THE ODYSSEY
ARLINGTON, VA

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Structural Option
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Structural Technical Report II

October 31, 2006

Pro-Con Structural Study of Alternative Floor Systems

Executive Summary:

The second structural technical report is a summary analysis and comparison of proposed alternative floor systems to the existing system of the Odyssey. The current system is a 2-way post-tensioned flat slab located throughout 15 residential levels of the building. A description of this system over a typical frame/bay is included in the preliminary sections of the report.

In the remaining sections of the report are the general analysis and descriptions of the following five alternative floor systems:

- 2-way Concrete Flat Slab
- 2-way Concrete Flat Slab with Drop Panels
- Prestressed Concrete Hollow-Core Plank
- Open Web Steel Joists / Composite Deck
- Composite Deck / Composite Beams

The alternative systems will be analyzed over the typical span conditions of the current system with loading developed from provisions of ASCE7-02. Properties and component sizes of each system are determined through analysis located in the Appendix. A summary of analyses and depictions of typical floor plans and sections are included in sections of the alternative systems. Advantages and disadvantages of each system are described throughout the report with a summarizing comparison table in the concluding sections. The table compares the floor systems by characteristics including overall depth, constructability, and general cost.

Throughout the analysis of the five alternative systems, the existing 2-way post tensioned flat slab remains the ideal floor system for the Odyssey's residential levels. Both steel designs provided better constructability of the floor system, however each greatly exceeded comparable floor depths. The concrete sections will require further investigation to determine weather or not they would be viable alternatives to the existing system. Primarily, the 2-way concrete flat slab compares most favorably to the existing conditions and would be the focus of an alternative floor design for the Odyssey.

Floor Loads:

The existing floor system and alternative systems are submitted to loads resulting from residential space on a typical level. The following loads are taken from construction design loads, material weights, and provisions of ASCE7-02.

Live Loads:

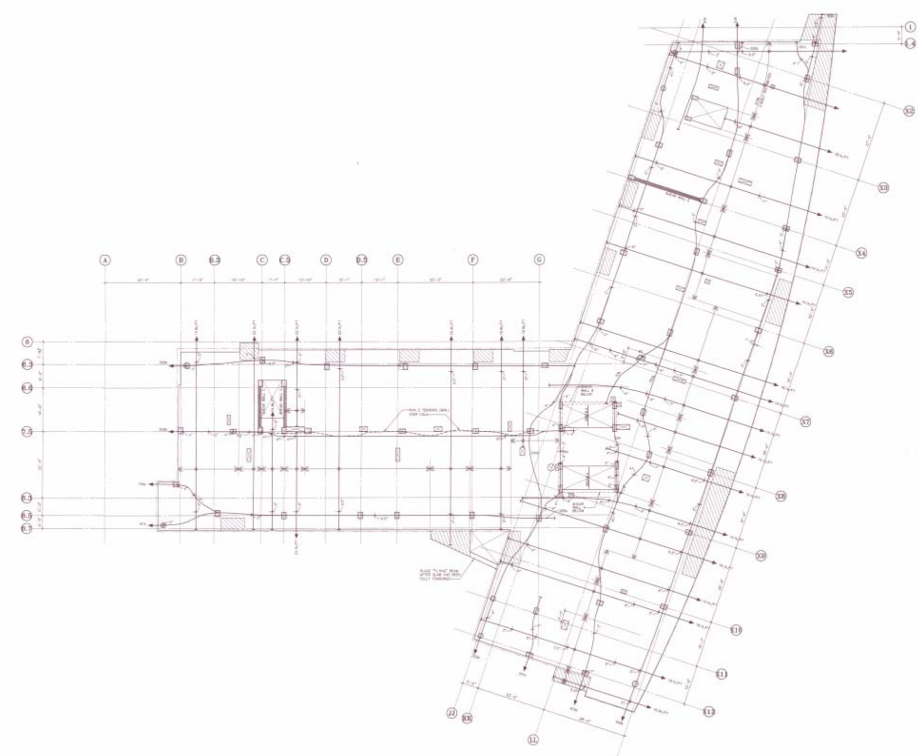
Residential Units & Corridors		40 psf

Dead Loads:

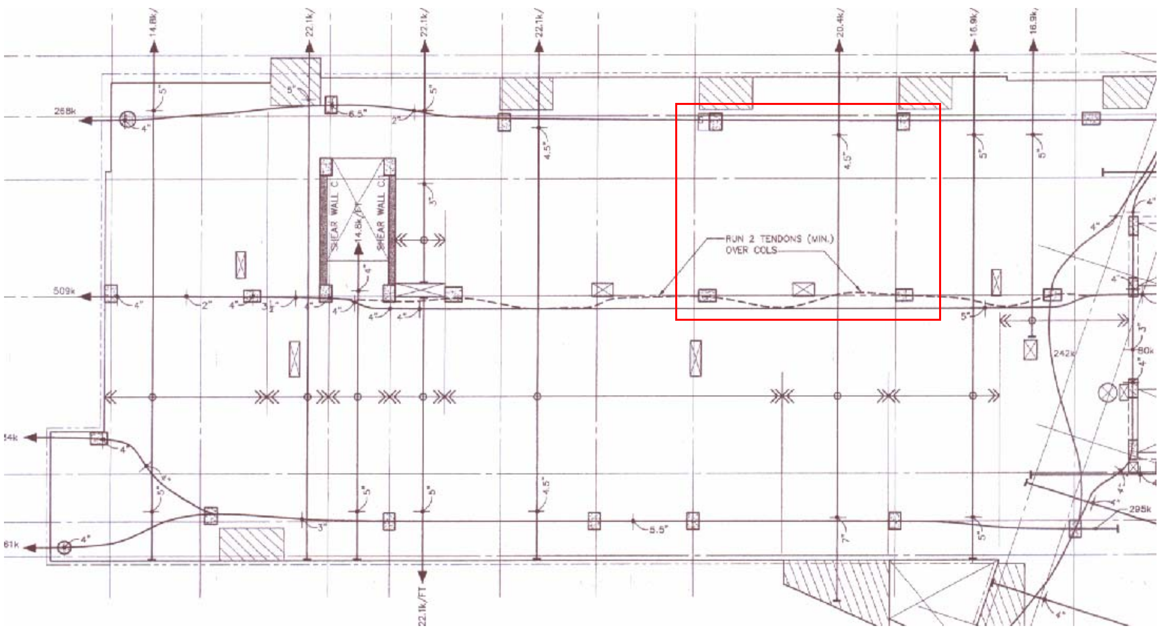
Concrete Slab	(8" slab)	100 psf
Partitions		8 psf
MEP		10 psf
Flooring	(1/2 Tile, Wood)	4 psf
Ceiling	(1/2" Gyp, Batt, Stud Rail)	5 psf

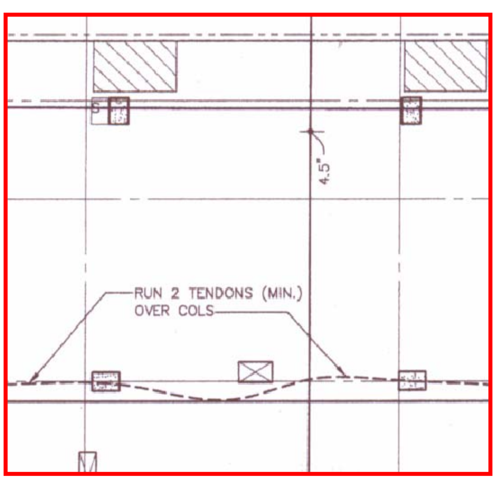
Existing Floor System Design:

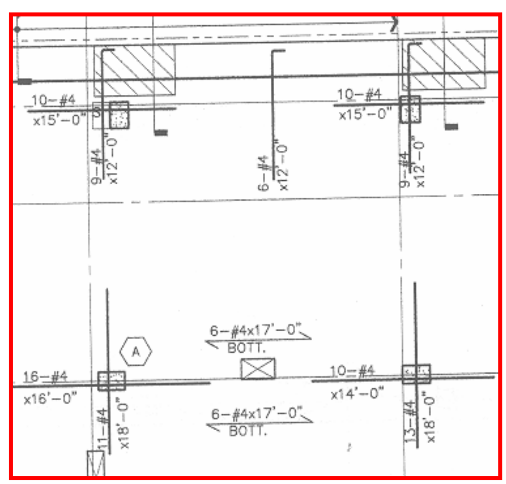
The Odyssey primarily consists of residential space ranging from the 1^{st} – 15^{th} levels. Each residential level is approximately 21,600 S.F. with similar layouts regarding apartment locations and associated loading. The 2-way post-tensioned concrete flat slab is ideal in residential construction, especially with zoning limitations on overall building height. The thin slab limits excess floor to floor height thereby increasing the number of floors and maximizing occupancy. Minimized floor to floor height also yield project savings by shortening internal and external building components including plumbing, wire/cable, and cladding. A disadvantage of the current system is the cost to implement the post-tensioned tendons into the floor system. Special equipment and post tensioning strands must be used which slows construction time and increases project cost.



The typical existing floor system is an 8” 2-way partially post-tensioned concrete flat slab with a concrete strength of 5 ksi. A typical bay size found throughout each frame level is 22’x 25’. Post-tensioned tendons of 7 low-relaxation wire strands drape between columns in the long direction and through the middle of the short span. The slab includes continuous bottom reinforcement of #4 bars @ 24” o.c in each span direction. Top reinforcement of the slab at columns is typically #4 bars expanding 1/3 the span in both directions. Added reinforcement in the long direction at slab openings in specified bays is also typically #4 bars. Columns of the typical floor bay are 18”x 26” with varying quantities of #11 bar reinforcement.







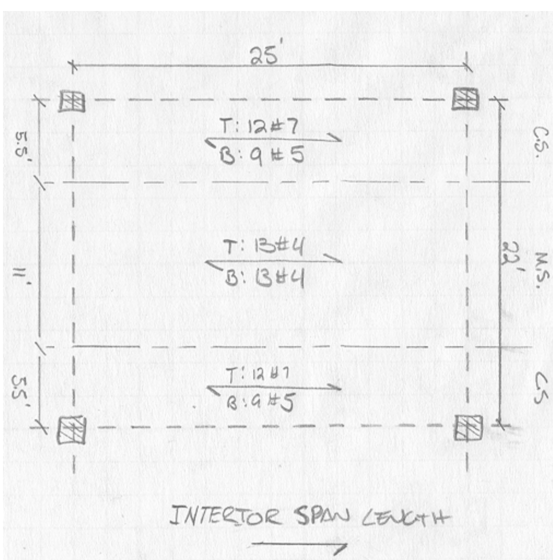
Alternative Floor System Designs:

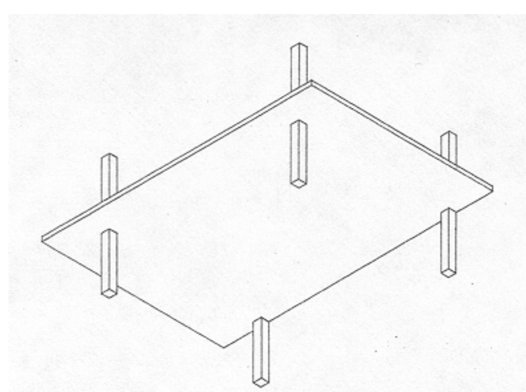
The design analyses of the following alternative floor systems were subjected to initial specifications for comparison to the existing 2-way post-tensioned slab system. Primarily, minimum total design depths for each floor system were considered in the analyses. Alterations in floor depth could extend construction above zoning height limits. As a result, occupancy and residential design would be subject to change by limiting the total number of levels in the Odyssey. Furthermore, the alternative designs were chosen to replace the existing system without significant alterations to other building systems or architectural designs. Examples include ceiling drop panels and mechanical duct work which require coordination with floor construction to avoid obstructions.

2-Way Concrete Flat Slab:

The first alternative floor system was a standard 2-way reinforced flat slab design using 4000 psi concrete and grade 60 reinforcing steel bars. The following design description is for an interior panel in the long span direction of 25'. Edge panel conditions are also analyzed and described in the Appendix. The 2002 CRSI Design Handbook was used for design aid and the load case was adjusted to 1.4D + 1.7L for the analysis of the system. A 9" slab with a gross weight of 112.5 psf was designed for minimal floor thickness. Middle strip (M.S.) reinforcement are #4 bars on the top and bottom of the slab. Column strip (C.S.) reinforcement are heavier bars with #7 bars on the top at the supports, and #5 bars on the bottom in the mid-span. Column sizes are designed at a minimum of 19".

