Paul, Minnesota
2. Idaho State University Field House, Pocatello, Idaho
3. Essex Community College Field House, Essex, Maryland
4. Mississippi Coasts Coliseum, Biloxi, Mississippi
5. Notre Dame University Field House, South Bend, Indiana

Page Four

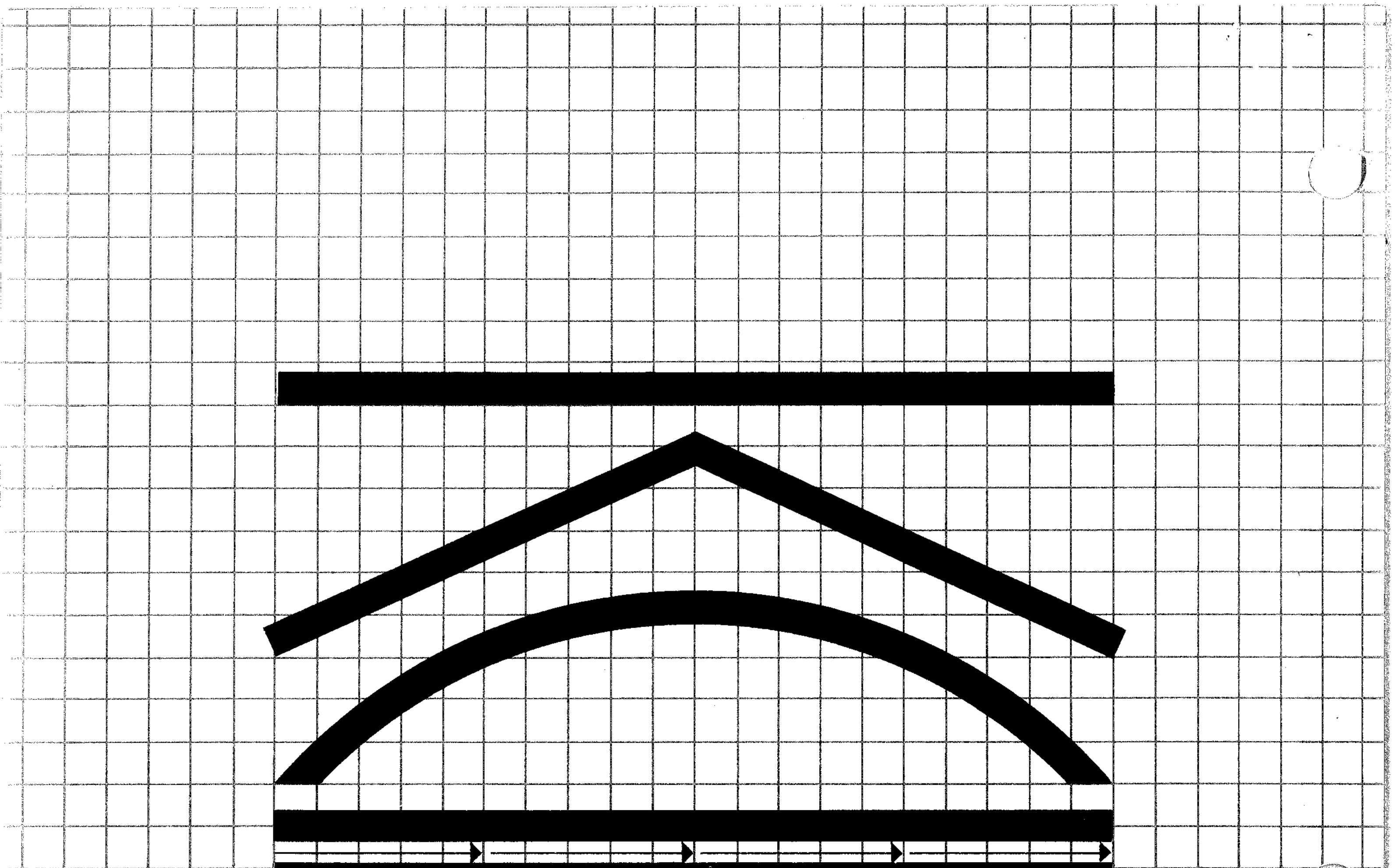
6. Southern Illinois University, Carbondale, Illinois
7. Westview School, LaGrange, Indiana
8. University of Michigan School of Architecture, Ann Arbor, Michigan
9. Robert Morris College, Pittsburgh, Pennsylvania

Page Five

10. Fayette County Correctional Facility, Lexington, Kentucky
11. Bay County Jail, Panama City, Florida
12. Baldwin County Correctional Facility, Milledgeville, Georgia
13. Parish Prison, New Orleans, Louisiana

Page Six

14. Logan International Airport, Boston, Massachusetts
15. Baxter-Travenol Laboratories, Chicago, Illinois
16. Sim Gideon Steam Plant, Bastrop, Texas
17. United Air Lines Baggage Claim Area, San Francisco, California



H. H. Robertson Company provides this publication for use in detailing some of its products and procedures which are available at the time of printing. The Company reserves the right to change or withdraw any products or procedures without notice. Current information and specific details can be obtained from your Robertson Sales Representative.

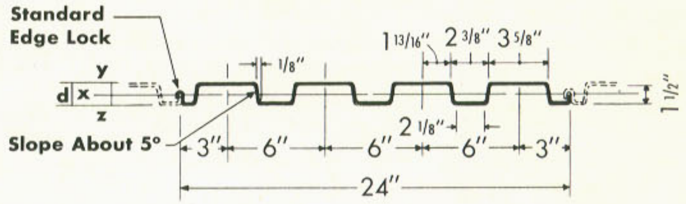
Robertson

H. H. Robertson Company
U.S. Building Products Division
400 Holiday Drive
Pittsburgh, Pa. 15220
(412) 928-7500

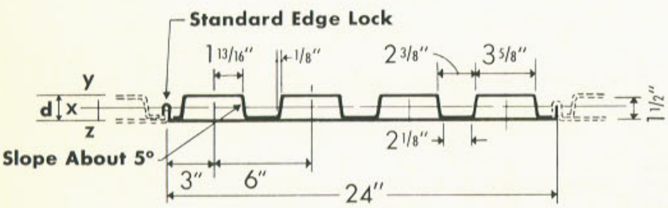
Printed in U.S.A.
Issued January, 1975
Reprinted March, 1981

Q-182-81 (SL)