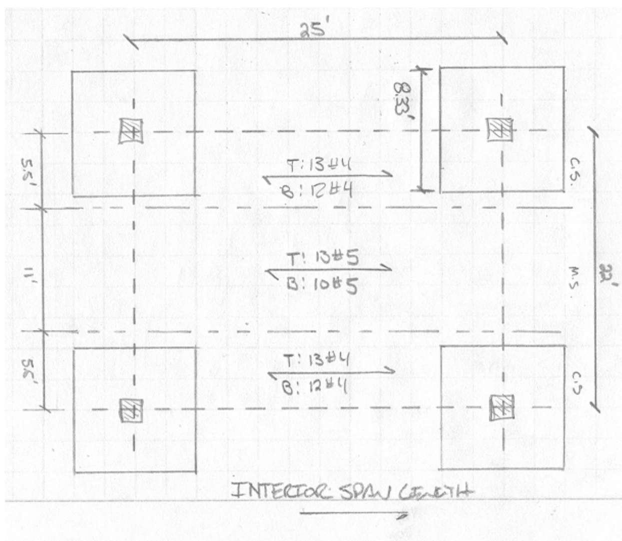
The primary advantage of the 2-way flat slab system is the thickness of the slab. The thickness maintains comparable floor height conditions with the existing post-tensioned system. The flat surface of the slab also benefits in coordination of other building systems integrated with the floor design. A disadvantage to the system is a slight accumulation of cost for the differential reinforcement found throughout the slab.



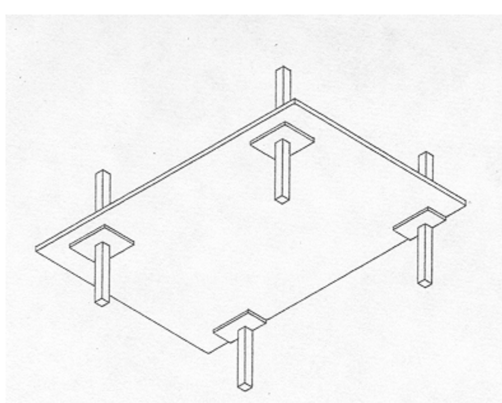


2-Way Concrete Flat Slab with Drop Panels:

Another alternative floor system considered was a 2-way flat slab with drop panels and the columns. The addition of drop panels would ensure a decreased slab thickness over the middle of a span, usually the main living areas of the residential spaces. The interior panel was considered and designed using the 2002 CRSI Design Handbook. The minimum slab thickness was determined to be 8.5" at the mid-span. Middle strip reinforcement was found to be #4 bars on the top and bottom of the slab. With the addition of drop panels to the column strip, the reinforcement was #5 bars at the top at supports and on the bottom of the slab in the mid-span. Drop panels were found to extend 5.5" past the floor slab with an 8.33' width. The minimum column size for this design is 12" sq.

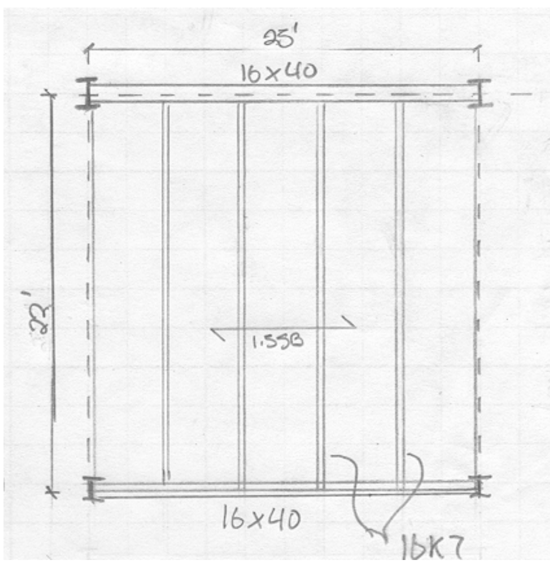


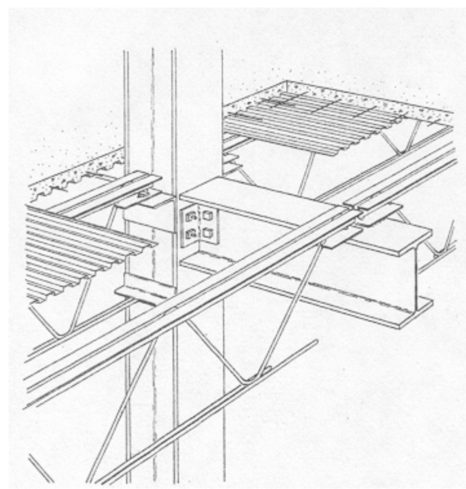
The advantage to this system is the minimum slab thickness achieved by adding drop panels. The drop panels also provide increased design strength, reducing column size and reinforcement in the column strips. The drop panels also may improve lateral resistance through the moment frames which will adjust sizing for concrete shear walls in the building. Disadvantages to this system are the obstruction of the drop panels throughout the floor plan. The panels will also require added labor and material costs for forming. Drop panels may also obstruct spaces near columns by reducing ceiling height at those spaces.



Open Web Steel Joists:

A steel joist design was considered as an alternative to concrete floor construction. The joists are designed with a 4" slab in consideration of maintaining a 2 hour fire rating between floors. The slab sits on 22 gauge 1.5 SB composite metal floor deck. Open web steel joists support the metal deck and slab and are spaced 5'-0" on center spanning 22'. The joists designed for this system are 16K7's with a depth of 16" and require 2 rows of bridging. Beams spanning 25' and supporting the joists are W16X40's and are non-composite with the slab and metal decking. The beams are sized for flexure and for a comparable average depth with the joists. The total weight of the steel joist system is 50psf.



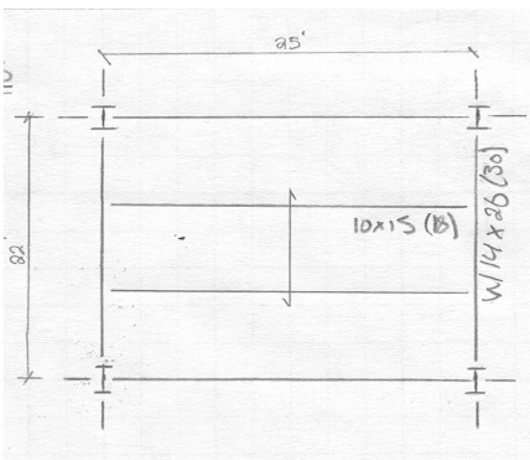


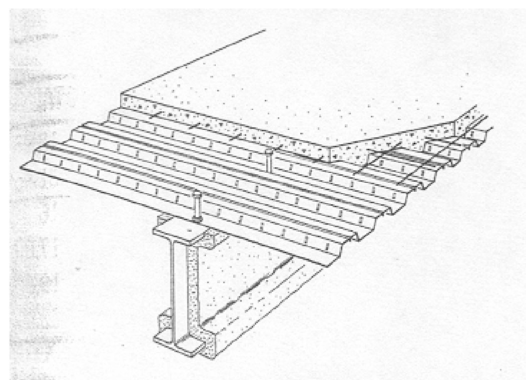
The advantage of open web steel joists is the total reduced weight of the system compared to a concrete floor. Reduction of weight in the floor system will likely reduce seismic loading and overall foundation design. Also, the constructability of a steel system is better than concrete in regard to speed of preparation and erection of the joists. Conversely, the floor depth increases to 20" with the steel joist system and floor heights will inevitably need to be increased as a result of space needed for mechanical duct. The system will have added costs for spray fireproofing; and as a result, the option of running mechanical duct through joists would be more costly and difficult. Lateral braced frames will also need to be designed in the joist span direction for lateral resistance lost as a result of replacing the concrete moment frames and shear walls with steel construction.

Composite Deck / Composite Beams:

An alternative steel system was considered using composite deck on composite beams spanning into girders. The slab and deck are designed as a 4” slab on 22 gauge 1.5 SB composite metal floor deck. Beam sizes found through flexural design calculations were W10x15 (18) spanning 25’ into W14x26 (30) girders. In comparison to the other steel floor alternative of steel joists, the beams will maintain an average floor depth of 18” to the steel joist’s 20”. The reduction of floor depth would make a composite beam system the better steel alternative to concrete construction. The overall weight of the composite deck and beam system is 45 psf.

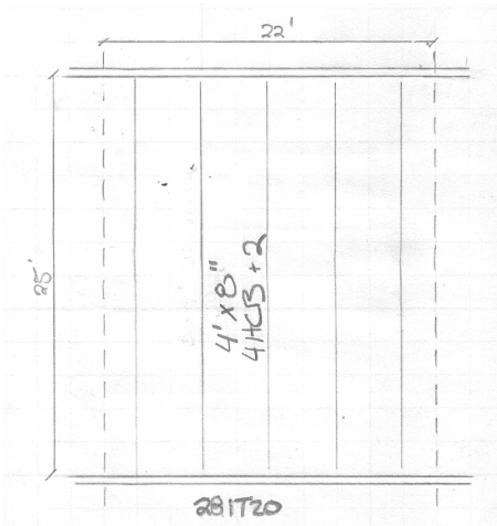
Although the composite beam system is the better steel alternative, the overall floor height would increase 10” over the original design. Consequently, design adjustments to other building systems would need to be considered and overall building height may surpass zoning limits. The advantage to using steel is the constructability of the system. Erection of the system is quicker without the need of formwork and shoring; however, placement of shear studs and fireproofing may have time and cost implications in comparison to concrete construction. Also, the lateral and foundation systems would require design adjustments with respect to the lighter steel system.

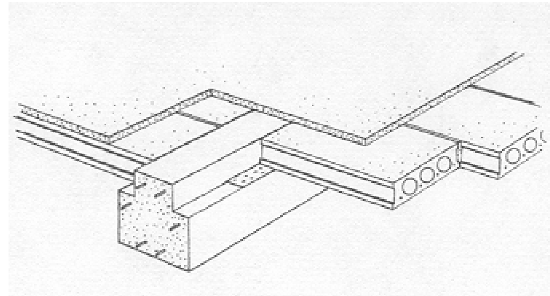




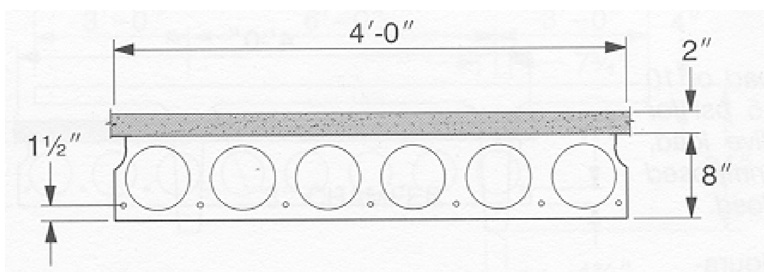
Prestressed Concrete Hollow-Core Plank:

A prestressed hollow-core plank system was chosen as another alternative concrete design for the floor system. Hollow-core plank seemed reasonable based on the similarities in construction advantages it shares with a post-tensioned flat slab. These designs achieve shallow depth to span ratios and thereby minimize floor height. The design used was referenced from the PCI Design Handbook and is a (4’x 8”) 4HCB +2 hollow-core plank with a 2” topping. The concrete design strength is f’c=5000psi and the prestressing are 6 straight low-relaxation strands. The planks span 25’ and rest on inverted tee beams supported at the columns. The beams are 28IT20 with 9 (1/2”) low-relaxation strands and span 22’. The overall weight of the prestressed hollow-core plank system is 109 psf.





The main advantage to constructing the floor system with prestressed beams and hollow-core planks is constructability through the speed of erection. Although the hollow-core plank is only 8” thick the total system depth would be dependent on the beams at 20”. The total weight of the hollow-core plank system is not significantly lighter than the other concrete alternatives proposed and therefore would not have advantages in seismic design.



Summary Comparison Table:

FLOOR SYSTEMS	System Depth (in.)	System Weight (psf)	Fireproofing (2 Hr)	Lateral/Foundation Investigation	Building Systems Investigation	Constructability 1-5 (-->Better)	*Approx. - Cost Per S.F. Mat.	Inst.	Total
P.T. Conc. Slab	8"	116	No	No	No	2	5.30	7.26	12.56
Conc. Slab	9"	115	No	No	No	3	5.20	7.05	12.25
Conc. Slab w/ Panels	14"	118	No	No	Yes/No	2	5.20	7.20	12.40
Hollow-Core Plank	22"	109	No	Yes/No	Yes/No	5	13.11	5.25	18.36
Steel Joists -Comp/Deck	20"	50	Yes	Yes	Yes	4	7.73	4.26	11.99
Comp Beams/Deck	18"	45	Yes	Yes	Yes	3	8.80	4.75	13.55

* Cost Averaged Per Bay Size, Quantity, Weight, Etc.

Comparison Conclusion:

A number of concrete and steel systems were chosen as alternatives for comparison to the existing floor system. Sizes were determined for a typical frame/bay by using design calculations and referencing design aids. Maintaining both floor depth and building system designs were the focus when comparing systems to more accurately determine viable alternatives to the existing system.

Throughout this comparison the 2-way post-tensioned flat slab remained the ideal system for the design of the Odyssey's residential floors. The alternative steel systems had good constructability and reduction in system weight which compared favorably to the existing system. However, both designs had increased floor depth to over 2x the existing depth and must be disregarded. The hollow-core plank system was also very good in terms of constructability. While overall weight is comparable to the post tensioned system, the cost and depth of the system increased substantially. An investigation into alternative supporting members may prove hollow-core plank as a suitable alternative for floor construction. The remaining concrete designs are very similar to the post-tensioned slab with only minor variations. The drop panels maintain decent floor depths throughout the mid-span, but may cause obstructions to other building systems around the columns. The flat plat system is the most appropriate alternative to the existing floor system. It maintains a shallow floor depth without the space hindrance of drop panels. Also, the cost implications of added reinforcement are offset by the removal of the post tensioning. With more investigation into the concrete systems, the 2-way flat plate slab will be the primary focus as the alternative to the existing floor structure of the Odyssey.

Appendix

References:

CRSI Design Handbook 2002

PCI Design Handbook 5th Edition 1999

LRFD Manual of Steel Construction 3rd Edition 2001

New Columbia Joist Co. – Steel Joists & Girders 2002

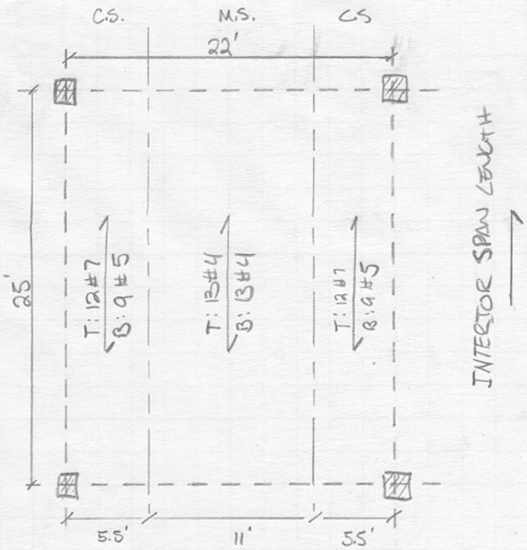
Wheeling Deck Products

R.S. Means Assemblies Cost Data 2000

2-WAY REINFORCED FLAT SLAB

DESIGN:

INTERIOR PANEL
LONG SPAN (C-C) 25'
$f'_c = 4000$ psi
$f_y = 60$ ksi



FACTORED SUPERIMPOSED LOAD:

* SLAB DEAD LOAD DEDUCTED
* LIVE LOAD REDUCTION <10%

$W_u = 1.2D + 1.6L$ → 96 PSF

$W_u = 1.4D + 1.7L$ → 100 PSF
* USE W/ CRSI 2002

MINIMUM SLAB THICKNESS

$t_s = l_n/33$ → 9" (ACI 318-5 TABLE 9.5(c))

CRSI DESIGN HANDBOOK 2002
* DESIGN FOR 25' SQ PANEL

FLAT PLATE SYSTEM
REF: PG. 9-26

REINFORCEMENT: BARS: LOAD $W_u = 100$ psf
*(1.4D+1.7L)

COLUMN STRIP:
TOP: 12 # 7 BARS
BOTTOM: 9 # 5 BARS

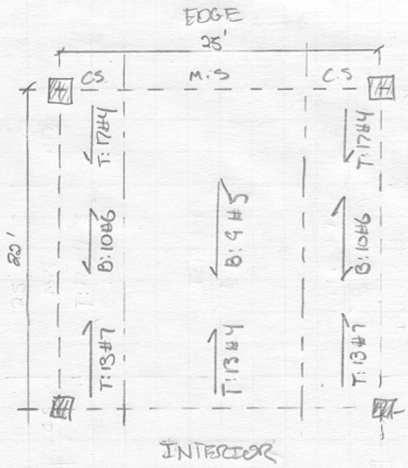
MIDDLE STRIP:
TOP: 13 # 4 BARS
BOTTOM: 13 # 4 BARS

COLUMN:
MINIMUM SIZE: 19" SQ.

FLOOR WEIGHT: SLAB: 112.5 psf
STEEL: 2.12 psf

115 psf

2-WAY REINFORCED FLAT SLAB



DESIGN:

EDGE PANEL
SPAN LENGTH 22.5'
$f'_c = 4000$ psi
$f_y = 60$ ksi

FACTORED SUPERIMPOSED LOAD:
* SLAB DEAD LOAD DEDUCTED
* LIVE LOAD REDUCTION ≤ 10%

$W_u = 1.2D + 1.6L = 96$ PSF

$W_u = 1.4D + 1.7L = 100$ PSF
* USE W/ CRSI 2002

MINIMUM SLAB THICKNESS
* BASED ON LONG SPAN (25')

$t_s = l_n/30 \rightarrow \underline{9''}$ (ACI 318-5 TABLE 9.5(c))

CRSI DESIGN HANDBOOK 2002
* DESIGN FOR 25' SQ PANEL

FLATE PLATE SYSTEM
REF: PG. 9-26

REINFORCEMENT: LOAD: $W_u = 100$ psf * 1.4D+1.7L

COLUMN STRIP:

TOP EXTERIOR : 17 #4 + 8
BOTTOM : 10 # 6
TOP INTERIOR : 13 # 7

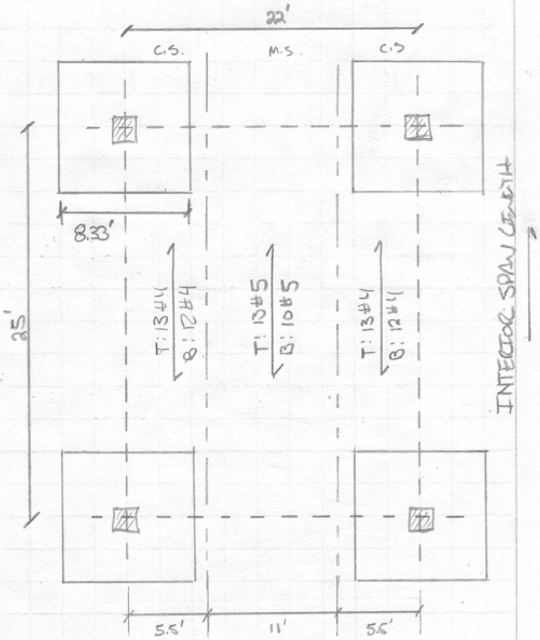
MIDDLE STRIP:

TOP INTERIOR : 13 #4
BOTTOM : 9 # 5

COLUMN:

MINIMUM SIZE: 24" SQ.

2-WAY REINFORCED FLAT SLAB W/ DROP PANELS



DESIGN:

INTERIOR PANEL
LONG SPAN (CC) 25'
f'_c = 4000 psi
f_y = 60 psi

FACTORED SUPERIMPOSED LOAD:

* SLAB DEAD LOAD DEDUCTED
* LIVE LOAD REDUCTION < 10%

$W_u = 1.2D + 1.6L \rightarrow 96$ PSF

$W_u = 1.4D + 1.7L \rightarrow 100$ PSF
*USE W/ CRSI 2002

MINIMUM SLAB THICKNESS

$t_s = l_n/36 \rightarrow$ **8.5"** (ACI 318-5 TABLE 9.5(c))

CRSI DESIGN HANDBOOK 2002 — FLAT PLATE SYSTEM W/ DROP PANELS
* DESIGN FOR 25' SQ PANEL — REF: PG. 10-17
REINFORCEMENT: BARS LOAD: W_u = 100 PSF

COLUMN STRIP:
TOP: 13 #5 BARS
BOTTOM: 10 #5 BARS

MIDDLE STRIP:
TOP: 13 #4 BARS
BOTTOM: 12 #4 BARS

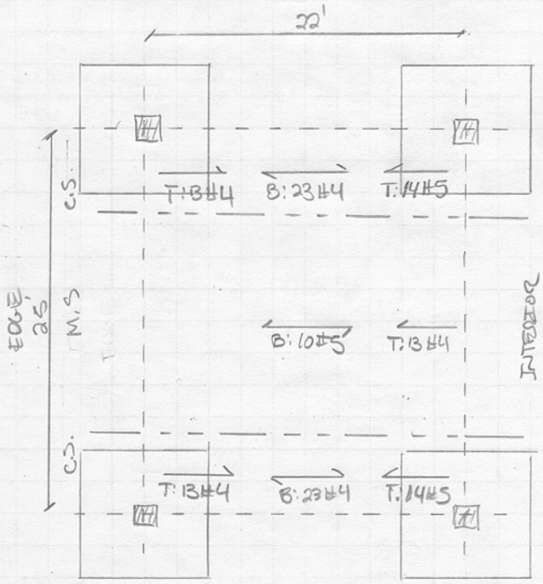
DROP PANELS:
DEPTH: 5.5"
WIDTH: 8.33'

COLUMN:
MINIMUM SIZE: 12" SQ.

FLOOR WEIGHT: SLAB - 106.25 psf
PANELS - 8.67 psf
STEEL - 3 psf

118 psf

2-WAY REINFORCED FLAT SLAB W/ DROP PANELS



DESIGN:

EXTERIOR PANEL
SPAN (C-C) 22'
$f'_c = 4000$ psi
$f_y = 60$ ksi

FACTORED SUPERIMPOSED LOAD
* SLAB DEAD LOAD DEDUCTED
* LIVE LOAD REDUCTION < 10%

$W_U = 1.2D + 1.6L \rightarrow 96$ psf

$W_U = 1.4D + 1.7L \rightarrow 100$ psf
* USE W/ CRSI 2002

MINIMUM SLAB THICKNESS

$t_s = l_n/33 = 8''$ USE 8.5" @ 25' SPAN

CRSI DESIGN HANDBOOK 2002
* DESIGN FOR 25' SQ PANEL

FLAT PLATE SYSTEM
W/ DROP PANELS
REF PG 10-17

REINFORCEMENT   LOAD: $W_U = 100$ psf

COLUMN STRIP:

TOP EXTERIOR: 13#4 + 4
BOTTOM : 23#4
TOP INTERIOR: 14#5

MIDDLE STRIP:

TOP INTERIOR: 13#4
BOTTOM : 10#5

DROP PANELS:

DEPTH: 5.5"
WIDTH: 8.33'

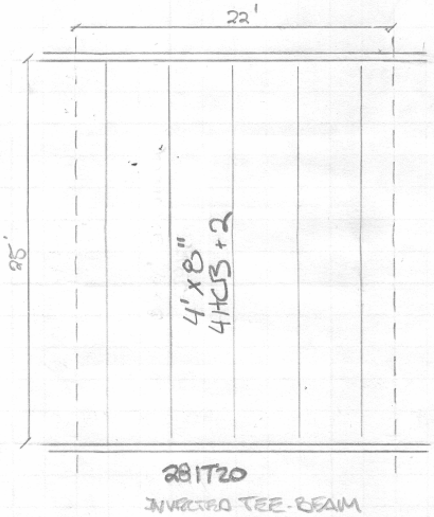
COLUMN:

MINIMUM SIZE: 12" SQ.