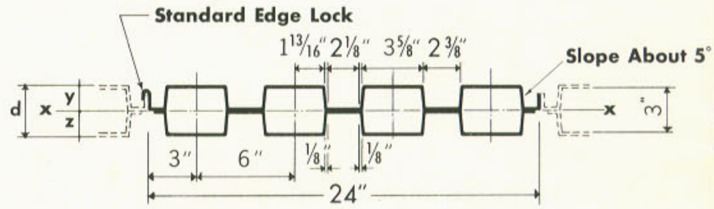
STANDARD ROBERTSON SECTIONS



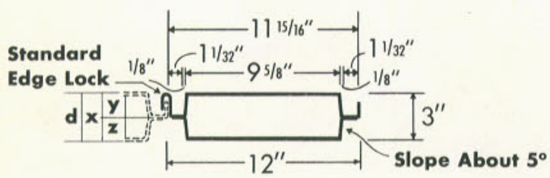
SEC. 3



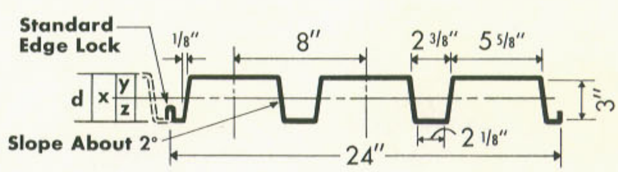
UKX



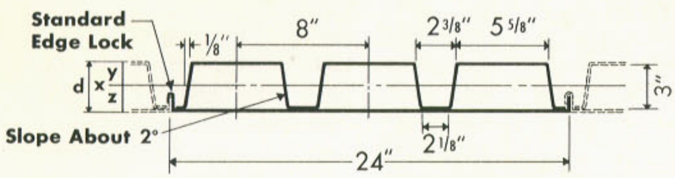
RK



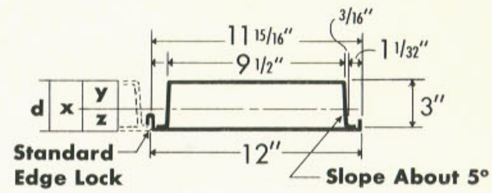
RKC



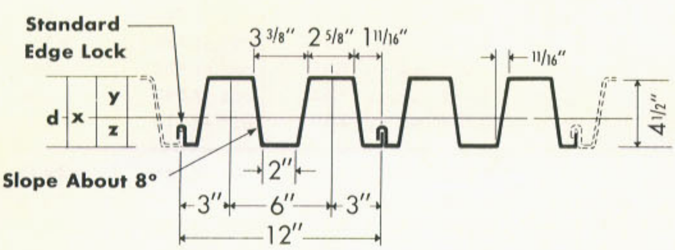
SEC. 21



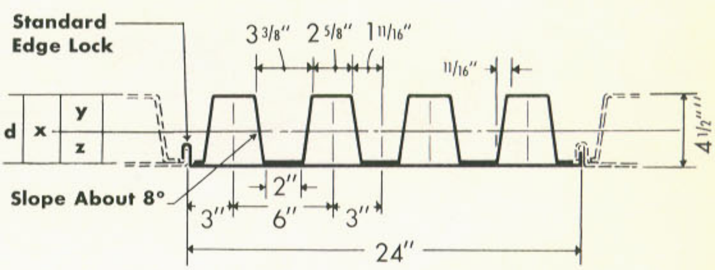
NKX



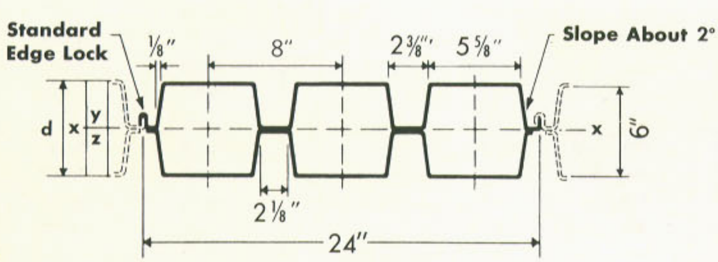
NKC



SEC. 12



FKX

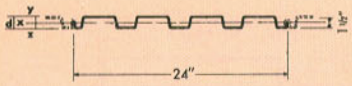
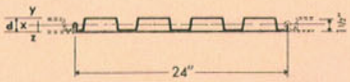
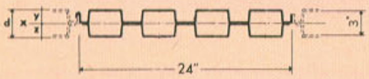
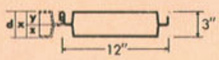
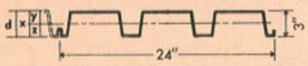
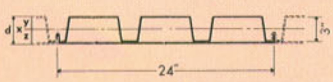
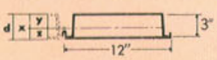
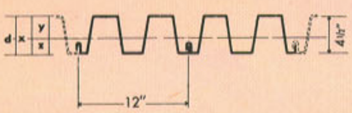
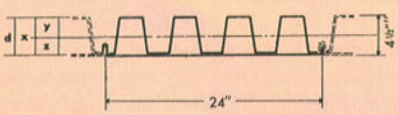
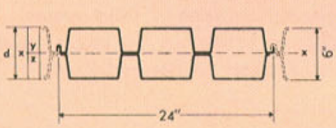


CK

The volume of masonry fill per square foot of floor surface (based on two inches above the top of the floor) is .22 cubic feet for Section 3, RK and UKX. For FKX and Section 12 it is 0.34 cubic feet per square foot of floor space. For NKX, CK and Section 21 the volume of concrete fill is 0.24 cubic feet per square foot of floor area. When 2½ inches of fill is required for the Section 3 type, FKX type and NKX type the volume of fill required respectively is 0.26, 0.38 and 0.28 cubic feet per square foot of floor space.

Note: Table of properties on pages 18 and 19. Load Tables on pages 20, 21 and 22.

TABLE OF PROPERTIES

Section	Section and Gauge	Wt./Sq. Ft. Lbs.	Overall Depth	Gross Area	Y Dist. In.	I for Defl. In.4
SEC. 3 	3-22	1.8	1.53	0.53	.826	.180
	3-20	2.3	1.53	0.65	.804	.230
	3-18	3.1	1.55	0.86	.764	.337
	3-16	3.8	1.56	1.07	.732	.442
	3-14	4.7	1.58	1.35	.712	.562
	3-12	6.5	1.61	1.84	.745	.756
UKX 	UKX 18-18	5.1	1.60	1.50	1.105	.566
	UKX 18-16	5.6	1.61	1.65	1.152	.603
	UKX 16-16	6.3	1.63	1.85	1.089	.763
	UKX 16-14	6.9	1.64	2.03	1.144	.820
	UKX 14-14	7.9	1.66	2.32	1.078	1.011
	UKX 12-12	11.0	1.72	3.24	1.085	1.373
RK 	RK 18-18	5.9	3.10	1.74	1.630	1.899
	RK 18-16	6.7	3.12	1.96	1.726	2.128
	RK 16-16	7.4	3.13	2.18	1.606	2.497
	RK 14-14	9.2	3.16	2.71	1.611	3.304
	RK 12-12	12.4	3.22	3.65	1.584	4.446
RKC 	RKC 16-16	6.73	3.12	1.94	1.840	2.238
	RKC 14-14	8.41	3.16	2.42	1.800	3.009
	RKC 12-12	11.78	3.22	3.39	1.750	4.729
SEC. 21 	21-22	2.3	3.030	0.65	1.633	.675
	21-20	2.8	3.036	0.78	1.595	.855
	21-18	3.7	3.048	1.04	1.530	1.258
	21-16	4.6	3.060	1.31	1.462	1.703
	21-14	5.8	3.075	1.63	1.393	2.264
	21-12	8.1	3.105	2.29	1.313	3.381
NKX 	NKX 18-18	5.7	3.096	1.69	2.149	2.125
	NKX 18-16	6.3	3.108	1.86	2.214	2.226
	NKX 16-16	7.2	3.120	2.11	2.109	2.888
	NKX 16-14	7.9	3.134	2.32	2.204	3.084
	NKX 14-14	9.0	3.149	2.64	2.068	3.903
	NKX 12-12	12.6	3.209	3.68	2.014	6.049
NKC 	NKC 16-16	6.35	2.995	1.89	2.18	2.05
	NKC 14-16	7.20	3.010	2.14	2.04	2.67
	NKC 14-14	7.94	3.024	2.35	2.14	2.86
	NKC 12-14	8.64	3.054	2.86	1.91	4.16
	NKC 12-12	11.10	3.084	3.29	2.07	4.67
SEC. 12 	12-20	3.7	4.53	1.01	2.494	2.933
	12-18	4.9	4.55	1.35	2.447	4.078
	12-16	6.0	4.56	1.69	2.419	5.195
	12-14	7.5	4.58	2.11	2.410	6.180
	12-12	10.4	4.61	2.89	2.501	8.587
FKX 	FKX 18-18	6.7	4.60	1.97	3.01	5.93
	FKX 18-16	7.2	4.61	2.12	3.13	6.30
	FKX 16-16	8.4	4.63	2.47	2.98	7.57
	FKX 16-14	9.1	4.64	2.68	3.11	8.06
	FKX 14-14	10.4	4.66	3.06	2.98	9.02
	FKX 12-12	14.5	4.72	4.26	3.07	12.59
CK 	CK 18-18	7.0	6.10	2.02	3.38	8.28
	CK 18-16	7.9	6.11	2.26	3.57	9.24
	CK 16-18	7.9	6.11	2.28	3.13	9.81
	CK 16-16	8.8	6.12	2.52	3.33	10.94
	CK 16-14	9.9	6.13	2.83	3.52	12.20
	CK 14-16	9.9	6.13	2.85	3.07	12.97
	CK 14-14	11.0	6.15	3.16	3.27	14.40
	CK 14-12	13.1	6.18	3.76	3.57	17.00
	CK 12-14	13.3	6.18	3.81	2.86	18.32
	CK 12-12	15.4	6.21	4.42	3.19	21.62

S.M. In.^{3}	Coef. of Strength in Bending	Coefficient of Deflection At 1/360	Safe End Reaction 3" Bearing
.203	2,705	7,900	855
.265	3,530	10,070	1,294
.398	5,310	14,700	2,240
.506	6,750	19,350	3,357
.633	8,445	24,575	4,916
.880	11,725	33,000	8,648
.472	6,290	24,700	2,240
.481	6,420	26,350	2,240
.654	8,700	33,350	3,357
.667	8,900	35,850	3,357
.893	11,900	44,200	4,916
1.353	18,000	60,000	8,648
1.104	14,725	83,000	2,240
1.168	15,525	93,000	2,240
1.483	19,775	109,100	3,357
1.982	26,425	144,400	4,916
2.865	38,200	194,300	8,648
1.140	15,200	97,800	1,679
1.560	20,770	131,500	2,458
2.520	33,650	206,675	4,324
.386	5,150	29,500	468
.500	6,660	37,400	766
.755	10,100	55,000	1,442
.982	13,100	74,400	2,266
1.261	16,800	99,000	3,409
1.823	24,300	147,800	6,191
.909	12,120	92,900	1,442
.923	12,300	97,300	1,442
1.260	16,800	126,200	2,266
1.285	17,140	134,800	2,266
1.746	23,300	170,600	3,409
2.833	37,800	264,400	6,191
.85	11,330	89,750	1,510
1.18	15,720	116,550	2,270
1.20	16,000	124,750	2,270
1.99	26,450	181,750	4,127
2.04	27,230	203,850	4,127
1.126	15,000	128,170	940
1.610	21,460	178,200	1,922
2.107	28,100	227,000	3,026
2.694	35,915	270,100	4,608
3.433	45,775	375,300	8,366
1.90	25,330	259,000	1,922
1.94	25,885	275,400	1,922
2.49	33,160	331,100	3,026
2.54	33,900	352,200	3,026
3.18	42,470	394,200	4,608
4.10	54,660	550,600	8,366
2.32	31,000	362,000	1,442
2.45	32,700	403,800	1,442
2.95	39,400	428,700	1,442
3.11	41,500	478,000	2,266
3.28	43,700	533,000	2,266
3.97	52,900	567,000	2,266
4.18	55,700	629,000	3,409
4.51	60,100	743,000	3,409
5.31	70,700	800,800	3,409
6.50	86,600	945,000	6,191

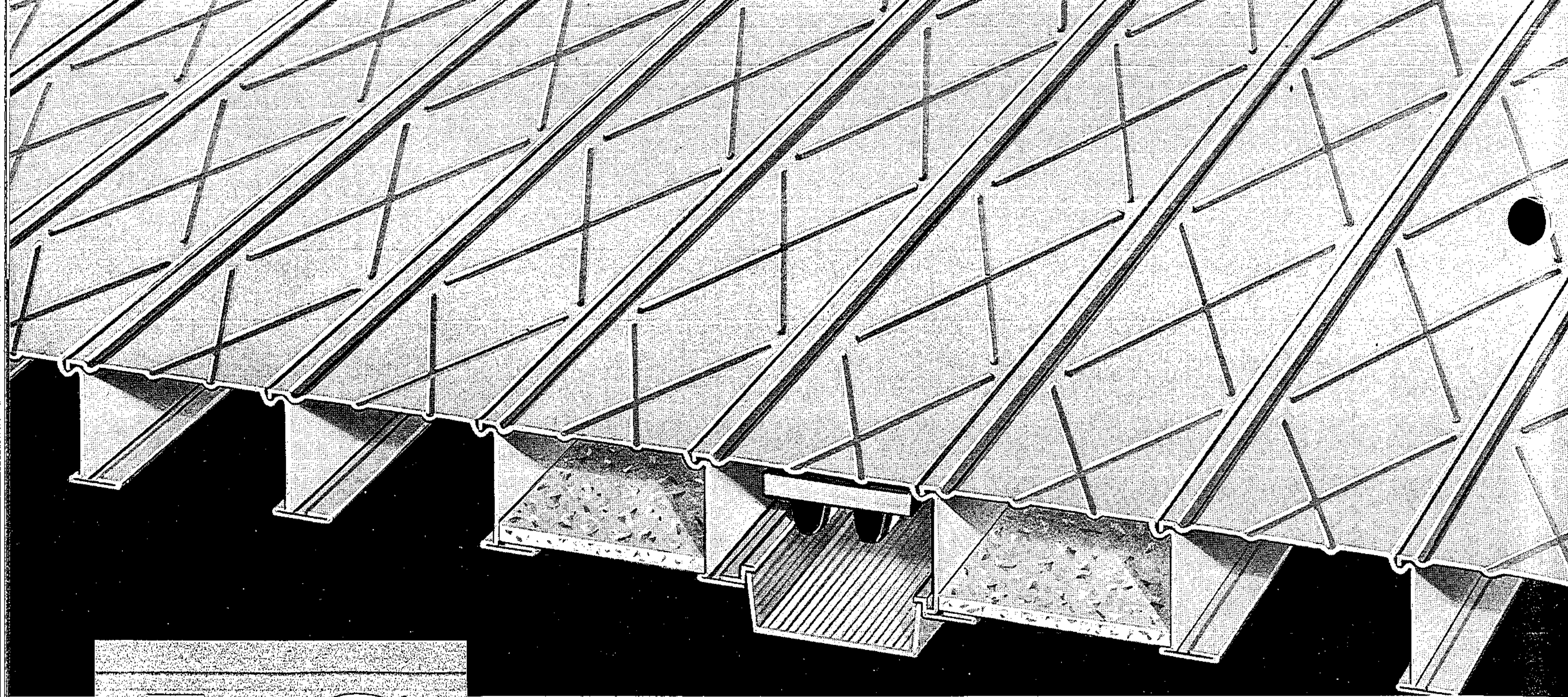
NOTES

Welded sections are designated by type and gauge of material. Letters designate type—RK, RKC, UKX, CK, FKX and NKX. The first number following the letters indicates the gauge of metal in the top element and the second number indicates the gauge of metal in the bottom element.

1. All properties of all sections have been computed in accordance with A.I.S.I. Specifications for Design of Light Gauge Steel Structural Members. (See Note 4).
2. "Y" values show distance from top of unit as used to center of gravity of unit.
3. All values given in table are for one-foot-widths of units.
4. End bearing values established by actual tests with a safety factor of 1.65 on yield strength.
5. To find total allowable uniformly distributed load per square foot, divide coefficient of bending given in table by the length of the span in feet squared. To find the allowable load which would cause the unit to deflect not greater than 1/360th of the span, divide the coefficient of deflection in column so marked by the cube of the length of the span in feet.
6. When the floor is continuous over three or more spans, the above coefficient of strength may be increased by 1.25 and the coefficient of deflection increased by 1.89. When it is continuous over two spans, the above coefficient of strength shall be used as is and the coefficient of deflection may be increased by 2.40.
7. As with steel beams, it is generally considered good practice to limit the span of floor units to 25 times their depth. Due to increased stiffness resulting from the addition of concrete fill over the top of the steel floor, the depth under that condition may be considered as being the total depth of the concrete and the steel floor.
8. When used for electrical raceways, the Underwriters' Laboratories approval requires 16 gauge minimum thickness of steel for bottom element and 18 gauge minimum thickness for top element with minimum concrete fill of 2½".

NOTE: UK, FK and NK available. Their properties are almost identical to UKX, FKX and NKX. Check with H. H. R. Co. District Office.

U.S. patent 2,694,475.



Robertson Long Span Roof Deck Simplicity.... Flexibility

The essence of a designer's wish is expressed in Robertson LS Deck units . . . simplicity of design . . . flexibility of application. The deck unit is available in 4.5", 6.0" and 7.5" depths, in 20, 18, 16 and 14 gauges, permitting spans to 32' for certain roof loads. (See property tables on page 11.) Longer lengths, up to 50', can be obtained for overhangs.

Unique design, efficient use of metal, plus the Robertson "stiffened web", achieve an exceptional strength-weight ratio for maximum economy. Complete uniformity is insured by cold forming in a continuous rolling operation.

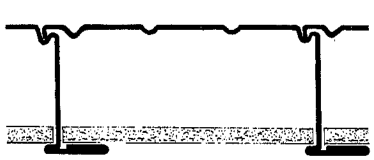
The architect may select almost any type of ceiling treatment. LS Deck can be left exposed for various applications; canopies, loading docks or other similar uses. It can be finished at any time with recessed lights and acoustic tile for schools, offices and other similar structures.

LS Deck is designed in accordance with American Iron & Steel Institute's specifications for light gauge structural members. With its continuous top sheet, it is easily adapted for use as a roof diaphragm for the transmittal of lateral forces due to seismic action or wind. A series of seven full scale tests, conducted at Cornell University by an independent consulting structural engineer, substantiate the performance of LS Deck for this usage. Table on page 11 lists lateral diaphragm design shears for the various depths, type and gauge sections.

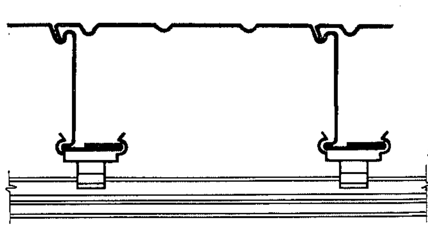
COMPLETE CEILING VERSATILITY

acoustical treatment

Acoustical tiles or pans offering a variety of aesthetic and color effects may be inserted on the integral shelf of the lower flanges of LS Deck for a finished acoustical ceiling. The resultant system, with standard acoustical units, produces a Noise Reduction Coefficient range of .70 to .80, based on tests conducted at Riverbank Acoustical Laboratories.



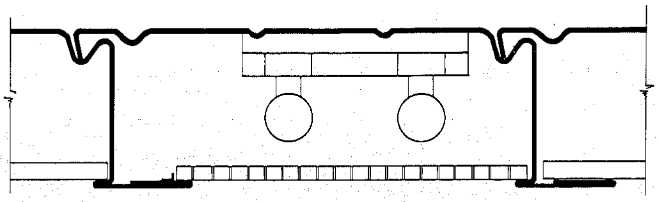
ACOUSTICAL TILE OR BOARD



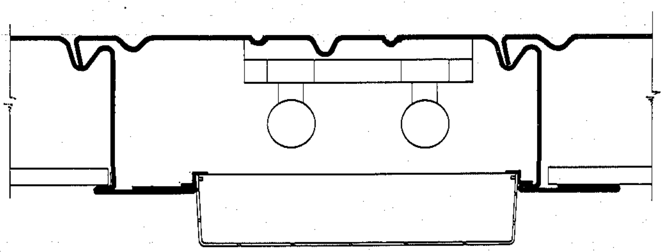
SUSPENDED METAL PAN

lighting

Various types of standard fluorescent fixtures can be readily installed in the space between webs of the deck units to provide a "recessed troffer" lighting effect. Interior surfaces of deck recess may be painted white to afford greater reflectivity. The integral lower flange shelves provide ready support for the diffuser which should be positively attached to prevent unintentional dislodgement, yet allow access for maintenance.