HOLLOW CORE PLANK

DESIGN:
SPAN: 25'
CONCRETE: $f'_c = 5$ ksi
NORMAL WT. (150 PCF)

TOPPING:
DEPTH: 2" $f'_c = 3$ ksi
NORMAL WT. (150)

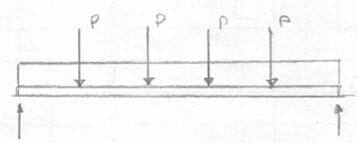


LOADS: (SERVICE)
DEAD:
TOPPING: 15 psf
PARTITIONS: 8 psf
FLOOR/CEILING: 9 psf
MEP: 10 psf
42 psf

LIVE:
RESIDENTIAL & CORRIDOR: 40 psf

TOTAL: 86 psf

INVERTED TEE BEAM:



PCI DESIGN HANDBOOK
PG: 2-26

$f'_c = 5000$ psi $f'_{ci} = 3{,}500$ psi

HOLLOW CORE PLANK: 4'x8" 4HCB+2

ALLOWABLE SUPERIMPOSED LOAD - SPAN 25'

FLEXURE: 89 psf > 40 psf (LIVE LOAD)

STRAND PATTERN: 66-S

(6) STRAIGHT 6/16" Defl = 0.2" l/360 = 0.83" ok
* DEAD LOAD

SYSTEM WEIGHT: 81 psf

INVERTED TEE BEAM

$W_u = 1.2(D) + 1.6(L)$ PCI DESIGN HANDBOOK
W_u = 700 plf + 291 plf = 991 plf PG: 2-44

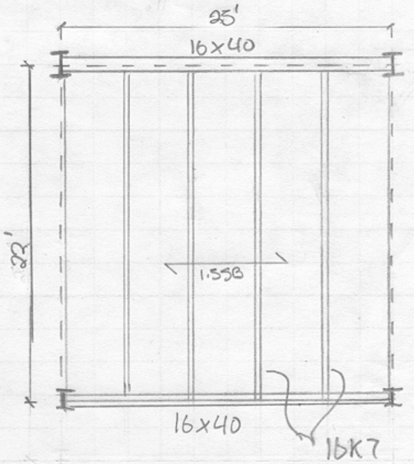
28IT20

SPAN: 22'
$f'_c = 5000$ psi
STRANDS: 9 (½ d) Low-LAX

WEIGHT: 28 psf $W_n = 3502$ plf > 991 plf
defl = 0.1" - l/360 = .73" ok.

DEPTH: 20"

OPEN WEB STEEL JOISTS



DESIGN:
SPAN 22'
NORMAL Wt. CONCRETE.

SLAB
4" SLAB (2 HR FIRE RATING)
W/ 6x6 W1.4xW1.4 ↳ W/GYP.
Wt = 36 psf

DECK:
1.5 SB - 22 GAUGE (UWHEELING)
CLEAR SPAN - 7'6" (3 SPAN)
LIVE LOAD - 400 psf
W_d = 1.7 psf

JOISTS:
5'0" OC (3 HR FIRE RATING, NORMAL Wt. CONCRETE)

LOADS:

DEAD:

MEP	10	psf
PARTITIONS	8	psf
FLOOR/CEILING	9	psf
SLAB/DECK	38	psf
	65	psf

LIVE:
RESIDENTIAL & CORRIDOR 40 psf

$W_{D+L} = (105\,psf)(5') = 525\,plf$
$W_L = (40\,psf)(5') = 200\,plf$

→ 16K7 JOIST @ 5' o.c.
2 ROWS OF BRIDGING
(NEW COLUMBIA JST CO.)

$W_{D+L} = 550\,plf > 525\,plf$
$W_L = 377\,plf > 200\,plf$
$Wt = 8.6\,psf$

GIRDER / BEAM
SPAN:
LOAD:

$W_U = 1.2D + 1.6L \rightarrow 1.2(74\,psf) + 1.6(.40) = 152.8\,psf$
$W_U = 152.8\,psf(22') = 3.36\,klf$

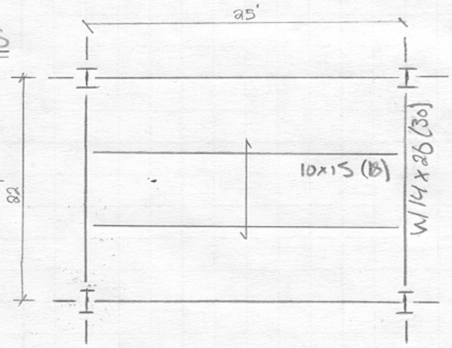
$$M_n = \frac{W_U l^2}{8} = \frac{(3.36\,klf)(25')^2}{8} = 262'^k$$

$$Z_x = \frac{M_n}{\phi F_y} = \frac{262'^k(12'')}{0.9(50^{ksi})} = 70\ in^3$$

→ W16x40 $Z_x = 73.0\ in^3$ AISC MANUAL

* SIZED TO MATCH JOIST CONSTRUCTION.

Composite Slab/Deck - Composite Beams



Design:

Slab:
- 4" slab depth (Normal Wt)
- (2 HR Fire Rating)
- 6x6 W1.4 x 1.4
- $f'_c = 4$ ksi

Deck:
- 1.5 SB Normal Wt (Wheeling)
- 22 Gauge - Depth 1.5"
- Clear span - 7.5' (3 span)
- Capacity - 400 psf → Total Wt. - 38 psf

Loads:

Dead:

Slab/Deck	38 psf
Partitions	8 psf
MEP	10 psf
Flooring/CLG.	9 psf
Assume: Beam	20 psf
	85 psf

Live:

Residential & Corridors	40 psf

Slab/Deck:

$1.2(65) + 1.6(40) = 142$ psf < 400 ok

Beam:

$1.2(85) + 1.6(40) = 166$ psf

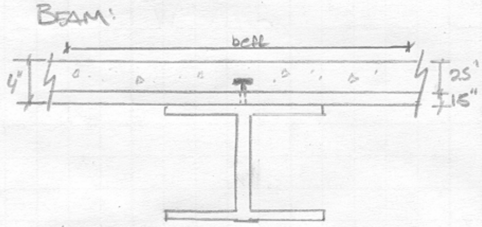
$166\text{ psf}\left(\frac{22'}{3}\right) = 1217$ plf

Girder:

$1217\text{ plf}(25') = 30.425^k$

* Design Wt. of Girder

Beam:



W Shape A992

Shear Bolts: 3/4"ϕ 1-3" $Q_n = 20.1^k$

$b_{eff} = \begin{cases} \text{Spacing} = 88" \\ \frac{\text{Span}}{4} = 75" \rightarrow \text{controls} \end{cases}$

$M_u = \frac{wl^2}{8} = \frac{(1.217^{klf})(25')^2(12")}{8} = 1141^{"-k}$

$M_n = \frac{M_u}{\phi} = \frac{1141^{"-k}}{0.85} = 1342.3^{"-k}$

Assume: $a = 1 \rightarrow Y_2 = 1 + 2.5 = 3.5"$

Try: W 10 x 15 $A_s = 4.41\text{ in}^2$, $d = 9.99"$

$C_c = 0.85(4^{ksi})(75")(2.5") = 637.5^k$

$T_s = 50^{ksi}(4.41\text{ in}^2) = 220.5^k$

$T_s = C_c$

$220.5^k = 0.85(4)(75")a \rightarrow a = .865"$

$M_n = 220.5\left(4 - \frac{.865}{2}\right) + 220.5\left(\frac{9.99"}{2}\right) = 1889^{"k}$

$\phi M_n = 1605.7^{"k} > 1141^{"k}$ ok

Shear Studs: $T_s / Q_n = \frac{220.5^k}{26.1^k} = 9 \rightarrow$ 18 studs

GIRDER:

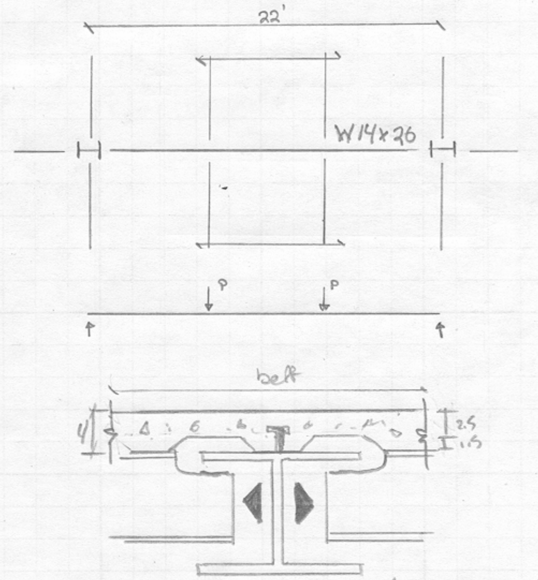
LOAD:

$P = 30.425^k$

$M_u = 30.425^k\left(\frac{22'}{3}\right) = 223.1'^k$

$M_n = \frac{M_u}{\Phi} = 262.5'^k = 3150''^k$

ASSUME: $a = 2$; $Y_2 = 3.5$



W-SHAPE A992

SHEAR BOLTS: 3/4"φ $l = 3"$

$Q_n = 20.1^k$

beff { SPACING
66" CONTROLS

TRY: W14x26 $A = 7.69\,in^2$, $d = 13.9\,in$

$C_c = 0.85(4^{ksi})(2.5")(66") = 561^k$

$T_s = 50(7.69\,in^2) = 384.5^k$

$T_s = C_c$

$384.5 = 0.85(4)(66")a \rightarrow a = 1.7"$

$M_n = 384.5\left(4 - \frac{1.7}{2}\right) + 384.5\left(\frac{13.9}{2}\right) = 3883.5''^k$

SHEAR STUDS: $T_s/Q_n = \frac{384.5^k}{20.1} = 15 \rightarrow$ USE 30.

TRY: W12x30 $A = 8.79\,in^2$, $d = 12.3\,in$

$C_c = 0.85(4)(2.5)(66) = 561^k$

$T_s = 50(8.79\,in^2) = 439.5^k$

$T_s = C_c$

$439.5^k = 0.85(4)(66")a \rightarrow 1.96"$

$M_n = 439.5^k\left(4 - \frac{1.96}{2}\right) + 439.5^k\left(\frac{12.3}{2}\right) = 4030.5''^k$

$\phi M_n = 285.5'^k > M_u = 223.1'^k$ OK

SHEAR STUDS: $\frac{T_s}{Q_n} = \frac{439.5^k}{20.1} = 17 \rightarrow$ USE <u>34</u>

* USE W14x26: SHEAR AND LATERAL RESISTANCE CONSIDERATIONS.

FLAT PLATE SYSTEM
(WITHOUT SHEARHEADS)

f'_c = 4,000 psi
Grade 60 Bars

SQUARE EDGE PANEL

9 in. = TOTAL THICKNESS OF SLAB — 0.750 c.f./s.f.

SPAN c.-c. Cols. $\ell_1 = \ell_2$	Factored Superimposed Load	(1) Min. Square Column		Total Panel Moments			Reinforcing Bars: Each Column Strip				Reinforcing Bars: Each Middle Strip		End Panel: Steel (psf), Location of Panel		
				−M Ext.	+M Int.	−M 1st. int.	Top Ext.	+	Bottom	Top Int.	Bottom	Top Int.	E	EC	C
(ft)	(psf)	(in.)	γ_f	(ft-kip)	(ft-kip)	(ft-kip)									
23	50	16	0.767	74	148	200	12-# 4	5	9-# 5	11-# 6	8-# 5	8-# 5	2.31	2.34	2.23
23	100	20	0.748	89	179	240	14-# 4	7	16-# 4	13-# 6	8-# 5	8-# 5	2.52	2.54	2.50
23	150	24	0.677	103	207	278	16-# 4	5	9-# 6	15-# 6	8-# 5	8-# 5	2.78	2.81	2.84
23	200	27	0.709	117	234	315	12-# 5	5	10-# 6	13-# 7	14-# 4	8-# 5	3.12	3.16	3.25
23	250	31	0.641	129	257	346	13-# 5	4	11-# 6	11-# 8	10-# 5	13-# 4	3.47	3.49	3.58
23	300	34	0.626	140	279	376	14-# 5	3	9-# 7	12-# 8	8-# 6	14-# 4	3.79	3.82	3.89
23	350	40	0.610	147	293	395	22-# 4	4	8-# 8	13-# 8	12-# 5	10-# 5	4.04	4.13	4.26
24	50	18	0.736	84	168	226	13-# 4	5	10-# 5	12-# 6	8-# 5	8-# 5	2.33	2.35	2.27
24	100	22	0.724	101	201	271	15-# 4	7	12-# 5	11-# 7	8-# 5	8-# 5	2.62	2.64	2.64
24	150	26	0.713	116	232	313	12-# 5	5	10-# 6	13-# 7	9-# 5	8-# 5	2.97	3.01	3.12
24	200	30	0.652	131	262	352	13-# 5	4	16-# 5	12-# 8	16-# 4	13-# 4	3.37	3.41	3.49
24	250	34	0.611	144	288	388	22-# 4	4	17-# 5	13-# 8	8-# 6	10-# 5	3.69	3.74	3.86
24	300	39	0.610	154	307	414	23-# 4	4	8-# 8	17-# 7	12-# 5	10-# 5	4.02	4.06	4.19
24	350	45	0.609	161	322	433	16-# 5	2	8-# 8	14-# 8	9-# 6	16-# 4	4.29	4.31	4.45
25	50	20	0.733	94	188	252	14-# 4	7	11-# 5	14-# 6	13-# 4	13-# 4	2.45	2.47	2.44
25	100	24	0.724	113	225	303	17-# 4	8	10-# 6	13-# 7	9-# 5	13-# 4	2.86	2.88	2.88
25	150	29	0.651	130	260	349	13-# 5	4	11-# 6	19-# 6	16-# 4	13-# 4	3.19	3.21	3.32
25	200	33	0.633	146	292	393	22-# 4	7	10-# 7	13-# 8	12-# 5	10-# 5	3.66	3.71	3.84
25	250	39	0.610	158	316	425	16-# 5	2	10-# 7	14-# 8	19-# 4	16-# 4	3.91	3.96	4.08
25	300	45	0.609	167	334	450	25-# 4	3	20-# 5	15-# 8	13-# 5	11-# 5	4.17	4.19	4.35
25	350	51	0.608	175	351	472	13-# 6	1	9-# 8	16-# 8	10-# 6	12-# 5	4.53	4.62	4.85
26	50	22	0.705	105	209	281	16-# 4	6	9-# 6	15-# 6	13-# 4	13-# 4	2.53	2.56	2.53
26	100	27	0.658	125	251	337	19-# 4	6	11-# 6	14-# 7	10-# 5	13-# 4	2.98	3.00	3.02
26	150	31	0.655	145	290	390	22-# 4	7	10-# 7	13-# 8	12-# 5	10-# 5	3.51	3.54	3.57
26	200	37	0.636	161	322	433	16-# 5	5	14-# 6	14-# 8	9-# 6	16-# 4	3.82	3.87	3.98
26	250	44	0.609	172	345	464	17-# 5	4	11-# 7	15-# 8	10-# 6	12-# 5	4.17	4.23	4.39
26	300	51	0.608	182	364	490	13-# 6	1	9-# 8	16-# 8	22-# 4	12-# 5	4.46	4.49	4.67
26	350	58	0.607	189	378	509	19-# 5	1	10-# 8	17-# 8	11-# 6	9-# 6	4.75	4.82	5.05
27	50	24	0.717	116	232	313	12-# 5	5	10-# 6	13-# 7	9-# 5	9-# 5	2.72	2.75	2.71
27	100	29	0.693	139	279	375	14-# 5	6	9-# 7	12-# 8	11-# 5	14-# 4	3.18	3.21	3.26
27	150	34	0.654	160	321	432	16-# 5	5	14-# 6	14-# 8	19-# 4	16-# 4	3.60	3.66	3.79
27	200	41	0.630	176	351	473	13-# 6	3	9-# 8	16-# 8	10-# 6	12-# 5	4.12	4.19	4.35
27	250	49	0.608	188	376	506	19-# 5	3	12-# 7	17-# 8	11-# 6	9-# 6	4.43	4.48	4.64
27	300	56	0.607	198	396	533	14-# 6	1	10-# 8	18-# 8	16-# 5	13-# 5	4.71	4.78	4.95
27	350	64	0.606	205	410	552	15-# 6	0	11-# 8	18-# 8	9-# 7	10-# 6	5.02	5.08	5.27
28	50	26	0.709	129	258	347	19-# 4	10	23-# 4	14-# 7	10-# 5	14-# 4	2.78	2.79	2.77
28	100	31	0.679	154	308	414	15-# 5	6	10-# 7	13-# 8	12-# 5	10-# 5	3.33	3.36	3.47
28	150	38	0.662	175	351	472	13-# 6	4	15-# 6	15-# 8	10-# 6	12-# 5	3.92	3.92	4.06
28	200	46	0.609	191	381	513	19-# 5	3	10-# 8	17-# 8	11-# 6	13-# 5	4.35	4.38	4.56
28	250	54	0.608	203	407	547	20-# 5	3	13-# 7	18-# 8	16-# 5	10-# 6	4.62	4.68	4.93
28	300	62	0.607	213	426	574	16-# 6	2	11-# 8	19-# 8	12-# 6	10-# 6	5.00	5.07	5.33
28	350	70	0.606	221	442	595	16-# 6	0	11-# 8	20-# 8	10-# 7	11-# 6	5.22	5.30	5.60

SQUARE INTERIOR PANEL

9 in. = TOTAL THICKNESS OF SLAB — 0.750 c.f./s.f.

(2) Span c.-c.	(3) Load	(1) Min. Sq. Col.	Reinforcing Bars: Column Strip		Reinforcing Bars: Middle Strip		Steel (psf), Location of Panel		
(ft)	(psf)	(in.)	Top	Bottom	Top	Bottom	I	IE	IC
23	50	11	14-# 5	8-# 5	8-# 5	8-# 5	2.37	2.39	2.42
23	100	15	17-# 5	8-# 5	8-# 5	8-# 5	2.55	2.57	2.60
23	150	19	20-# 5	13-# 4	8-# 5	8-# 5	2.77	2.79	2.81
23	200	23	12-# 7	10-# 5	8-# 5	8-# 5	3.11	3.14	3.17
23	250	28	11-# 8	16-# 4	8-# 5	8-# 5	3.42	3.43	3.43
23	300	33	11-# 8	8-# 6	13-# 4	8-# 5	3.56	3.61	3.65
23	350	40	12-# 8	12-# 5	9-# 5	8-# 5	3.82	3.87	3.92
24	50	12	16-# 5	8-# 5	8-# 5	8-# 5	2.38	2.39	2.41
24	100	17	11-# 7	8-# 5	8-# 5	8-# 5	2.70	2.70	2.69
24	150	22	12-# 7	14-# 4	8-# 5	8-# 5	2.90	2.92	2.95
24	200	26	11-# 8	16-# 4	8-# 5	8-# 5	3.27	3.30	3.34
24	250	31	12-# 8	12-# 5	9-# 5	8-# 5	3.61	3.65	3.70
24	300	39	13-# 8	19-# 4	10-# 5	8-# 5	3.86	3.86	3.86
24	350	47	13-# 8	9-# 6	10-# 5	13-# 4	4.01	4.05	4.09
25	50	14	13-# 6	13-# 4	13-# 4	13-# 4	2.50	2.52	2.54
25	100	19	12-# 7	9-# 5	13-# 4	13-# 4	2.82	2.85	2.87
25	150	24	14-# 7	16-# 4	13-# 4	13-# 4	3.13	3.13	3.12
25	200	29	12-# 8	12-# 5	9-# 5	13-# 4	3.48	3.52	3.57
25	250	37	13-# 8	9-# 6	10-# 5	13-# 4	3.78	3.82	3.86
25	300	46	14-# 8	20-# 4	16-# 4	9-# 5	4.01	4.06	4.10
25	350	54	14-# 8	10-# 6	16-# 4	9-# 5	4.17	4.26	4.36
26	50	16	20-# 5	13-# 4	13-# 4	13-# 4	2.48	2.49	2.51
26	100	21	13-# 7	10-# 5	13-# 4	13-# 4	2.88	2.90	2.92
26	150	26	12-# 8	12-# 5	9-# 5	13-# 4	3.33	3.37	3.41
26	200	33	13-# 8	13-# 5	10-# 5	13-# 4	3.61	3.64	3.68
26	250	43	14-# 8	10-# 6	16-# 4	9-# 5	3.94	3.99	4.05
26	300	52	15-# 8	22-# 4	11-# 5	10-# 5	4.19	4.24	4.28
26	350	62	15-# 8	11-# 6	12-# 5	10-# 5	4.43	4.51	4.59
27	50	18	12-# 7	10-# 5	9-# 5	9-# 5	2.74	2.76	2.78
27	100	23	12-# 8	17-# 4	9-# 5	9-# 5	3.17	3.17	3.16
27	150	29	13-# 8	13-# 5	10-# 5	13-# 4	3.45	3.48	3.52
27	200	39	14-# 8	10-# 6	11-# 5	14-# 4	3.78	3.86	3.93
27	250	49	15-# 8	11-# 6	12-# 5	10-# 5	4.18	4.26	4.33
27	300	59	16-# 8	16-# 5	12-# 5	16-# 4	4.38	4.46	4.54
27	350	69	17-# 8	16-# 5	9-# 6	16-# 4	4.61	4.67	4.72
28	50	19	14-# 7	16-# 4	14-# 4	14-# 4	2.82	2.82	2.82
28	100	26	13-# 8	19-# 4	10-# 5	14-# 4	3.29	3.29	3.29
28	150	33	15-# 8	14-# 5	11-# 5	10-# 5	3.78	3.78	3.79
28	200	45	16-# 8	23-# 4	12-# 5	10-# 5	4.05	4.09	4.13
28	250	56	17-# 8	16-# 5	13-# 5	16-# 4	4.37	4.41	4.46
28	300	67	17-# 8	12-# 6	13-# 5	11-# 5	4.57	4.65	4.73
28	350	77	18-# 8	17-# 5	20-# 4	12-# 5	4.79	4.89	4.99

(1) Columns same above and below plate.
(2) Center-to-center of columns; $\ell_1 = \ell_2$.
(3) Superimposed factored load (factored dead load has been deducted).

f'_c = 4,000 psi
Grade 60 Bars

FLAT SLAB SYSTEM

SQUARE EDGE PANEL — With Drop Panels — No Beams

SPAN c.-c. $\ell_1 = \ell_2$ (ft)	Factored Superim-posed Load (psf)	Square Drop Panel		Square Column (3)		REINFORCING BARS (E. W.)							MOMENTS		
						Column Strip (1)				Middle Strip		Total Steel (psf)	Edge (–) (ft-k)	Bot. (+) (ft-k)	Int. (–) (ft-k)
		Depth (in.)	Width (ft)	Size (in.)	γ_f	Top Ext.	+	Bottom	Top Int.	Bottom	Top Int.				
h = 8.5 in. = TOTAL SLAB DEPTH BETWEEN DROP PANELS															
22	100	4.00	7.33	12	0.676	11-#4	1	10-#5	11-#5	10-#4	11-#4	2.01	79.1	158.2	213.0
22	200	4.00	7.33	15	0.746	11-#4	4	10-#6	15-#5	9-#5	8-#5	2.57	107.1	214.2	288.4
22	300	5.50	7.33	17	0.638	12-#4	2	18-#5	25-#4	12-#5	10-#5	3.08	135.1	270.1	363.6
22	400	7.00	7.33	18	0.629	13-#4	2	9-#8	18-#5	14-#5	12-#5	3.70	163.8	327.7	441.1
22	500	8.50	8.80	20	0.629	14-#4	1	12-#8	14-#6	8-#8	10-#6	4.67	192.3	415.9	517.8
23	100	4.00	7.67	12	0.786	12-#4	4	18-#4	19-#4	12-#4	12-#4	2.13	90.8	181.5	244.4
23	200	5.50	7.67	15	0.697	12-#4	4	16-#5	15-#5	16-#4	9-#5	2.64	123.3	246.7	332.1
23	300	7.00	7.67	17	0.630	13-#4	3	11-#7	12-#6	10-#6	17-#4	3.40	155.6	311.2	418.9
23	400	7.00	9.20	19	0.738	15-#4	5	18-#6	20-#5	9-#7	10-#6	4.00	187.3	374.5	504.2
23	500	8.50	9.20	20	0.658	16-#4	3	13-#8	12-#7	20-#5	16-#5	4.83	220.6	451.7	593.8
24	100	5.50	8.00	12	0.706	13-#4	2	21-#4	19-#4	9-#5	13-#4	2.27	103.9	207.7	279.6
24	200	7.00	8.00	15	0.633	13-#4	3	19-#5	15-#5	12-#5	10-#5	2.80	140.6	281.3	378.7
24	300	7.00	8.00	17	0.722	15-#4	4	17-#6	14-#6	11-#6	13-#5	3.71	177.9	355.7	478.9
24	400	8.50	9.60	19	0.630	16-#4	2	16-#7	15-#6	10-#7	16-#5	4.43	214.8	429.5	578.2
25	100	5.50	8.33	12	0.766	13-#4	4	23-#4	14-#5	10-#5	13-#4	2.34	117.8	235.6	317.2
25	200	7.00	8.33	15	0.686	13-#4	4	15-#6	12-#6	10-#6	12-#5	3.11	159.8	319.5	430.1
25	300	8.50	8.33	17	0.643	15-#4	3	15-#7	14-#6	10-#7	15-#5	4.08	202.5	405.0	545.2
25	400	8.50	10.00	20	0.723	18-#4	5	14-#8	13-#7	9-#8	10-#7	5.01	243.4	486.8	655.3