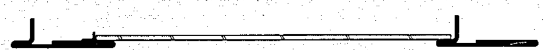


PLASTIC LOUVER



SNAP-IN PLEXIGLAS

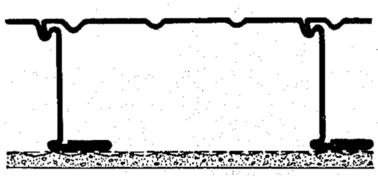
HOLOPHANE LENS



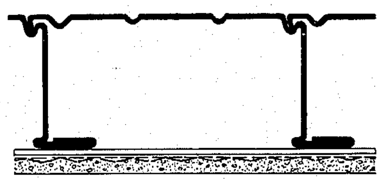
PRISMATIC PLASTIC LENS

fireproofing

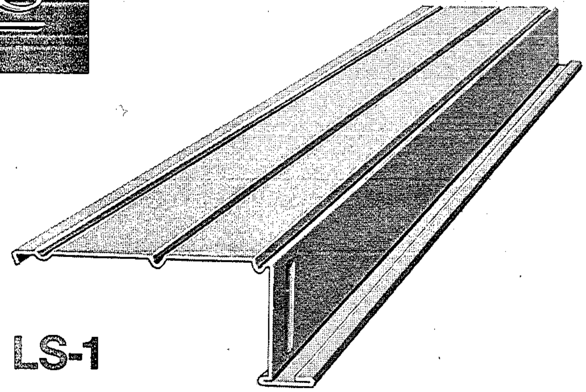
Where areas require fire-rated construction, sprayed on ceiling protection provides a simple economical method of acquiring the necessary hourly rating.



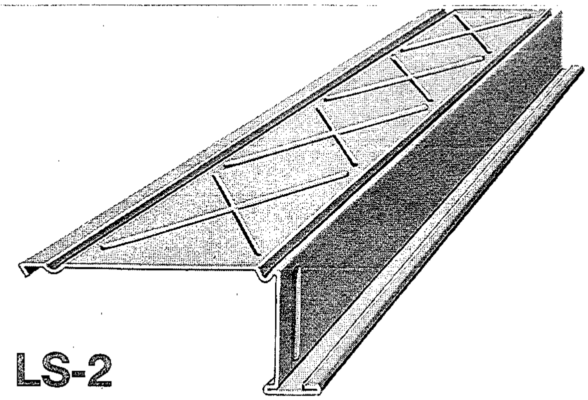
SPRAYED-ON
ACOUSTIC
FIREPROOFING



¼" DIA. WELDED RODS
WITH SPRAYED-ON
ACOUSTIC FIREPROOFING



LS-1



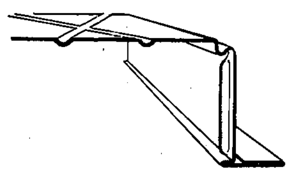
LS-2

LS-1 and LS-2 differ in their distribution of metal and the method of top (compression) flange stiffening to achieve a maximum strength property range with a minimum number of sections. LS-1 is designed for HEAVIER than normal roof loads or where MODERATE seismic or wind shear forces must be handled with nominal horizontal deflection.

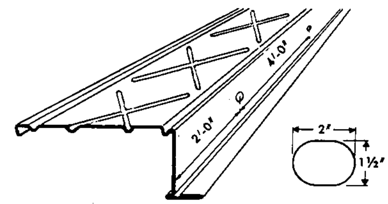
LS-2 is recommended for NORMAL roof loads or where HIGH seismic or wind shear forces must be handled with minimum horizontal deflections. The "X" pattern of the stiffening embossments acts similar to structural "X" bracing, resulting in higher load carrying ability and lower horizontal deflection under seismic or wind loading.

features

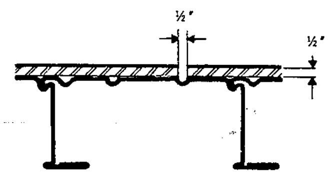
INTEGRAL WEB STIFFENER—In balanced design, Robertson's LS web element is sufficient for shear transfer. The exclusive "web stiffener," formed as an integral part of the section, provides web strength exceeding that of two unstiffened webs of equal gauge, as determined by witnessed tests, results of which are available upon request.



ACCESS HOLES—Electrical wiring perpendicular to the span of LS Deck is usually accomplished at butt joints. However, when specified, Robertson supplies LS Deck with two access holes near one end of the unit. These afford additional access for cross-wiring and connections without extending above or below the deck structure.

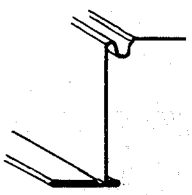


FLAT TOP PLATE—The top plate opening of only ⅝" permitting the use of a minimum ½" thickness of roof insulation, presents a supporting area of nearly 100% for the insulation and a ready, flat working surface.

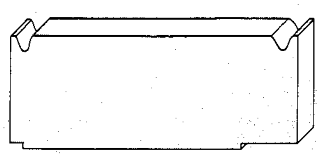


VAPOR PERMEABILITY—Recent tests run by the engineering department of a leading University using the desiccant method of ASTM C 355-59T for the rate of water vapor transmission of LS Deck, established an average of only .25 perm. This eliminates the necessity of vapor barriers on LS Deck.

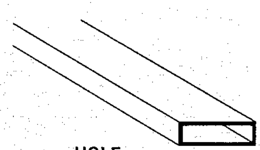
accessories



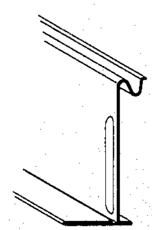
REINFORCING WEB



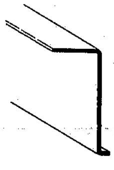
NEOPRENE
PROFILE CLOSURE
For sound and sight



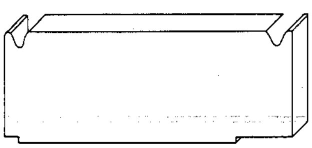
HOLE
REINFORCING
TUBE
3½" x 1" x 14 GA.



STARTING
CHANNEL

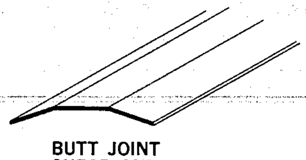


"Z" PLATE

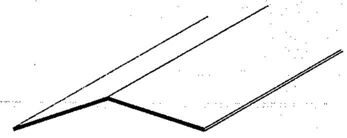


14 GAUGE
PROFILE PLATE

SEISMIC SHEAR TRANSFER ELEMENTS



BUTT JOINT
SHEAR AND
COVER PLATE



RIDGE PLATE

properties

Section & Gauge	Wt./Sq. Ft. Lbs.	Overall Depth	I In.^{4}	S.M. In.^{3}	Coeff. Of Strength In Bending	Coeff. Of Deflection L/360	Coeff. Of Deflection L/240	Web Strength* Value 2" Min. Bearing/End/Ft. of Width
7.5 LS2-18	4.3	7.548	9.10	2.03	27070	397710	596560	1260
7.5 LS2-16	5.5	7.560	13.00	2.98	39730	568150	852230	2110
7.5 LS1-18	4.5	7.548	11.73	2.46	32800	512650	768970	1260
7.5 LS1-16	5.6	7.560	15.30	3.11	41470	668670	1003010	2110
7.5 LS1-14	6.9	7.575	19.72	3.92	52270	861840	1292760	2110
6.0 LS2-20	3.1	6.036	3.95	1.14	15200	172630	258950	580
6.0 LS2-18	4.0	6.048	5.55	1.53	20400	242560	363840	1290
6.0 LS1-18	4.3	6.048	7.21	1.87	24930	315110	472660	1290
6.0 LS1-16	5.2	6.060	9.40	2.36	31470	410820	616230	2050
4.5 LS2-20	2.8	4.536	2.05	0.77	10230	89580	134390	380
4.5 LS2-18	3.7	4.548	2.88	1.03	13730	125870	188800	950
4.5 LS1-18	4.0	4.548	3.87	1.32	17600	169130	253700	950
4.5 LS1-16	5.0	4.560	5.03	1.66	22130	219830	329750	1530

NOTES:

*1. Web strength values for LS deck derived from test data.

2. All tabulation has been computed in accordance with the A.I.S.I. "Standard Specifications for Design of Light Gage Steel." Values given are for 12" width.