SQUARE INTERIOR PANEL

With Drop Panels(2) — No Beams

SPAN c.-c. $\ell_1 = \ell_2$ (ft)	Factored Superim-posed Load (psf)	(3) Square Column	REINFORCING BARS (E. W.)					Concrete (cu. ft / sq. ft)
			Column Strip		Middle Strip		Total Steel (psf)	
		Size (in.)	Top	Bottom	Top	Bottom		
h = 8.5 in. = TOTAL SLAB DEPTH BETWEEN DROP PANELS								
22	100	12	16-#4	11-#4	11-#4	11-#4	1.94	0.745
22	200	17	14-#5	9-#5	11-#4	11-#4	2.31	0.745
22	300	20	15-#5	18-#4	9-#5	8-#5	2.71	0.759
22	400	21	16-#5	14-#5	8-#6	14-#4	3.16	0.773
22	500	22	17-#5	13-#6	13-#5	12-#5	3.84	0.822
23	100	12	12-#5	12-#4	12-#4	11-#4	2.01	0.745
23	200	17	14-#5	16-#4	13-#4	11-#4	2.33	0.759
23	300	20	11-#6	21-#4	16-#4	9-#5	2.91	0.773
23	400	23	28-#4	16-#5	19-#4	16-#4	3.35	0.802
23	500	23	14-#6	20-#5	15-#5	13-#5	4.09	0.822
24	100	12	12-#5	9-#5	13-#4	12-#4	2.09	0.759
24	200	18	14-#5	18-#4	14-#4	12-#4	2.38	0.773
24	300	20	18-#5	11-#6	12-#5	10-#5	3.22	0.773
24	400	23	14-#6	10-#7	22-#4	12-#5	3.76	0.822
25	100	12	13-#5	10-#5	13-#4	12-#4	2.12	0.759
25	200	18	16-#5	21-#4	16-#4	9-#5	2.65	0.773
25	300	20	18-#5	18-#5	10-#6	12-#5	3.43	0.787
25	400	23	12-#7	9-#8	9-#7	10-#6	4.32	0.822

NOTES: (1) 50 percent of these bars may be placed in the middle third of column strip. (2) Drop panels same size as for edge panels. (3) Same column size above and below slab.

STANDARD LOAD TABLE

FOR OPEN WEB STEEL JOISTS, K-SERIES

Based on a Maximum Allowable Tensile Stress of 30 ksi
Adopted by the Steel Joist Institute November 4, 1985;
Revised to May 1, 2000 – Effective August 1, 2002

The black figures in the following table give the TOTAL safe uniformly distributed load-carrying capacities, in pounds per linear foot, of K-Series Steel Joists. The weight of DEAD loads, including the joists, must be deducted to determine the LIVE load-carrying capacities of the joists. Sloped parallel-chord joists shall use span as defined by the length along the slope.

The figures shown in RED in this load table are the LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the figures in RED by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

The approximate joist weights per linear foot shown in these tables do not include accessories.

The approximate moment of inertia of the joist, in inches⁴ is; $I_j = 26.767(W_{LL})(L^3)(10^{-6})$, where W_{LL} = RED figure in the Load Table and L = (Span - .33) in feet.

For the proper handling of concentrated and/or varying loads, see Section 5.5 in the Recommended Code of Standard Practice for Steel Joists and Joist Girders.

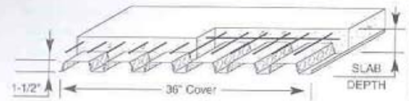
<u>**Where the joist span exceeds the unshaded area**</u> of the load table, the row of bridging nearest the mid-span shall be diagonal bridging with bolted connections at the chords and intersections.

STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, K-SERIES
Based on a Maximum Allowable Tensile Stress of 30 ksi

Joist Designation	8K1	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	16K4	16K5	16K6	16K7	16K9
Depth (in.)	8	10	12	12	12	14	14	14	14	16	16	16	16	16	16	16
Approx. Wt (lbs./ft.)	5.1	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.0	7.5	8.1	8.6	10.0
Span (ft.) ↓ 8	550 550															
9	550 550															
10	550 480	550 550														
11	532 377	550 542														
12	444 288	550 455	550 550	550 550	550 550											
13	377 225	479 363	550 510	550 510	550 510											
14	324 179	412 289	500 425	550 463	550 463	550 550	550 550	550 550	550 550							
15	281 145	358 234	434 344	543 428	550 434	511 475	550 507	550 507	550 507							
16	246 119	313 192	380 282	476 351	550 396	448 390	550 467	550 467	550 467	550 550	550 550	550 550	550 550	550 550	550 550	550 550
17		277 159	336 234	420 291	550 366	395 324	495 404	550 443	550 443	512 488	550 526	550 526	550 526	550 526	550 526	550 526
18		246 134	299 197	374 245	507 317	352 272	441 339	530 397	550 408	456 409	508 456	550 490	550 490	550 490	550 490	550 490
19		221 113	268 167	335 207	454 269	315 230	395 287	475 336	550 383	408 347	455 386	547 452	550 455	550 455	550 455	550 455
20		199 97	241 142	302 177	409 230	284 197	356 246	428 287	525 347	368 297	410 330	493 386	550 426	550 426	550 426	550 426
21			218 123	273 153	370 198	257 170	322 212	388 248	475 299	333 255	371 285	447 333	503 373	548 405	550 406	550 406
22			199 106	249 132	337 172	234 147	293 184	353 215	432 259	303 222	337 247	406 289	458 323	498 351	550 385	550 385
23			181 93	227 116	308 150	214 128	268 160	322 188	395 226	277 194	308 216	371 252	418 282	455 307	507 339	550 363
24			166 81	208 101	282 132	196 113	245 141	295 165	362 199	254 170	283 189	340 221	384 248	418 269	465 298	550 346
25						180 100	226 124	272 145	334 175	234 150	260 167	313 195	353 219	384 238	428 263	514 311
26						166 88	209 110	251 129	308 156	216 133	240 148	289 173	326 194	355 211	395 233	474 276
27						154 79	193 98	233 115	285 139	200 119	223 132	268 155	302 173	329 188	366 208	439 246
28						143 70	180 88	216 103	265 124	186 106	207 118	249 138	281 155	306 168	340 186	408 220
29										173 95	193 106	232 124	261 139	285 151	317 167	380 198
30										161 86	180 96	216 112	244 126	266 137	296 151	355 178
31										151 78	168 87	203 101	228 114	249 124	277 137	332 161
32										142 71	158 79	190 92	214 103	233 112	259 124	311 147

1.5 SB Normal Weight

Wheeling Composite Deck



Section Properties (per ft. of width)

Gage	t in	Wd psf	Sp in³	Sn in³	Ip in⁴	In in⁴	As in²	Fy ksi
22	0.0295	1.7	0.172	0.180	0.146	0.182	0.478	50
20	0.0358	2.0	0.218	0.229	0.190	0.221	0.581	50
18	0.0474	2.7	0.301	0.311	0.284	0.294	0.769	40
16	0.0600	3.4	0.388	0.394	0.374	0.373	0.973	40

145 pcf Normal Weight Concrete

Total Slab Depth D / Wt. Conc. / Area Conc.	Gage	Maximum Unshored Clear Spans: Single Span	Double Span	Triple Span	Composite Properties: Iavg in⁴/ft	Sc in³/ft	Superimposed Live Loads - psf: No Studs — Span - Feet and Inches: 6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"
	22	5'-10"	7'-9"	7'-11"	3.573	0.887	400	343	292	251	217	189	166	146	129	114	101	90
4"	20	6'-9"	9'-0"	9'-2"	3.854	1.052	400	400	352	303	262	229	201	178	158	140	125	111
36.3 psf	18	7'-2"	9'-5"	9'-8"	4.333	1.345	400	400	360	310	269	235	206	182	161	142	128	115
20.6 in²	16	8'-4"	10'-6"	10'-11"	4.782	1.638	400	400	360	310	269	235	206	182	161	142	128	115
	22	5'-6"	7'-5"	7'-6"	5.107	1.087	400	400	360	309	268	233	205	180	160	142	126	113
4-1/2"	20	6'-4"	8'-7"	8'-8"	5.496	1.291	400	400	400	373	324	283	249	220	195	174	156	140
42.4 psf	18	6'-9"	8'-11"	9'-3"	6.160	1.653	400	400	400	383	332	290	255	226	200	179	160	143
24.8 in²	16	7'-10"	10'-0"	10'-4"	6.789	2.018	400	400	400	383	332	290	255	226	200	179	160	143
	22	5'-3"	7'-1"	7'-2"	7.022	1.293	400	400	400	370	320	279	245	216	191	170	152	136
5"	20	6'-1"	8'-2"	8'-4"	7.544	1.538	400	400	400	400	388	339	298	264	235	209	187	168
48.4 psf	18	6'-5"	8'-6"	8'-9"	8.431	1.972	400	400	400	400	398	348	307	271	241	215	193	173
29.3 in²	16	7'-6"	9'-6"	9'-10"	9.280	2.415	400	400	400	400	398	348	307	271	241	215	193	173
	22	5'-0"	6'-9"	6'-10"	9.360	1.503	400	400	400	400	374	326	287	253	224	199	178	159
5-1/2"	20	5'-10"	7'-10"	7'-11"	10.036	1.791	400	400	400	400	400	397	349	309	275	245	220	197
54.4 psf	18	6'-2"	8'-2"	8'-5"	11.187	2.301	400	400	400	400	400	400	360	318	283	253	227	204
34.1 in²	16	7'-2"	9'-2"	9'-5"	12.298	2.824	400	400	400	400	400	400	360	318	283	253	227	204
	22	4'-10"	6'-6"	6'-7"	12.157	1.717	400	400	400	400	400	374	329	290	258	229	205	183
6"	20	5'-7"	7'-6"	7'-8"	13.012	2.048	400	400	400	400	400	400	400	355	316	282	253	227
60.5 psf	18	5'-11"	7'-10"	8'-1"	14.468	2.636	400	400	400	400	400	400	400	366	326	291	261	235
39.4 in²	16	6'-10"	8'-9"	9'-1"	15.883	3.242	400	400	400	400	400	400	400	366	326	291	261	235

D, Wc, Ac	Gage	Single Span	Double Span	Triple Span	Stud Factors: 2' o.c.	3' o.c.	Superimposed Live Loads - psf: Studs @ 1'-0" O.C. — Span - Feet and Inches: 6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"
	22	5'-10"	7'-9"	7'-11"	0.91	0.84	400	400	400	371	305	255	215	182	156	135	118	103
4"	20	6'-9"	9'-1"	9'-2"	0.88	0.82	400	400	400	400	329	275	231	197	169	146	127	111
36.3 psf	18	7'-2"	9'-5"	9'-5"	0.86	0.80	400	400	400	400	370	309	260	221	190	164	142	125
20.6 in²	16	8'-4"	10'-6"	10'-11"	0.83	0.78	400	400	400	400	400	341	287	244	209	181	157	138
	22	5'-6"	7'-5"	7'-6"	0.92	0.85	400	400	400	400	387	339	299	261	224	193	168	147
4-1/2"	20	6'-4"	8'-7"	8'-8"	0.89	0.83	400	400	400	400	400	392	330	261	241	208	181	158
42.4 psf	18	6'-9"	8'-11"	9'-3"	0.87	0.81	400	400	400	400	400	400	370	314	270	233	203	177
24.8 in²	16	7'-10"	10'-0"	10'-4"	0.84	0.79	400	400	400	400	400	400	400	347	297	257	223	195
	22	5'-3"	7'-1"	7'-2"	0.93	0.86	400	400	400	400	400	393	347	307	274	245	220	198
5"	20	6'-1"	8'-2"	8'-4"	0.89	0.84	400	400	400	400	400	400	400	371	330	285	248	217
48.4 psf	18	6'-5"	8'-6"	8'-9"	0.88	0.82	400	400	400	400	400	400	400	392	350	314	277	243
29.3 in²	16	7'-6"	9'-6"	9'-10"	0.85	0.81	400	400	400	400	400	400	400	400	400	351	305	267
	22	5'-0"	6'-9"	6'-10"	0.93	0.87	400	400	400	400	400	400	395	350	312	279	250	225
5-1/2"	20	5'-10"	7'-10"	7'-11"	0.90	0.85	400	400	400	400	400	400	400	400	378	339	305	276
54.4 psf	18	6'-2"	8'-2"	8'-5"	0.88	0.83	400	400	400	400	400	400	400	400	400	359	323	292
34.1 in²	16	7'-2"	9'-2"	9'-5"	0.85	0.82	400	400	400	400	400	400	400	400	400	400	400	354
	22	4'-10"	6'-6"	6'-7"	0.94	0.88	400	400	400	400	400	400	400	392	349	313	281	253
6"	20	5'-7"	7'-6"	7'-8"	0.91	0.86	400	400	400	400	400	400	400	400	400	381	343	310
60.5 psf	18	5'-11"	7'-10"	8'-1"	0.89	0.84	400	400	400	400	400	400	400	400	400	400	363	328
39.4 in²	16	6'-10"	8'-9"	9'-1"	0.86	0.83	400	400	400	400	400	400	400	400	400	400	400	400

1) Refer to the Design Notes, Note 7 for information on live load limits for fire-rated construction. See Page CD-3.
2) If stud spacing exceeds 1'-0" o.c., reduce live load by applicable stud factor listed above for actual stud spacing.
3) If welded wire fabric is not used, the live loads should be reduced by 10%.

03200 | Concrete Reinforcement

03220 | Welded Wire Fabric

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	2005 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
0100	6 x 6 - W1.4 x W1.4 (10 x 10) 21 lb. per C.S.F. R03220-030	2 Rodm	35	.457	C.S.F.	19.35	17.35		36.70	50
0200	6 x 6 - W2.1 x W2.1 (8 x 8) 30 lb. per C.S.F.		31	.516		25.50	19.60		45.10	60.50
0300	6 x 6 - W2.9 x W2.9 (6 x 6) 42 lb. per C.S.F.		29	.552		33	21		54	70.50
0400	6 x 6 - W4 x W4 (4 x 4) 58 lb. per C.S.F.		27	.593		44	22.50		66.50	85
0500	4 x 4 - W1.4 x W1.4 (10 x 10) 31 lb. per C.S.F.		31	.516		17.70	19.60		37.30	52
0600	4 x 4 - W2.1 x W2.1 (8 x 8) 44 lb. per C.S.F.		29	.552		21	21		42	57.50
0650	4 x 4 - W2.9 x W2.9 (6 x 6) 61 lb. per C.S.F.		27	.593		30	22.50		52.50	70
0700	4 x 4 - W4 x W4 (4 x 4) 85 lb. per C.S.F.	▼	25	.640	▼	54	24.50		78.50	99
0750	Rolls									
0800	2 x 2 - #14 galv., 21 lb/C.S.F., beam & column wrap	2 Rodm	6.50	2.462	C.S.F.	28	93.50		121.50	185
0900	2 x 2 - #12 galv. for gunite reinforcing	"	6.50	2.462	"	31.50	93.50		125	189

03230 | Stressing Tendons

½"φ + L = 70'
wt → 0.53 #/LF

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
0010	PRESTRESSING STEEL Post-tensioned in field R03410-090									
0100	Grouted strand, 50' span, 100 kip	C-3	1,200	.053	Lb.	1.13	1.85	.10	3.08	4.34
0150	300 kip		2,700	.024		.63	.82	.04	1.49	2.07
0300	100' span, 100 kip		1,700	.038		1.13	1.31	.07	2.51	3.43
0350	300 kip		3,200	.020		1.01	.70	.04	1.75	2.27
0500	200' span, 100 kip		2,700	.024		1.13	.82	.04	1.99	2.62
0550	300 kip		3,500	.018		1.01	.64	.03	1.68	2.18
0800	Grouted bars, 50' span, 42 kip		2,600	.025		.59	.86	.05	1.50	2.08
0850	143 kip		3,200	.020		.57	.70	.04	1.31	1.79
1000	75' span, 42 kip		3,200	.020		.59	.70	.04	1.33	1.81
1050	143 kip	▼	4,200	.015		.53	.53	.03	1.09	1.48
1200	Ungrouted strand, 50' span, 100 kip	C-4	1,275	.025		.46	.97	.03	1.46	2.14
1250	300 kip		1,475	.022		.46	.83	.03	1.32	1.92
1400	✗ 100' span, 100 kip @ 25' COST/4		1,500	.021		.46	.82	.03	1.31	1.89
1450	300 kip		1,650	.019		.46	.75	.02	1.23	1.77
1600	200' span, 100 kip		1,500	.021		.46	.82	.03	1.31	1.89
1650	300 kip		1,700	.019		.46	.72	.02	1.20	1.73
1800	Ungrouted bars, 50' span, 42 kip		1,400	.023		.40	.88	.03	1.31	1.92
1850	143 kip		1,700	.019		.40	.72	.02	1.14	1.66
2000	75' span, 42 kip		1,800	.018		.40	.68	.02	1.10	1.59
2050	143 kip		2,200	.015		.40	.56	.02	.98	1.38
2220	Ungrouted single strand, 100' slab, 25 kip		1,200	.027		.46	1.03	.03	1.52	2.24
2250	35 kip	▼	1,475	.022	▼	.46	.83	.03	1.32	1.92

03240 | Fibrous Reinforcing

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
0010	FIBROUS REINFORCING									
0100	Synthetic fibers, add to concrete				Lb.	3.87			3.87	4.26
0110	1-1/2 lb. per C.Y.				C.Y.	6			6	6.60
0150	Steel fibers, add to concrete				Lb.	.44			.44	.48
0155	25 lb. per C.Y.				C.Y.	11			11	12.10
0160	50 lb. per C.Y.					22			22	24
0170	75 lb. per C.Y.					34			34	37.50
0180	100 lb. per C.Y.				▼	44			44	48.50

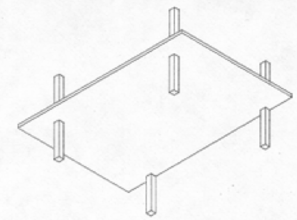
COST

QTY	UNIT	MAT	INST	EQUIP	TOTAL
0.067	LB	0.153	.21	.001	0.364

lb/SF

B10 Superstructure

B1010 Floor Construction



General: Flat Plates: Solid uniform depth concrete two-way slab without drops or interior beams. Primary design limit is shear at columns.

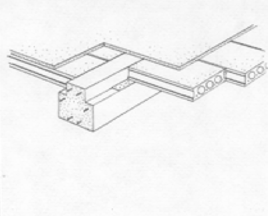
Design and Pricing Assumptions:
Concrete f'c to 4 KSI, placed by concrete pump.
Reinforcement, fy = 60 KSI.
Forms, four use.
Finish, steel trowel.
Curing, spray on membrane.
Based on 4 bay x 4 bay structure.

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM B1010 223 2000					
15'X15' BAY 40 PSF S. LOAD, 12" MIN. COL.					
Forms in place, flat plate to 15' high, 4 uses	.992	S.F.	1.42	4.41	5.83
Edge forms to 6" high on elevated slab, 4 uses	.065	L.F.	.01	.21	.22
Reinforcing in place, elevated slabs #4 to #7	1.706	Lb.	.78	.60	1.38
Concrete ready mix, regular weight, 3000 psi	.459	C.F.	1.51		1.51
Place and vibrate concrete, elevated slab less than 6", pump	.459	C.F.		.57	.57
Finish floor, monolithic steel trowel finish for finish floor	1.000	S.F.		.70	.70
Cure with sprayed membrane curing compound	.010	C.S.F.	.06	.07	.13
TOTAL			3.78	6.56	10.34

B1010 223 Cast in Place Flat Plate

	BAY SIZE (FT.)	SUPERIMPOSED LOAD (P.S.F.)	MINIMUM COL. SIZE (IN.)	SLAB THICKNESS (IN.)	TOTAL LOAD (P.S.F.)	COST PER S.F. MAT.	INST.	TOTAL
2000	15 x 15	40	12	5-1/2	109	3.78	6.60	10.38
2200	RB1010-010	75	14	5-1/2	144	3.81	6.60	10.41
2400		125	20	5-1/2	194	3.95	6.65	10.60
2600		175	22	5-1/2	244	4.04	6.70	10.74
3000	15 x 20	40	14	7	127	4.35	6.65	11
3400	RB1010-100	75	16	7-1/2	169	4.62	6.80	11.42
3600		125	22	8-1/2	231	5.05	6.95	12
3800		175	24	8-1/2	281	5.10	6.95	12.05
4200	20 x 20	40	16	7	127	4.36	6.65	11.01
4400		75	20	7-1/2	175	4.67	6.80	11.47
4600		125	24	8-1/2	231	5.10	6.95	12.05
5000		175	24	8-1/2	281	5.10	7	12.10
5600	20 x 25	40	18	8-1/2	146	5.05	6.95	12
6000		75	20	9	188	5.20	7.05	12.25
6400		125	26	9-1/2	244	5.60	7.25	12.85
6600		175	30	10	300	5.85	7.35	13.20
7000	25 x 25	40	20	9	152	5.20	7.05	12.25
7400		75	24	9-1/2	194	5.50	7.20	12.70
7600		125	30	10	250	5.85	7.35	13.20
8000								

B1010 Floor Construction



General: Beams and hollow core slabs priced here are for plant produced prestressed members transported to the site and erected.

The 2" structural topping is applied after the beams and hollow core slabs are in place and is reinforced with W.W.F.

Design and Pricing Assumptions:

Prices are based on 10,000 S.F. to 20,000 S.F. projects and 50 mile to 100 mile transport.

Concrete for prestressed members is f'c 5 KSI.

Concrete for topping is f'c 3000 PSI and placed by pump.

Prestressing steel is fy = 250 or 300 KSI.

W.W.F. is 6 x 6 – W1.4 x W1.4 (10 x 10).

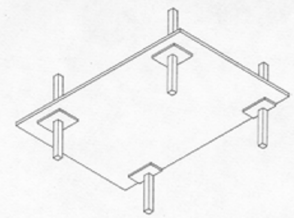
Note: Deduct from prices 20% for Southern states. Add to prices 10% for Western states.

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM B1010 238 4300					
20'X20' BAY, 6" PLANK, 40 PSF S. LOAD, 135 PSF TOTAL LOAD					
12" x 20" precast "T" beam, 20' span	.038	L.F.		.78	.78
Installation labor and equipment	.038	L.F.	4.60		4.60
12" x 20" precast "L" beam, 20' span	.025	L.F.		.78	.78
Installation labor and equipment	.025	L.F.	2.48		2.48
Precast prestressed concrete roof/floor slabs 6" deep, grouted	1.000	S.F.	5.45	2.23	7.68
Edge forms to 6" high on elevated slab, 4 uses	.050	L.F.	.01	.16	.17
Forms in place, bulkhead for slab with keyway, 1 use, 2 piece	.013	L.F.	.02	.06	.08
Welded wire fabric rolls, 6 x 6 - W1.4 x W1.4 (10 x 10), 21 lb/csf	.010	C.S.F.	.22	.29	.51
Concrete ready mix, regular weight, 3000 psi	.170	C.F.	.56		.56
Place and vibrate concrete, elevated slab less than 6", pump	.170	C.F.		.21	.21
Finish floor, monolithic steel trowel finish for finish floor	1.000	S.F.		.70	.70
Cure with sprayed membrane curing compound	.010	C.S.F.	.06	.07	.13
TOTAL			13.40	5.28	18.68

B1010 238 Precast Beam & Plank with 2" Topping

	BAY SIZE (FT.)	SUPERIMPOSED LOAD (P.S.F.)	PLANK THICKNESS (IN.)	TOTAL DEPTH (IN.)	TOTAL LOAD (P.S.F.)	COST PER S.F. MAT.	INST.	TOTAL
4300	20x20	40	6	22	135	13.40	5.30	18.70
4400	RB1010 -010	75	6	24	173	14.20	5.30	19.50
4500		100	6	28	200	14.60	5.30	19.90
4600	20x25	40	6	26	134	12.55	5.25	17.80
5000	RB1010 -100	75	8	30	177	13.60	4.99	18.59
5200		100	8	30	202	13.60	4.99	18.59
5400	25x25	40	6	38	143	13.95	5.25	19.20
5600		75	8	38	183	13.95	5.25	19.20
6000		100	8	46	216	15.55	4.96	20.51
6200	25x30	40	8	38	144	13.25	4.94	18.19
6400		75	10	46	200	14.05	4.72	18.77
6600		100	10	46	225	14.05	4.72	18.77
7000	30x30	40	8	46	150	14.35	4.93	19.28
7200		75	10	54	181	15.35	4.93	20.28
7600		100	10	54	231	15.35	4.93	20.28
7800	30x35	40	10	54	166	13.85	4.69	18.54
8000		75	12	54	200	14.45	4.52	18.97
8200	35x35	40	10	62	170	14.35	4.68	19.03
9300		75	12	62	206	15.50	5.30	20.80
9500	35x40	40	12	62	167	14.80	5.30	20.10
9600	40x40	40	12	62	173	15.50	5.30	20.80

B1010 Floor Construction



General: Flat Slab: Solid uniform depth concrete two-way slabs with drop panels at columns and no column capitals.