3. Coefficients of Strength and Deflection given are for simple spans. To obtain the uniformly distributed load in pounds per square foot, which any section will carry on a simple span at stress not to exceed 20,000 p.s.i., divide coefficient of strength of that section by span in feet squared. To find the uniformly distributed live load permissible for a deflection not to exceed L/240 or L/360 of a span (as required) divide coefficient of deflection by the span in feet cubed.

4. Properties apply to simple span condition only. For multiple span and cantilever conditions consult H. H. R. Co. District Office.

5. When specifying LS deck units, designate by depth, type and gauge. As an example, 7.5 LS-2-18 would indicate 7.5" depth LS-2 type in 18 gauge material.

design shears

Depth	Deck Type	Gauge	Design Shear (#/LF)*
4.5	LS2	20	510
4.5	LS2	18	860
4.5	LS1	18	790
4.5	LS1	16	890
6.0	LS2	20	510
6.0	LS2	18	860
6.0	LS1	18	575
6.0	LS1	16	650
7.5	LS2	18	860
7.5	LS2	16	970
7.5	LS1	18	575
7.5	LS1	16	650
7.5	LS1	14	720

*All recommended design shear values in the above table are based on a safety factor of 3 applied to the failure shear values from tests. This is the generally accepted safety factor for use in designing light gauge steel diaphragms to resist seismic action or wind. The above design shear values are applicable for all deck spans up to the maximum span for each deck unit under vertical loading.

selection table **Total Load (dead + live) shown in pounds per square ft.**

LS 7.5 MAX. LENGTH 50'-0"	Type of Span	Rib Depth	Unit Type & Gauge	Purlin Spacing 20'-0"	21'-0"	22'-0"	23'-0"	24'-0"	25'-0"	26'-0"	27'-0"	28'-0"	29'-0"	30'-0"	31'-0"	32'-0"
	Simple Span	7.5"	LS2-18	68	61	56	51	47	43	40	37	35	32	30	28	26
			LS1-18	82	74	68	62	57	52	49	45	42	39	36	34	32
			LS2-16	99	90	82	75	69	64	59	55	51	47	44	41	39
			LS1-16	104	94	86	78	72	66	61	57	53	49	46	43	40
			LS1-14	131	119	108	99	91	84	77	72	67	62	58	54	51

LS 6.0 MAX. LENGTH 50'-0"	Type of Span	Rib Depth	Unit Type & Gauge	Purlin Spacing 16'-0"	17'-0"	18'-0"	19'-0"	20'-0"	21'-0"	22'-0"	23'-0"	24'-0"	25'-0"	26'-0"	27'-0"	28'-0"
	Simple Span	6.0"	LS2-20	59	53	47	42	38	34	31	29	26	24	22	21	19
			LS2-18	80	71	63	57	51	46	42	39	35	33	30	28	26
			LS1-18	97	86	77	69	62	57	52	47	43	40	37	34	32
			LS1-16	123	109	97	87	79	71	65	59	55	50	47	43	40

LS 4.5 MAX. LENGTH 50'-0"	Type of Span	Rib Depth	Unit Type & Gauge	Purlin Spacing 10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"	16'-0"	17'-0"	18'-0"	19'-0"	20'-0"	21'-0"	22'-0"
	Simple Span	4.5"	LS2-20	75*	69*	63*	58*	52	45	40	35	32	28	26	23	21
			LS2-18	137	113	95	81	70	61	54	48	42	38	34	30	28
			LS1-18	176	145	122	104	90	78	69	61	54	48	43	38	35
			LS1-16	221	183	154	131	113	98	86	77	68	60	53	48	43

NOTES: 1. *Indicates end bearing governs. 2. For multiple span and cantilever conditions consult H.H.R. Company District Office. 3. In this table the dead load was assumed to be the weight of the deck and 7 p.s.f. for insulation and built-up roofing.

SPECIFICATION LS DECK

1. GENERAL—All roof areas noted on the plans shall be covered with LS deck as manufactured by H. H. Robertson Company.

2. MATERIAL—LS deck and flashing shall be formed from steel sheets conforming to ASTM A-245-64. The steel shall have received before being formed, a metal protective coating of zinc conforming to ASTM A525-65T wiped coating and to Federal Specification QQ-S-775 c Type 1, class e. Units shall be (select depth, type and gauge in accordance with the following nomenclature): Examples: 4.5 LS1-16, 7.5 LS2-18, etc.

3. CONSTRUCTION–LS deck shall consist of a one piece, single web section, having integral stiffening ribs formed in the top flange. Deck units shall have a lower flange 2⅞" wide to provide maximum lateral stability and an integral shelf on each side of the web for support of acoustical or light diffusing elements. At the ends of deck units, vertical stiffening ribs shall be impressed as an integral part of the webs to provide a web strength equal to or exceeding that of two unstiffened webs. The webs (shall) (shall not) (select one) have shop-punched electrical access holes for transverse passage of wiring. Side joints shall be interlocking (male-female) and continuous for the length of the section. LS deck shall have a coverage width of 12". The sections shall be formed in 4.5", 6" and 7.5" depth, of 20, 18, 16 and 14 USS gauge steel and of types LS1 and LS2 as designated in "Material" above.

4. SHOP FINISH—LS deck shall have the standard metal coated finish without any additional shop treatment.

5. DESIGN—LS deck shall be capable of carrying the specified total loads with a maximum fiber stress not to exceed 20,000 psi on the actual thickness of metal. Maximum allowable deflection under roof live load shall not exceed (L/240) (L/360) of the span length. Design load (dead load + live load) shall be taken from the contract drawings without allowance for impact. Deck design is to be in accordance with the American Iron and Steel Institute's "Specification for the Design of Light Gage Cold-Formed Steel Structural Members, 1962."

LS Deck shall be capable of providing continuous bracing for the compression flange of all horizontal roof supporting members such as beams, girders, arches and trusses so that the compression flange can carry the full design stress. Welding of the deck shall be proportioned to the bracing force required. (Design specifications to state the minimum horizontal shear values to be provided by the deck).

6. ERECTION–LS deck, as manufactured by H. H. Robertson Company, is to be installed by qualified deck erector. All LS deck shall be laid in strict accordance with the manufacturer's instructions below and as shown on the layout prepared for erector's use.

1. Inaccuracies in alignment or level of supporting members shall be brought to the attention of the proper parties in writing and corrected by others before the deck is placed to insure compliance of supporting steel, plates or walls with the design drawings and deck manufacturer's layout details.

2. Starting Point—all starting points are shown on the LS Deck layout thus; ⊕

3. Weld starting web to supports with fillet welds centered at the base of bottom flange. Hold 90° angle between web and support.

4. Place succeeding units, performing each of the following 3 operations, in order, before proceeding to the next unit.

A. Place next unit.
Locate the leading edge of bottom flange and weld to supports with welds centered at base of bottom flanges.

B. Check and hold 90° angle between web and support.

C. Weld top longitudinal joints at each end of deck unit. Note: Side of ½" lip not necessarily in contact with side of female joint, since holding coverage at bottom flange and 90° angle of webs to support governs.

5. Proceed with remaining longitudinal joint, welding 2'-6" on centers, or as otherwise specified in detail.

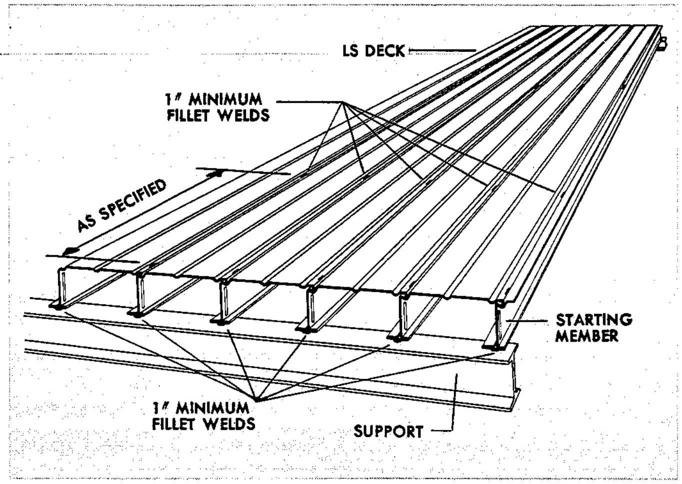
6. Place succeeding sheet in the initial bay in the same manner, *making certain that units are welded as they are placed.* Longitudinal joint welding can be done as each sheet is laid or after the entire deck is in place, depending on size of the job. The erector shall decide which procedure is most economical in each case.

7. LS Deck installed in adjoining bays in the same manner must be aligned, web for web, and immediately welded.

8. After welds have cooled, apply a touch-up coat of a suitable aluminum colored metal primer.

9. The treatment of end joints will vary with job requirements. The proper details for a given job will be indicated on the LS Deck layout.

10. Insert rubber void closures, where required.



7. WORK TO BE INCLUDED IN OTHER CONTRACTS

(a) Painting—The field preparation and painting of the exposed surface of the metal coated steel deck shall be covered under the General Painting Specifications.

(b) Acoustic Treatment—Furnishing and application of the acoustic treatment shall be covered under the Acoustic Specifications.

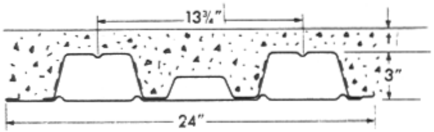
(c) Lighting—Furnishing and installation of lighting shall be covered under the Electrical, Wiring and Lighting Specifications. The electrical contractor shall inspect all LS Deck installations to determine that opening width and height dimensions are acceptable for fixture installation and diffuser attachment.

(d) Steel Framing—All structural steel and structural steel attachments required to adequately support the deck shall be furnished by others. All steel framing shall be erected in conformance with the tolerances set forth in the AISC Standard Code of Practice.

(e) Miscellaneous—All trades whose work involves the cutting of holes, reinforcing or drilling of deck, shall furnish all work and labor necessary and at the cost of those trades. All such work done shall be in strict accordance with the deck manufacturer's instructions and in a neat, workmanlike manner, without damage to roof deck units or accessories.

(f) Built-up Roofing—(1) Insulation shall be as required (minimum ½" thick) and shall be applied according to manufacturer's recommendation. (2) Roofing shall be mopped to the insulation according to the manufacturer's recommendations (to be furnished and installed by the built-up roofing contractor).

QL-GKX-24"-20/20



Section Properties Steel Unit Only

$I_s = 1.440$
$(+)S_t = .637$
$(+)S_b = 1.533$
$(-)S_t = .648$
$(-)S_b = 1.200$

Denotes shoring required on simple spans, no shoring on multiple spans.

Denotes shoring required on simple and 2-span conditions only.

Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9

Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	46.0	52.0	57.5
V_R Lbs.	1027	1120	1218
I_c	9.881	12.474	15.451
S_{cc}	5.204	6.105	7.084
S_{bc}	3.114	3.535	3.971

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
8.	256	280	304
8.5	241	263	286
9.	228	248	270
9.5	216	235	256
10.	205	224	243
10.5	195	213	195
11.	186	170	184
11.5	150	162	175
12.	142	154	166
12.5	136	146	158
13.	129	139	150
13.5	123	133	143
14.		127	137

N=14

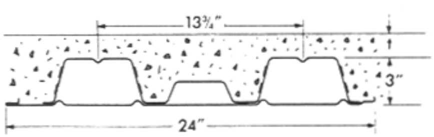
Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	35.8	40.3	47.2
V_R Lbs.	1026	1111	1251
I_c	8.520	10.781	14.818
S_{cc}	3.869	4.532	5.638
S_{bc}	2.969	3.376	4.012

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
8.	256	277	312
8.5	241	261	294
9.	228	246	278
9.5	216	233	263
10.	205	222	250
10.5	195	211	238
11.	186	202	227
11.5	178	193	188
12.	171	160	178
12.5	142	153	170
13.	136	146	162
13.5	130	139	155
14.		134	149

QL-GKX-24"-18/20



Section Properties Steel Unit Only

$I_s = 1.781$
$(+)S_t = .872$
$(+)S_b = 1.712$
$(-)S_t = .839$
$(-)S_b = 1.342$

Denotes shoring required on simple spans, no shoring on multiple spans.

Denotes shoring required on simple and 2-span conditions only.

Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9

Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	46.7	52.8	58.2
V_R Lbs.	1016	1104	1198
I_c	10.611	13.436	16.697
S_{cc}	5.364	6.290	7.305
S_{bc}	3.417	3.897	4.396

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	225	245	266
9.5	214	232	252
10.	203	220	239
10.5	193	210	228
11.	184	200	217
11.5	176	192	208
12.	169	184	199
12.5	162	176	154
13.	156	137	147
13.5	122	130	140
14.		125	134
14.5		119	128
15.		114	123

N=14

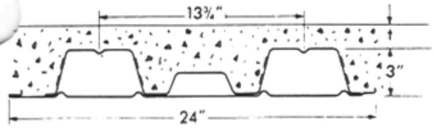
Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	36.5	41.1	47.9
V_R Lbs.	1021	1100	1233
I_c	9.077	11.519	15.897
S_{cc}	3.981	4.661	5.797
S_{bc}	3.237	3.701	4.426

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	226	244	274
9.5	215	231	259
10.	204	220	246
10.5	194	209	234
11.	185	200	224
11.5	177	191	214
12.	170	183	205
12.5	163	176	197
13.	157	169	189
13.5	151	162	153
14.		132	146
14.5		127	140
15.		122	134

QL-GKX-24"-18/18



Section Properties Steel Unit Only

$I_s = 1.928$
$(+)S_t = .893$
$(+)S_b = 2.056$
$(-)S_t = .875$
$(-)S_b = 1.756$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.
▨ Denotes shoring required on simple and 2-span conditions only.
■ Denotes shoring required on all span conditions.
__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	47.4	53.4	58.8
V_R Lbs.	1028	1117	1211
I_c	12.076	15.253	18.910
S_{cc}	5.755	6.741	7.816
S_{bc}	4.028	4.576	5.143

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	228	248	269
9.5	216	235	255
10.	205	223	242
10.5	195	212	230
11.	187	203	220
11.5	178	194	210
12.	171	186	201
12.5	164	178	156
13.	158	138	149
13.5	123	132	142
14.		126	135
14.5		120	129
15.		115	124

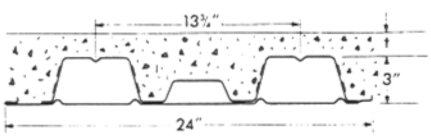
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	37.1	41.7	48.5
V_R Lbs.	1032	1112	1245
I_c	10.234	12.981	17.859
S_{cc}	4.245	4.974	6.175
S_{bc}	3.811	4.347	5.171

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	229	247	276
9.5	217	234	262
10.	206	222	249
10.5	196	211	237
11.	187	202	226
11.5	179	193	216
12.	172	185	207
12.5	165	177	199
13.	158	171	191
13.5	153	164	154
14.		133	148
14.5		128	141
15.		123	136

QL-GKX-24"-16/20



Section Properties Steel Unit Only

$I_s = 2.100$
$(+)S_t = 1.066$
$(+)S_b = 1.866$
$(-)S_t = 1.022$
$(-)S_b = 1.469$

☐ Denotes shoring required on simple spans, no shoring on multiple spans.
▨ Denotes shoring required on simple and 2-span conditions only.
■ Denotes shoring required on all span conditions.
__ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9 Concrete Weight=145 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	47.5	53.5	58.9
V_R Lbs.	1009	1092	1183
I_c	11.299	14.339	17.865
S_{cc}	5.515	6.464	7.508
S_{bc}	3.708	4.245	4.807

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	224	242	262
9.5	212	230	249
10.	201	218	236
10.5	192	208	225
11.	183	198	215
11.5	175	190	205
12.	168	182	197
12.5	161	174	189
13.	155	168	182
13.5	149	161	138
14.		123	132
14.5		118	126
15.		113	120

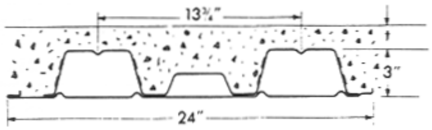
N=14 Concrete Weight=110 pcf
Concrete Strength (f'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	37.2	41.8	48.7
V_R Lbs.	1019	1092	1219
I_c	9.599	12.208	16.898
S_{cc}	4.088	4.782	5.944
S_{bc}	3.493	4.012	4.824

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	226	242	271
9.5	214	230	256
10.	203	218	243
10.5	194	208	232
11.	185	198	221
11.5	177	190	212
12.	169	182	203
12.5	163	174	195
13.	156	168	187
13.5	151	161	180
14.		156	174
14.5		150	138
15.		121	133

QL-GKX-24"-16/18



Section Properties
Steel Unit Only

$I_s = 2.275$
$(+)S_t = 1.094$
$(+)S_b = 2.212$
$(-)S_t = 1.067$
$(-)S_b = 1.868$

▨ Denotes shoring required on simple spans, no shoring on multiple spans.

☐ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9

Concrete Weight=145 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	48.1	54.1	59.5
V_R Lbs.	1022	1106	1197
I_c	12.707	16.086	19.988
S_{cc}	5.885	6.890	7.989
S_{bc}	4.309	4.914	5.543

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	227	245	266
9.5	215	232	252
10.	204	221	239
10.5	194	210	228
11.	185	201	217
11.5	177	192	208
12.	170	184	199
12.5	163	177	191
13.	157	170	184
13.5	151	163	177
14.		158	133
14.5		119	128
15.		114	122

N=14

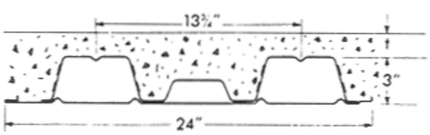
Concrete Weight=110 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	37.8	42.4	49.3
V_R Lbs.	1033	1106	1233
I_c	10.708	13.604	18.769
S_{cc}	4.340	5.078	6.300
S_{bc}	4.055	4.645	5.555

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	229	245	274
9.5	217	232	259
10.	206	221	246
10.5	196	210	234
11.	187	201	224
11.5	179	192	214
12.	172	184	205
12.5	165	177	197
13.	158	170	189
13.5	153	163	182
14.		158	176
14.5		152	170
15.		147	134

QL-GKX-24"-16/16



Section Properties
Steel Unit Only

$I_s = 2.422$
$(+)S_t = 1.116$
$(+)S_b = 2.549$
$(-)S_t = 1.102$
$(-)S_b = 2.313$

▨ Denotes shoring required on simple spans, no shoring on multiple spans.