Design and Pricing Assumptions:

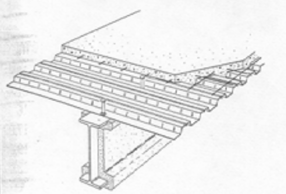
Concrete f'c = 3 KSI, placed by concrete pump.
Reinforcement, fy = 60 KSI.
Forms, four use.
Finish, steel trowel.
Curing, spray on membrane.
Based on 4 bay x 4 bay structure.

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM B1010 222 1700					
15'X15' BAY 40 PSF S. LOAD, 12" MIN. COL. 6" SLAB, 1-1/2" DROP, 117 PSF					
Forms in place, flat slab with drop panels, to 15' high, 4 uses	.993	S.F.	1.58	4.55	6.13
Forms in place, exterior spandrel, 12" wide, 4 uses	.034	SFCA	.04	.27	.31
Reinforcing in place, elevated slabs #4 to #7	1.588	Lb.	.73	.56	1.29
Concrete ready mix, regular weight, 3000 psi	.513	C.F.	1.69		1.69
Place and vibrate concrete, elevated slab, 6" to 10" pump	.513	C.F.		.53	.53
Finish floor, monolithic steel trowel finish for finish floor	1.000	S.F.		.70	.70
Cure with sprayed membrane curing compound	.010	C.S.F.	.06	.07	.13
TOTAL			4.10	6.68	10.78

B1010 222 Cast in Place Flat Slab with Drop Panels

	BAY SIZE (FT.)	SUPERIMPOSED LOAD (P.S.F.)	MINIMUM COL. SIZE (IN.)	SLAB & DROP (IN.)	TOTAL LOAD (P.S.F.)	COST PER S.F. MAT.	INST.	TOTAL
1700	15 x 15	40	12	6 - 1-1/2	117	4.10	6.65	10.75
1720	RB1010 -010	75	12	6 - 2-1/2	153	4.19	6.75	10.94
1760		125	14	6 - 3-1/2	205	4.38	6.90	11.28
1780		200	16	6 - 4-1/2	281	4.61	7.05	11.66
1840	15 x 20	40	12	6-1/2 - 2	124	4.37	6.80	11.17
1860	RB1010 -100	75	14	6-1/2 - 4	162	4.56	6.95	11.51
1880		125	16	6-1/2 - 5	213	4.84	7.10	11.94
1900		200	18	6-1/2 - 6	293	4.97	7.20	12.17
1960	20 x 20	40	12	7 - 3	132	4.59	6.90	11.49
1980		75	16	7 - 4	168	4.86	7.05	11.91
2000		125	18	7 - 6	221	5.40	7.30	12.70
2100		200	20	8 - 6-1/2	309	5.50	7.40	12.90
2300	20 x 25	40	12	8 - 5	147	5.10	7.15	12.25
2400		75	18	8 - 6-1/2	184	5.50	7.45	12.95
2600		125	20	8 - 8	236	6	7.75	13.75
2800		200	22	8-1/2 - 8-1/2	323	6.20	7.90	14.10
3200	25 x 25	40	12	8-1/2 - 5-1/2	154	5.35	7.25	12.60
3400		75	18	8-1/2 - 7	191	5.65	7.50	13.15
4000		125	20	8-1/2 - 8-1/2	243	6.05	7.80	13.85
4400		200	24	9 - 8-1/2	329	6.35	7.95	14.30
5000	25 x 30	40	14	9-1/2 - 7	168	5.80	7.50	13.30
5200		75	18	9-1/2 - 7	203	6.20	7.80	14
5600		125	22	9-1/2 - 8	256	6.50	8	14.50
5800		200	24	10 - 10	342	6.90	8.25	15.15
6400	30 x 30	40	14	10-1/2 - 7-1/2	182	6.30	7.75	14.05

B1010 Floor Construction



Description: Table below lists costs ($/S.F.) for a floor system using composite steel beams with welded shear studs, composite steel deck, and light weight concrete slab reinforced with W.W.F. Price includes sprayed fiber fireproofing on steel beams.

Design and Pricing Assumptions:
Structural steel is A36, high strength bolted.
Composite steel deck varies from 22 gauge to 16 gauge, galvanized.
Shear Studs are 3/4".
W.W.F., 6 x 6 – W1.4 x W1.4 (10 x 10)
Concrete f'c = 3 KSI, lightweight.
Steel trowel finish and cure.
Fireproofing is sprayed fiber (non-asbestos).
Spandrels are assumed the same as interior beams and girders to allow for exterior wall loads and bracing or moment connections.

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	INST.	TOTAL
SYSTEM B1010 256 2400					
20X25 BAY, 40 PSF S. LOAD, 5-1/2" SLAB, 17-1/2" TOTAL THICKNESS					
Structural steel	4.320	Lb.	4.23	1.47	5.70
Welded shear connectors 3/4" diameter 4-7/8" long	.163	Ea.	.09	.25	.34
Metal decking, non-cellular composite, galv. 3" deep, 22 gauge	1.050	S.F.	1.76	.75	2.51
Sheet metal edge closure form, 12", w/2 bends, 18 ga, galv	.045	L.F.	.15	.08	.23
Welded wire fabric rolls, 6 x 6 - W1.4 x W1.4 (10 x 10), 21 lb/csf	1.000	S.F.	.22	.29	.51
Concrete ready mix, light weight, 3,000 PSI	.333	C.F.	2		2
Place and vibrate concrete, elevated slab less than 6", pumped	.333	C.F.		.41	.41
Finishing floor, monolithic steel trowel finish for finish floor	1.000	S.F.		.70	.70
Curing with sprayed membrane curing compound	.010	C.S.F.	.06	.07	.13
Shores, erect and strip vertical to 10' high	.020	Ea.		.33	.33
Sprayed mineral fiber/cement for fireproof, 1" thick on beams	.483	S.F.	.22	.38	.60
TOTAL			8.73	4.73	13.46

B1010 256 Composite Beams, Deck & Slab

	BAY SIZE (FT.)	SUPERIMPOSED LOAD (P.S.F.)	SLAB THICKNESS (IN.)	TOTAL DEPTH (FT.-IN.)	TOTAL LOAD (P.S.F.)	COST PER S.F. MAT.	INST.	TOTAL
2400	20x25	40	5-1/2	1 - 5-1/2	80	8.75	4.73	13.48
2500	RB1010 -100	75	5-1/2	1 - 9-1/2	115	9.10	4.73	13.83
2750		125	5-1/2	1 - 9-1/2	167	11.05	5.55	16.60
2900		200	6-1/4	1 - 11-1/2	251	12.40	6	18.40
3000	25x25	40	5-1/2	1 - 9-1/2	82	8.65	4.49	13.14
3100		75	5-1/2	1 - 11-1/2	118	9.60	4.56	14.16
3200		125	5-1/2	2 - 2-1/2	169	10	4.94	14.94
3300		200	6-1/4	2 - 6-1/4	252	13.45	5.80	19.25
3400	25x30	40	5-1/2	1 - 11-1/2	83	8.85	4.47	13.32
3600		75	5-1/2	1 - 11-1/2	119	9.50	4.52	14.02
3900		125	5-1/2	1 - 11-1/2	170	10.95	5.10	16.05
4000		200	6-1/4	2 - 6-1/4	252	13.50	5.80	19.30
4200	30x30	40	5-1/2	1 - 11-1/2	81	8.80	4.61	13.41
4400		75	5-1/2	2 - 2-1/2	116	9.50	4.83	14.33
4500		125	5-1/2	2 - 5-1/2	168	11.45	5.40	16.85
4700		200	6-1/4	2 - 9-1/4	252	13.65	6.25	19.90
4900	30x35	40	5-1/2	2 - 2-1/2	82	9.20	4.78	13.98
5100		75	5-1/2	2 - 5-1/2	117	10	4.88	14.88
5300		125	5-1/2	2 - 5-1/2	169	11.75	5.55	17.30
5500		200	6-1/4	2 - 9-1/4	254	13.75	6.30	20.05
5750	35x35	40	5-1/2	2 - 5-1/2	84	9.85	4.79	14.64
6000		75	5-1/2	2 - 5-1/2	121	11.20	5.15	16.35

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B1010 Floor Construction

B1010 250 Steel Joists, Beams & Slab on Columns

	BAY SIZE (FT.)	SUPERIMPOSED LOAD (P.S.F.)	DEPTH (IN.)	TOTAL LOAD (P.S.F.)	COLUMN ADD	COST PER S.F. MAT.	INST.	TOTAL
3700	20x25	40	44	83		7.35	4.11	11.46
3800					column	.79	.28	1.07
3900	20x25	65	26	110		8	4.36	12.36
4000					column	.79	.28	1.07
4100	20x25	75	26	120		7.85	4.18	12.03
4200					column	.95	.33	1.28
4300	20x25	100	26	145		8.35	4.34	12.69
4400					column	.95	.33	1.28
4500	20x25	125	29	170		9.25	4.74	13.99
4600					column	1.11	.38	1.49
4700	25x25	40	23	84		7.85	4.28	12.13
4800					column	.76	.26	1.02
4900	25x25	65	29	110		8.30	4.47	12.77
5000					column	.76	.26	1.02
5100	25x25	75	26	120		8.70	4.46	13.16
5200					column	.89	.30	1.19
5300	25x25	100	29	145		9.65	4.85	14.50
5400					column	.89	.30	1.19
5500	25x25	125	32	170		10.20	5.05	15.25
5600					column	.98	.34	1.32
5700	25x30	40	29	84		8.15	4.46	12.61
5800					column	.74	.25	.99
5900	25x30	65	29	110		8.50	4.63	13.13
6000					column	.74	.25	.99
6050	25x30	75	29	120		9.15	4.25	13.40
6100					column	.82	.28	1.10
6150	25x30	100	29	145		9.90	4.49	14.39
6200					column	.82	.28	1.10
6250	25x30	125	32	170		10.65	5.45	16.10
6300					column	.94	.33	1.27
6350	30x30	40	29	84		8.55	4.04	12.59
6400					column	.68	.24	.92
6500	30x30	65	29	110		9.65	4.42	14.07
6600					column	.68	.24	.92
6700	30x30	75	32	120		9.85	4.49	14.34
6800					column	.79	.27	1.06
6900	30x30	100	35	145		10.95	4.83	15.78
7000					column	.92	.32	1.24
7100	30x30	125	35	172		11.95	5.95	17.90
7200					column	1.02	.35	1.37
7300	30x35	40	29	85		9.60	4.40	14
7400					column	.58	.20	.78
7500	30x35	65	29	111		10.70	5.50	16.20
7600					column	.75	.26	1.01
7700	30x35	75	32	121		10.70	5.50	16.20
7800					column	.77	.26	1.03
7900	30x35	100	35	148		11.55	5	16.55
8000					column	.94	.33	1.27
8100	30x35	125	38	173		12.85	5.40	18.25
8200					column	.96	.33	1.29
8300	35x35	40	32	85		9.85	4.47	14.32
8400					column	.67	.24	.91