☐ Denotes shoring required on simple and 2-span conditions only.

■ Denotes shoring required on all span conditions.

___ For use of design loads in excess of 200 psf (above horizontal line) see note 6a.

Refer to Design Notes.

N=9

Concrete Weight=145 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
Dead Load (psf)	48.7	54.8	60.2
V_R Lbs.	1032	1116	1207
I_c	14.023	17.735	21.996
S_{cc}	6.207	7.267	8.417
S_{bc}	4.902	5.578	6.273

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3
9.	229	248	268
9.5	217	235	254
10.	206	223	241
10.5	196	212	230
11.	187	203	219
11.5	179	194	210
12.	172	186	201
12.5	165	178	193
13.	158	171	185
13.5	152	165	178
14.		159	134
14.5		120	129
15.		115	123

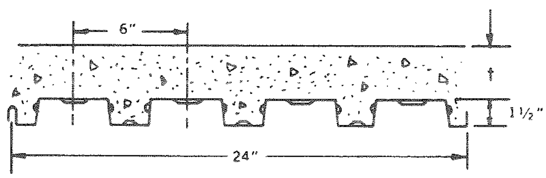
N=14

Concrete Weight=110 pcf
Concrete Strength (f 'c)=3000 psi
Slab Width=12 in.

	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
Dead Load (psf)	38.4	43.0	49.9
V_R Lbs.	1042	1116	1243
I_c	11.728	14.895	20.520
S_{cc}	4.555	5.333	6.613
S_{bc}	4.608	5.269	6.281

Total superimposed load, (PSF)

Span Feet	Concrete Slab Thickness, t (in.)		
	2.0	2.5	3.25
9.	231	248	276
9.5	219	234	261
10.	208	223	248
10.5	198	212	236
11.	189	202	226
11.5	181	194	216
12.	173	186	207
12.5	166	178	198
13.	160	171	191
13.5	154	165	184
14.		159	177
14.5		153	171
15.		148	135



SECTION PROPERTIES
Steel Unit Only

I_s = .23
(+) S_t = .265
(+) S_b = .291
(−) S_t = .298
(−) S_b = .261

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
Dead Load (psf)	39.4	45.5	51.5	57.5	63.6
V_R Lbs.	1047	1200	1356	1516	1678
I_c	2.850	3.929	5.209	6.695	8.388
S_{cc}	2.581	3.244	3.971	4.760	5.605
S_{bc}	1.269	1.539	1.816	2.100	2.388

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.5	4	4.5
6.	349	400	452	505	559
6.25	335	384	434	* 447	* 495
6.5	322	369	* 383	* 428	** 474
6.75	310	* 325	* 368	** 411	** 455
7.	* 273	* 313	** 353	** 395	** 437
7.25	* 263	* 301	** 340	** 380	*** 421
7.5	* 253	** 290	** 327	*** 366	*** 405
7.75	** 242	** 279	** 316	*** 353	*** 391
8.	** 224	** 270	*** 305	*** 341	*** 377
8.25	** 209	*** 261	*** 295	*** 329	*** 364
8.5	** 194	*** 246	*** 285	*** 318	*** 352
8.75	*** 186	*** 229	*** 273	*** 308	*** 341
9	*** 171	*** 214	*** 254	*** 294	*** 330
9.25	*** 157	*** 199	*** 236	*** 273	*** 309
9.5	*** 145	*** 186	*** 220	*** 254	*** 287
9.75	*** 134	*** 173	*** 205	*** 237	*** 267
10.	*** 124	*** 162	*** 192	*** 220	*** 248
10.25	*** 115	*** 151	*** 179	*** 205	*** 230
10.5	*** 107	*** 141	*** 166	*** 191	*** 214
10.75	*** 100	*** 132	*** 155	*** 178	*** 198
11.		*** 123	*** 144	*** 165	*** 184
11.25		*** 114	*** 134	*** 153	*** 170
11.5		*** 107	*** 125	*** 142	*** 157
11.75		*** 99	*** 116	*** 132	*** 145
12.		*** 92	*** 108	*** 122	*** 134

N=14

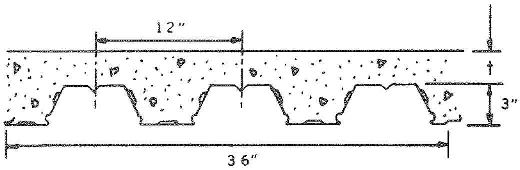
Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
Dead Load (psf)	30.4	35	37.3	39.6	45.9
V_R Lbs.	1030	1177	1252	1329	1544
I_c	2.460	3.411	3.956	4.548	6.424
S_{cc}	1.907	2.400	2.666	2.945	3.772
S_{bc}	1.195	1.456	1.590	1.726	2.108

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.5	3	3.25	3.5	4.1875
6.	343	392	417	443	514
6.25	329	376	400	425	494
6.5	317	362	385	409	475
6.75	305	348	371	393	* 427
7.	294	336	357	* 353	* 410
7.25	272	* 301	* 321	* 340	* 395
7.5	252	* 291	* 309	* 328	** 381
7.75	* 231	* 281	* 298	** 317	** 368
8.	* 210	** 268	** 288	** 306	** 355
8.25	* 191	** 250	** 274	** 296	*** 343
8.5	** 175	** 233	** 256	** 278	*** 332
8.75	** 160	** 218	*** 247	*** 270	*** 322
9.	** 147	*** 204	*** 231	*** 252	*** 310
9.25	** 136	*** 188	*** 217	*** 236	*** 290
9.5	*** 125	*** 174	*** 202	*** 221	*** 272
9.75	*** 116	*** 161	*** 186	*** 207	*** 255
10.	*** 107	*** 149	*** 173	*** 195	*** 239
10.25	*** 100	*** 138	*** 160	*** 183	*** 224
10.5	*** 93	*** 129	*** 149	*** 171	*** 210
10.75	*** 86	*** 120	*** 139	*** 160	*** 197
11.		*** 112	*** 130	*** 149	*** 185
11.25		*** 104	*** 121	*** 139	*** 173
11.5		*** 98	*** 113	*** 131	*** 162
11.75		*** 92	*** 106	*** 122	*** 152
12.		*** 86	*** 100	*** 115	*** 142

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.
——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.



SECTION PROPERTIES
Steel Unit Only

I_s = 1.221
(+) S_t = .816
(+) S_b = .769
(−) S_t = .803
(−) S_b = .712

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	45.6	51.7	57.7	63.8	75.9
V_R Lbs.	1951	2117	2299	2493	2903
I_c	6.672	8.534	10.704	13.190	19.125
S_{cc}	4.167	4.908	5.729	6.622	8.605
S_{bc}	1.916	2.219	2.539	2.872	3.567

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.	269	313	360	399	440
9.25	252	294	337	365	398
9.5	237	276	315	334	359
9.75	223	259	290	305	323
10.	209	244	266	278	289
10.25	197	229	244	253	259
10.5	186	213	224	230	** 355
10.75	175	196	204	209	** 330
11.	165	180	187	188	** 305
11.25	156	166	170	** 238	*** 311
11.5	147	152	** 198	** 225	*** 294
11.75	136	140	** 187	** 213	*** 277
12.	125	** 153	** 177	*** 209	*** 262
12.25	116	** 145	** 167	*** 198	*** 248
12.5	107	** 137	*** 164	*** 187	*** 234
12.75	** 113	** 130	*** 155	*** 177	*** 221
13.	** 107	*** 126	*** 147	*** 167	*** 209
13.25	** 101	*** 119	*** 139	*** 158	*** 198
13.5	*** 96	*** 113	*** 131	*** 150	*** 187
13.75		*** 107	*** 124	*** 141	*** 176
14.		*** 101	*** 117	*** 134	*** 167
14.25		*** 95	*** 111	*** 126	*** 157
14.5		*** 90	*** 105	*** 119	*** 148
14.75		*** 85	*** 99	*** 113	*** 140
15.			*** 93	*** 106	*** 131
15.25			*** 88	*** 100	*** 124
15.5			*** 83	*** 94	*** 116
15.75			*** 78	*** 89	*** 109
16.			*** 73	*** 83	*** 102

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	35.3	39.9	44.5	46.8	55.4
V_R Lbs.	1967	2116	2285	2375	2734
I_c	5.858	7.485	9.397	10.461	15.113
S_{cc}	3.143	3.685	4.290	4.615	5.952
S_{bc}	1.819	2.107	2.413	2.572	3.194

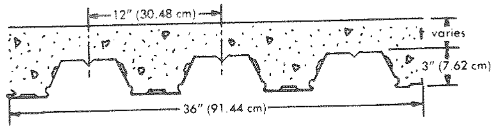
TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.	264	306	352	376	470
9.25	248	288	331	353	441
9.5	233	271	311	333	406
9.75	219	255	293	313	374
10.	207	241	277	296	344
10.25	195	227	261	279	317
10.5	184	214	247	263	391
10.75	174	203	233	244	267
11.	165	192	219	226	245
11.25	156	182	203	209	224
11.5	148	172	188	193	204
11.75	140	163	174	178	** 253
12.	133	154	161	164	** 240
12.25	126	143	149	151	** 228
12.5	119	133	138	** 172	** 217
12.75	113	123	** 153	** 164	*** 213
13.	108	115	** 145	** 156	*** 202
13.25	102	** 120	** 138	** 148	*** 192
13.5	96	** 114	** 132	*** 145	*** 183
13.75		** 108	*** 128	*** 138	*** 174
14.		** 103	*** 122	*** 131	*** 165
14.25		*** 99	*** 116	*** 124	*** 157
14.5		*** 94	*** 110	*** 118	*** 149
14.75		*** 90	*** 105	*** 112	*** 142
15.			*** 99	*** 107	*** 135
15.25			*** 94	*** 102	*** 128
15.5			*** 90	*** 96	*** 122
15.75			*** 85	*** 92	*** 116
16.			*** 81	*** 87	*** 110

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.

Q-LOCK FLOOR
QL-99-18 GA.



QL-99

QL-99-18

Steel Unit Only

I_s = 1.221 (166.74)
S_b = 0.769 (41.34)
S_t = 0.816 (46.29)

n = 14

Concrete Weight = 110 PCF (1762 Kg/m³)
Concrete Strength = 3000 PSI (211 Kg/cm²)
Slab Width = 12" (30.48 cm)

	CONCRETE SLAB THICKNESS (t)	
	3.25"	8 cm
Dead Load PSF (Kg/m²)	46.800	224
V_R	2375.000	3479
I_c	10.461	1369
S_{cc}	4.615	241
S_{bc}	2.572	134.8

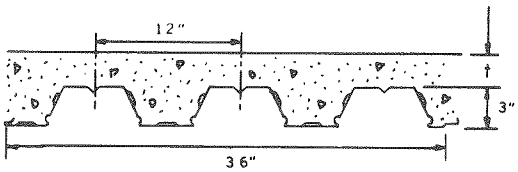
TOTAL SUPERIMPOSED LOAD POUNDS PER SQUARE FOOT (Kg/m²)

SPAN FEET	SPAN METER	SIMPLE SPAN — Concrete Slab Thickness (t) 3.25"	SIMPLE SPAN 8 cm	TWO SPAN — Concrete Slab Thickness (t) 3.25"	TWO SPAN 8 cm	THREE OR MORE SPANS — Concrete Slab Thickness (t) 3.25"	THREE OR MORE SPANS 8 cm
9.	2.5	376	2202	376	2202	376	2202
9.25	2.6	354	2016	354	2016	354	2016
9.5	2.7	333	1855	333	1855	333	1855
9.75	2.8	313	1709	313	1709	313	1709
10.	2.9	296	1577	296	1577	296	1577
10.25	3.0	279	1460	279	1460	279	1460
10.5	3.1	263	1352	264	1352	264	1352
10.75	3.2	244	1255	249	1255	249	1255
11.	3.3	226	1147	236	1167	236	1167
11.25	3.4	209	1040	224	1084	224	1084
11.5	3.5	193	937	212	1011	212	1011
11.75	3.6	178	845	201	942	201	942
12.	3.7	164	762	191	884	191	884
12.25	3.8	151	684	181	825	181	825
12.5	3.9	*178	* 791	*177	* 791	172	771
12.75	4.0	*169	* 742	*169	* 742	164	723
13.0	4.1	*160	* 693	*160	* 693	156	* 693
13.25	4.2	*152	* 649	*152	* 649	148	* 649
13.5	4.3	*145	* 605	*145	* 610	*145	* 610
13.75	4.4	*138	* 566	*138	* 571	*138	* 571
14.	4.5	*131	* 532	*131	* 532	*131	* 532
14.25	4.6	*124	* 498	*124	* 498	*124	* 498
14.5	4.7	*118	* 464	*118	* 469	*118	* 469
14.75	4.8	*112	* 435	*113	* 435	*113	* 435
15.	4.9	*107	* 405	*107	* 410	*107	* 410
15.25	5.0	*102	* 381	*102	* 381	*102	* 381
15.5		* 96		* 97		* 97	
15.75		* 92		* 92		* 92	
16.		* 87		* 87		* 87	

Note: *Denotes shored span; Design loads above heavy horizontal line, see Design Note 6 (a).
Data of other gages and depths of concrete for unusual design requirements are available from your H. H. Robertson Company representative.

Robertson

3"-QL-99-16



SECTION PROPERTIES
Steel Unit Only

I_s = 1.531
(+) S_t = 1.018
(+) S_b = .964
(−) S_t = 1.018
(−) S_b = .964

N=9

Concrete Weight = 145 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
Dead Load (psf)	46.5	52.6	58.6	64.6	76.7
V_R Lbs.	1960	2118	2294	2483	2885
I_c	7.892	10.088	12.656	15.605	22.671
S_{cc}	4.542	5.338	6.223	7.189	9.340
S_{bc}	2.35	2.722	3.116	3.527	4.386

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.5	4.5
9.	340	395	454	515	625
9.25	319	371	426	485	573
9.5	300	349	401	456	525
9.75	283	329	378	430	481
10.	266	310	356	398	440
10.25	251	292	336	367	402
10.5	237	276	318	339	367
10.75	224	261	295	313	334
11.	212	247	274	288	303
11.25	201	234	253	265	274
11.5	190	221	234	243	247
11.75	180	206	216	223	** 346
12.	171	191	200	204	** 324
12.25	162	177	184	186	** 302
12.5	154	165	169	** 236	** 281
12.75	146	152	* 196	** 224	** 262
13.	136	141	** 187	** 213	*** 277
13.25	127	* 154	** 178	** 203	*** 264
13.5	* 126	** 146	** 169	** 193	*** 250
13.75		** 139	** 161	** 184	*** 238
14.		** 132	** 153	*** 180	*** 226
14.25		** 126	** 146	*** 171	*** 215
14.5		** 120	*** 142	*** 162	*** 204
14.75		** 114	*** 135	*** 154	*** 194
15.			*** 128	*** 147	*** 184
15.25			*** 122	*** 139	*** 175
15.5			*** 115	*** 132	*** 166
15.75			*** 110	*** 126	*** 157
16.			*** 104	*** 119	*** 149

N=14

Concrete Weight = 110 pcf
Concrete Strength (f'c) = 3000 psi
Slab Width = 12 in.

	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
Dead Load (psf)	36.2	40.8	45.3	47.6	56.2
V_R Lbs.	1986	2124	2285	2371	2720
I_c	6.862	8.755	10.986	12.232	17.693
S_{cc}	3.418	3.993	4.639	4.987	6.424
S_{bc}	2.222	2.573	2.947	3.142	3.907

TOTAL SUPERIMPOSED LOAD, POUNDS PER SQUARE FOOT

Span Feet	Concrete Slab Thickness, t (in.)				
	2.0	2.5	3	3.25	4.1875
9.	329	382	439	469	586
9.25	310	360	413	442	552
9.5	292	339	390	416	521
9.75	275	320	368	393	491
10.	260	302	347	371	464
10.25	245	285	328	351	439
10.5	232	270	311	332	410
10.75	220	256	294	314	380
11.	208	242	279	298	353
11.25	197	230	265	283	327
11.5	187	218	251	269	303
11.75	178	207	239	254	281
12.	169	197	227	237	260
12.25	161	187	215	221	240
12.5	153	178	201	206	222
12.75	145	170	187	192	204
13.	136	162	175	179	** 252
13.25	129	154	163	166	** 240
13.5	122	145	152	* 182	** 229
13.75		136	* 162	* 173	** 219
14.		* 134	* 155	** 166	** 209
14.25		* 128	** 148	** 158	** 200
14.5		* 122	** 141	** 151	** 188
14.75		** 116	** 135	** 144	*** 187
15.			** 129	** 138	*** 179
15.25			** 123	** 132	*** 171
15.5			** 118	*** 128	*** 163
15.75			*** 114	*** 122	*** 156
16.			*** 109	*** 117	*** 149

* Denotes shoring required on simple spans, no shoring on multiple spans.
** Denotes shoring required on simple and 2-span conditions only.
*** Denotes shoring required on all span conditions.

——— For use of design loads in excess of 200 psf (above horizontal line) see note 6a page 8.